Sugar Beet and World Travel

A Short Autobiography of Dr. Sydney Ellerton
1914-2011

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Chapter 1: Meeting the World

It was an unpretentious and rather straggly village, Shavington, just off to the south of the direct line from Crewe to Nantwich in South Cheshire. The main road from the Potteries to Chester ran straight through, taking very little notice of it. Most of the village, and particularly its older centre, lay on a mile-long loop on the north side of this road. There were one or two old timber-framed cottages, but most of the houses were Victorian or newer. Built of brownish, rather undistinguished brick, they were dotted along both sides of the road irregularly, as if they had been shaken out of a giant pepper pot. There were a few short terraces, but mostly they were in pairs with gardens at the sides, front and back. There were a few dedicated families who grew flowers or vegetables for show and nurtured them like children. There were others who could only manage weedy tangles. Among the devotees were the Morgans, on the corner opposite the co-op. They had serried ranks of chrysanthemums, carefully disbudded and tied to stakes with little conical hats over each bloom to keep the rain and strong sunshine off. They look a bit like Chinese field workers with their traditional hats, lined up in rows to await the arrival of a mandarin. It was not only the blooms that had hats. There were some bamboo canes put in to deceive the hordes of wicked earwigs, which were intent upon having a nibble at the flowers. Under these hats were traps for the little beasts. Even today, that special smell of chrysanthemems, brings back memories of the Morgans to me.

The Brookshaws were experts too. The god they worshipped was the sweet pea, germinated early, transplanted with loving care into the kindest, most deeply trenched and fertilised soil which skill could provide. They were trained up giant bamboo canes, tied up with raffia and with every tendril removed in case it should reach out a sinister grasp and bend the flower stalk. They used to get the highest accolades in the big shows, like Shrewsbury and Southport. If they came back with only second prizes, gloom reigned at the Brookshaws and the neighbours would hear dark mutterings about midnight raids by competitors to steal their best flowers. This kind of thing was not mere fantasy. Some of the competitors would stop at nothing to win. In later years they widened their field and became expert florists in all kinds of ways. When I was 25 years old, I went to see Mrs Brookshaw to order bouquets for my wedding. I had not seen her for years and years and she took one look at me and said ‘My word Sydney, you’ve grown!’.

Most gardeners were neither wonderful nor awful and most of the bigger gardens were planted at least in part with vegetables. Some also rented allotments along the

Crewe Road, plots of exactly similar shape and size, where much rivalry was to be seen. My father had one for a few years, but he didn't get involved with the rivalry, he just grew nice, fresh vegetables for the table.

A few of the houses had a stone let into the wall just below the roof, proclaiming the initials of the proud first owner and the date of the building. Some did not have to be dated, like Alma Buildings, which recalled a battle in the Crimean War. There is little doubt, though, that most of the village had grown up after the arrival of the railway. This had given birth to the town of Crewe, just a couple of miles away and Shavington was mostly a railway dormitory.

Everybody burnt coal in open fires or in cast-iron cooking ranges, regularly black-leaded with paste from little yellow and black striped packages of Zebra polish. There was a central fire with a water boiler on one side and an oven on the other. Regulating the fire to get the right result when cooking demanded much expertise, doubtless born from much trial and error. Mother had developed great skill and her cakes were mouth-watering. Sometimes a chimney would go on fire and there would be a dense plume of smoke, smelling of burnt, sulphurous soot. Even without that, a pall of smoke would sometimes hang clingingly over the village and slide down the hill into Pusey Dale, where the brook crossed the road.

The village had two pubs, the 'Elephant and Castle' and 'The Vine', both still open as I write. Then there was a Working Men's Club, converted from an old watermill down by a small stream, where I used to catch tiddlers and take them home in jam jars with a bit of pondweed inside. Pubs and clubs were regarded by some as sinks of iniquity, especially by the Methodists. Of course they were in any case out of bounds for a small boy. Father and mother did not patronise them either, not because they were prudish about it, but because they preferred to spend their time and limited means otherwise.

There were in all three little general stores and also Kendrick's, the paper shop. There was a sub-postoffice too and a barber who operated in a large shed. Our nearest store was Warner's, a corner shop with windows on both sides and a flat, painted area high up on the corner, proclaiming it as J.R.C. Warner's General Store and Off-Licence. It was staffed by father and son with mother popping in from time to time. Mrs Warner was a large, rather frumpish lady prone to overdressing and, in her own opinion if in no other, a cut above the general population. She adorned herself with a powerful, cloying, far from subtle perfume, but maybe that was necessary to overcome the all-pervading smell of paraffin, coming from a large red tank in the corner as you went in. Paraffin was much in demand, as mains electricity had not yet arrived in the village and people used oil lamps for lighting

and sometimes Primus stoves for cooking. Jack Warner, the son, had a pretty young wife who seemed to manage not to be cowed by her mother-in-law.

The two Misses Cadman ran another corner shop down ‘Bag Street’, an often muddy, unadopted cul-de-sac which officially carried the rather posh name of Osborne Grove. Posh because it was named after Osborne House, Queen Victoria’s favourite retreat in the Isle of Wight. Nothing could be more different. The Cadman sisters had not married, maybe because of the shortage of eligible males after the slaughter of the first world war. They seemed to love children, for they stocked all sorts of goodies to be bought for a halfpenny or a penny. They were patient while the children pondered, often for a long time, on how to spend their money.

‘Platt’s’ was at the other end of the village, near the ‘Elephant’, a small general store in a red-brick house with flat-roofed extension on the ground floor to accommodate the shop. We didn’t normally trade there, as it was so far away. It was easier to take a bus to Crewe.

Dolly Broadhurst presided over the Post Office. Her shop was stocked with various ladies’ things, such as knitting wool, patterns and sewing thread. These were stacked higgledy-piggledy on a profusion of shelves and some of them hung from the dark, low wooden beams. She was a plump, rosy-faced, bustling lady, well-liked in the village. Not many years later I used to ask her for special corners of sheets of stamps which bore ‘control numbers’, for I was already getting infected with an enthusiasm for philately (or stamp collecting). Her rosy-cheeked husband Joe ran a bakery at the back of the shop.

The largest shop by far was the Co-op, which incorporated a butcher’s shop as well as a very busy grocery. Cooperative Societies were very strong in the industrial north, being founded on the principle that private traders were wicked and grasping. This was where the main shopping was done. Every customer had a membership number (I still remember ours was 779) and for each purchase he received a little receipt of which a carbon copy went to the office in Crewe. Every single purchase, however small, was added up and ascribed to the member’s number and each quarter a dividend, popularly known as the ‘divi’, was paid out of profits; maybe ten percent. To do all this without any kind of mechanical aid must have been prodigiously labour-intensive, but, of course, labour was cheap. Children were sent along by their parents to collect the weekly grocery order. Things like sugar and flour were weighed up into bags on the premises and the assistants were expert at making neat little conical bags out of flat sheets of paper, with a twist at the bottom and the top neatly tucked in. Butter and margarine came

in great blocks or barrels, from which pounds and half-pounds were cut. Sugar was always wrapped in blue bags, which made it look whiter and purer. Tea was prepackaged, right down to one-ounce packets for twopence. I liked best the smell of fresh bread and could not resist tearing off strips of crust to eat on the way home.

There were some travelling suppliers too. Mr Parton came with his cart and plodding horse with its sagging back. When he stopped to serve customers, the horse was allowed to nibble at the contents of a canvas nosebog. The cart had a roof, and hardware was displayed on shelves on each side. Behind the shelves was a tank containing paraffin burning oil. On the back was a tap and various clanking jug-measures: gallon, half-gallon and quart. Mr Parton rang a handbell as he went along, sitting on the front seat. The roof did not extend forward to cover him, which was too bad for him it it was wet. He looked as sad as his horse and inevitable smelt of paraffin. He was Warner's competitor for paraffin sales and was popular, because he took it straight to the houses.

Then there was Mr Titterton, tall, thin and cadaverous. His name sounded like a stammer. He must have been served us at a later date, because he had a motor lorry: when one is very young, time sequences get a bit mixed up. Mr Titterton used to go to a colliery over the border in Staffordshire and buy his coal direct, selling it round the houses for two shillings a hundredweight. He did not look strong enough to carry the hundredweight sacks to the coal shed, but I suppose there is a knack to such things.

Two occasional visitors brought excitement to the younger ones. Sometimes a street organ-grinder turned up, complete with monkey, wearing a colourful little coat. More often came the rag-and-bone man with a horse and cart, offering prizes, such as a goldfish in a bowl, to any children who could induce their parent to part with enough old clothes. The less successful children had to put up with balloons. While they envied their luckier friends they also blamed their parents for not trying hard enough to find old things. The rag-and-bone man's cart gradually piled up with nondescript goods, which could be described as having odour rather than aroma.

There were one or two village enterprises besides shops. There was Jim Wigley, for instance, often seen walking to the bus stop in his uniform as a Great Western guard, carrying his well-worn leather bag with two long handles, from which his red and green flags protruded. That was equipment for his official job. Unofficially and possibly illegally, he was the local bookmaker. The 'bookie's runners', who went around collecting bets for him, were certainly not within the law.

For shopping outside the village there was the bus, every 15 minutes to Crewe and every 45 minutes to Nantwich. Some of the buses from Crewe went on to Wybunbury (pronounced Wymbrey unless one wanted to be posh) and Walgherton. This was called Walkerton. Cheshire seems to be full of such place-names, the best-known being Cholmondeley, pronounced ‘Chumley’.

Both Nantwich and Crewe had a good selection of shops, mostly family businesses in those days. One of the nicest was Hawthorn’s, with a smell of freshly roasting coffee wafting out right into the street. In Crewe the insidious invasion of the chain store had begun. There were Boots and Halfords, Currys, which was at that time little more than a cycle shop, and W.H. Smith. There was also a covered market hall of ornate, Victorian design in brick. Down below, local butchers, fruiterers, confectioners and others competed with their wares. Upstairs was Cohen’s Penny Bazaar, a very poor imitation of Woolworths. It had to suffice most of the time, though, because a visit to the real Woolworths meant going to Manchester or Liverpool, 30 or 45 miles away. At the back of the market it got more exciting, especially on a winter Saturday evening. Part of the area was covered with a galvanised iron roof like a Dutch barn. Here were the noisy vendors of ‘seconds’ from the Potteries, plates, cups and saucers and much besides, clanking them together loudly to prove that they rang true and were not cracked. This was one to the accompaniment of much loud, fast and often amusing patter, persuading the lookers-on that they were really being done a great favour.

Behind this covered area was what we regarded as the real ‘back of the market’. It was in the open, on unsurfaced ground sometimes full of muddy puddles. Lighting was from yellowish, smoky naphtha flares, which gave rise to rather sinister, flickering shadows. Naphtha was nothing to do with moth-balls, but was a petroleum distillate. Cheap-jacks vied with each other with their racy patter and it was a great game to watch. Many of them could have made their living in the music halls. Here and there it became a bit gruesome. One fellow filled his table with large glass jars containing massive tapeworms and other intestinal parasites preserved in formalin. He was proclaiming what would happen to us if we did not take his pills. I used to imagine these creatures groping about inside me and indeed I used to wonder if there was even room for them. There were real bargains to be had too, for, in the absence of refrigeration, anything perishable had to be sold on a Saturday night for whatever price could be obtained. We often bought fruit that way, but for meat we had out favourite butcher, not in the market, and stuck to him.

Just a few yards from this animated scene was the New Theatre, mostly operating as a twice-nightly music hall, but sometimes doing musicals, plays or light opera,

such as Gilbert and Sullivan. I remember seeing ‘Ruddigore’ there and also Shakespeare’s ‘Taming of the Shrew’. The exterior was plain enough, but inside it was all rococo and red plush, with soft colours and little cherubs picked out in gold. Smoking was only allowed in the twice-nightly shows and the smoke got pretty thick at times. Before the show a big fire-proof curtain was lowered across the front of the stage, covered with advertisements for local traders. When I was taken to the theatre I was always given a packet of those little brick-shaped, wrapped sweets called chocolate neapolitans. If I see them anywhere today, my mind goes back to Crewe.

I have been carried away with thoughts of the local town life and must return to Shavington, and to the provision made for a smooth passage into the hereafter. To this end there were three chapels and a church. The chapels seemed to have been smitten with an overdose of schism, for they were entitled Wesleyan Methodist, Primitive Methodist and United Methodist, which presumably had at some stage been united with still another brand of methodist. Each had its annual anniversary celebration and invitations were sent out to all. The Wesleyans seemed to have some claim to superiority because their chapel was bigger and newer than the others and several of the more prosperous local businessmen were members. The ‘Uniteds’ by comparison were a down-trodden lot.

Although they had been going for a long time, in some circles the non-conformist churches were still in some quarters regarded as rather disreputable breakaways and some were prone to feel that the only direct way to the Pearly Gates was with the Church of England, simply called the ‘Church’. There were two or three strange people in the village who went even further into the realms of historical orthodoxy and they had to go to Crewe to worship. Rumour had it they owed allegiance to the Pope. A girl in my class in school was one of these, but somehow or other it had to be admitted that she seemed quite normal. Later she transferred to the greater safety of the convent school in Crewe. The school building later became the police headquarters and I have no idea what happened to the girls.

The church at the end of the terrace was what was known as a ‘Mission Church’, which meant that it was a satellite of the fine parish church in Wybunbury, a couple of miles further into the countryside. It sounded as if Wybunbury was where those of the true faith were concentrated and that it was necessary to have a ‘Mission’ to convert the heathen in Shavington. It was built of wood, with corrugated iron cladding painted with red oxide paint and a tiny belfry with a single, tinny bell. Such churches were disrespectfully known as ‘tin tabernacles’. This one had a schoolroom at the back, a separate building in similar style. I was despatched there on Sunday afternoons and sometimes to the service in the church

in the morning. In the evenings mother, father and I often went together and in the winter, with the hanging oil lamps all giving out their yellowish light, it had a rather special atmosphere. I used to like the hymn-singing well enough but found the sermons long and boring, as most children did. At the beginning of the prayer book were the most complicated tables for working out the dates of Easter and I often used to try to use them instead of attending to the improving words from the pulpit. Producing a silver threepenny bit for a collection, no less than 25 per cent of my weekly pocket money, was a serious wrench. Once I put my weekly shilling in by mistake and quickly and shame-facedly took it out again and put in my little silver threepenny 'joey'. I was amazed and shocked when the uncle of my friend John Meeres put a ten-shilling note on the plate, but then he was a banker who commuted to Manchester, riding his motorbike to Crewe station.

The church was in the charge of a curate, the vicar being resident in Wybunbury. The curate I best remember was Mr Peers, 6ft 4½in tall, which was phenomenal in those days, when people generally were quite a bit shorter than they are today. He had been invalided out of the war because of shellshock. He was a friendly and quite diffident person. The Sunday school had various teachers, under the supervision of Edwin West, who was very earnest but also very deaf and we despicable youngsters used to play him up when we had a chance. Young people can be cruel to the handicapped. There was a Sunday school 'treat' once a year, usually in the grounds of some not-too-distant big house. It was timed with great practicality to occur the day after the annual garden party, which took place in the grounds of the vicarage in Wybunbury. We had all the leftover cakes and other goodies. We never had Sunday school trips, as the venues were always within walking distances.

There were still some renegades about and the Crewe branch of the Salvation Army used to come down from time to time to try to recruit them by performing in the street with their band and their singing. They wore uniforms, that of the women being particularly ugly, with a dark-blue or black costume and hats like peculiarly-shaped baskets with a red and gold band bearing the name 'The Salvation Army'. They had tambourines and drums for rhythm, cornets and a far from euphonious euphonium; when possible a tuba too, to play the regulation oompah-oompah accompaniment. They would play and sing Sankey and Moody hymns at one street corner, make a little speech, mostly heard only by themselves, and would then trudge with grim determination to another place. They were hardly inspiring and rarely successful in gaining recruits, but they had done their bit of mission work and no doubt felt better for it.

My parents had moved to Shavington from near-by Wybunbury when I was one year old. It was nearer Crewe and handier for my father to get to work. I was the only child and stayed so. The address revealed the Methodist influence in the village, for it was ‘Wesley Terrace’. From it we could look down the road to Crewe, but there was also a view across farmland all the way to Mow Cop, some twelve miles away on the borders of Cheshire and Staffordshire. It was a hill capped by an old ruin and from its summit there was a wonderful view all round. There was farmland in most directions, but there was also a view of the Potteries, nesting in a hollow with smoke hanging in the air. At that time the pots were fired in bottle kilns; hundreds of them.

In the village there was no street lighting of any kind. The night sky shone bright and we could see the shooting stars and the markings on the moon which kindled the imagination of the young. From time to time the furnace doors at the Shelton Iron Works fifteen miles away would be opened, or hot slag would be tipped in a glowing cascade down the steep slope of the heap. The red glow in the eastern sky would remind us that industry was not so very far away.

Chapter 2: Growing Up In The Village

In those days village communities were very self-contained. Although people made trips by train, these rarely seemed to lead to close friendships in other areas. Most marriages were within the village or within a radius of five miles or so. My parents were exceptional in that their homes were nearly 40 miles apart. Their meeting happened because father's sister Lily was on the domestic staff at the same place as my mother. My father-to-be went to visit his sister and it is very evident that his eyes strayed!

A very few people came from outside to live with us. There was a Swiss couple, the Blattners, Mr Blattner being a chef in a big hotel in Manchester. There was also the Williams family, not so exotic, for they had only moved in from Wales. Mr Williams was a pharmicist in Crewe. There were the McCandlesses too, who came from Northern Ireland and took over Heath's farm. George, their son, came to school with me.

The towns were slightly more mixed. Each seemed to have its Italian family, making and selling ice cream. Crewe had its brothers Delucchi and Shrewsbury its Sidolis. 'Joe' Delucchi came up to Shavington several evenings a week during the summer, in his little brightly painted cart with canopy. He went all around the village, ringing his bell and selling twopenny wafers and penny 'cornets'. When we acquired a small dog, Paddy, a Cairn terrier, he used to follow the ice cream cart right round the village. My father used to give Joe a penny to give Paddy an ice-cream at some point on the round. Ice cream was totally unavailable during the winter except in the big cities.

Another foreign element in the towns was the Chinese laundry, where the owners worked in a hot steamy atmosphere which must have been most unpleasant. There were two in Crewe.

Half a mile from home, on the way to Wybunbury and just beyond the Brookshaws', lived Mr Mottershead. He was a florist in Crewe. He teamed up with a Dr English from near-by Haslington to start a zoo. It was small and had no really large animals. It prospered as many of its visitors came down the main road from the Potteries, especially at weekends. Before many years it moved and became Chester Zoo, still prestigious to this day.

Wesley Terrace had twelve houses and we were about in the middle. Some of the neighbours had children of about my age and, looking at the rather dismal side of

things for a moment, two of the four nearest died of diseases which would not have claimed their lives today. George Wycherley, I watched fade away with diabetes, too early to have the advantage of Banting's insulin. He was a close friend of mine and it was all very hurtful. My father lost a close friend in the same way. Gwen Reade succumbed to tuberculosis, probably the greatest scourge of the time. The Morgans, the chrysanthemum hobbyists near home, had two very bright sons who had gained degrees in Manchester and had just got started in the chemical industry when they were stricken. They both died. Mr Morgan gave me their photographic darkroom stock of papers and equipment and I remember that I was almost afraid to touch it, in case of infection. I knew it was illogical, but there was such a fear of 'consumption'. There was one lady in the village, Miss Collett, who took communion in church separately from all the others because there was a suspicion that her disease was still active. The well-to-do, of which there were not many, would be sent to sanatoria at high altitude ...

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...shippon, the local name for cow-house, lit by a hurricane lamp which cast eerie shadows on the rough, whitewashed walls. The cows in their confined space were sometimes steaming and always produced quite a rich atmosphere! Of course the milk had to be fetched every day, because without any form of cooling at source or in the home, it would not keep.

The Galleys were a very unusual family. There were George, Jim, Joe and Patty, all living in the farmhouse and unmarried. Patty kept house and got up early to make cheese, but from time to time she would disappear to a mental home for a few weeks. I had no idea what the trouble was and whenever I went to the farmhouse she seemed perfectly normal. Albert was the odd man out in that he was married and lived away from the farm. A few years later George bought his first car and was reported, when he found himself heading for a ditch, to have thrown his arms up in the air and shouted 'Whoa'.

Most of Galley's farm was permanent pasture, but they also grew oats and swedes for the cattle and various vegetables. There were pigs and poultry too. They kept a red and white bull in a loose-box with straw bedding. Apart from serving his own harem, the bull had other duties, for neighbouring smallholders would bring their cows along for his attention. Sometimes we small boys would happen to be around and would watch the proceedings with awe. Instead of learning about the birds and the bees, I guess I learnt my basic biology from watching the goings-on of

shorthorn cattle. Curiously, it was always the boys who wanted to watch. Maybe girls are bolder nowadays.

My part of Cheshire was not as flat as some. The brook just down the road had carved a valley for itself and the countryside was generally undulating. There were some arable crops: potatoes, oats and vegetables, but most of the land was in permanent pasture. There were mostly small fields with hedgerows. Growing in the hedgerows were trees, oaks and sometimes ash, elms or limes. The overall impression was one of endless, green parkland. The farms had shorthorn herds, with massive, large-footed shire horses for traction. In the farmhouses the famous Cheshire cheese was made, heavy work and long hours indeed for the farmers' wives. A few things were just beginning to change. On Charlesworth's farm on the way to Wybunbury I remember seeing an iron monster for the first time – a farm tractor, ploughing noisily and much more roughly than the horse ploughs. On the other hand, really old devices could still be seen. On Fairclough's farm there was a long timber arm attached to a central bevel gear. A horse tied up to the end of the arm would walk round and round, turning the shaft which disappeared into the building, to turn the churn which made butter. There were still some countryside puzzles for the very young. Hills in roads were called 'banks', like Dodd's Bank near home. I used to be confused about this, wondering where the money was stored.

I don't remember much before the end of the war, when I was aged 4½ years. I was upset when my pram was sold and disappeared for all time down the 'entry' between our house and the Wilkinsons'. A strange thing one day was that a group of men arrived with a lorry and asked if they could fix a huge sheet to the front of the house and the house next door. After dark they projected pictures on to it and invited the local populace to come and watch. It wasn't exactly a drive-in cinema, but of course they had not been invented then. I presume, though I did not understand it then, that they were recruiting for the armed forces, promoting National Savings or appealing for some other such cause.

There were special events a little later, too. One must have been about 1920, certainly before full-time broadcasting was started by the British Broadcasting Company (not yet Corporation) in 1922. A man brought a whole collection of boxes and wires and rigged up a tall pole with guy ropes in the yard of the infant's school. Everybody was invited along in the evening to hear for the first time the magic of 'wireless'. One of the boxes was topped by a row of bright lights, which were the old-style, directly heated, 'bright emitter' valves.

One special event occurred every year. The old country tradition of May Day was still observed in many villages. Before the day we practised in the school yard, practised dancing round the maypole, holding interlacing, brightly coloured ribbons. We hoped that the pattern would work out all right on the day. Any mistake showed up and there was no way to hide it. The pattern was undone by reversing the dance, more chance for error and a frightful tangle. There was a May Queen, who was driven in a horse carriage to the scene of the crowning ceremony, which was on a canopied dais in the field behind the Vine Inn. One year, when I was about six years old, I rode with her as the 'crown-bearer', sitting on the high front seat alongside the driver in a white silk shirt and shorts, with the crown resting on a purple velvet cushion on my knee. This was to be presented at the right moment in the ceremony to the person who did the actual crowning. I felt very important and certainly very prim and proper.

The main fun of May Day, however, went late into the night, for a fairground had been set up in the same field. There was a brightly painted roundabout with prancing horses, coloured lights and a steam organ. The organ would have little automated men who would beat drums and bells with a stick. There were swings, a coconut shy, a shooting gallery and all sorts of other attractions. Gaudy prizes were shown on stands, creating desires we never knew we had. After dark it was like fairyland, for the wonderful showmen's steam engines, with their massive rotating flywheels and their brightly shining brass barley sugar pillars, holding up the roof. They were all running, hissing and exuding clouds of steam as they drove generators and, by means of floppy and dangerous-looking flat belts, the various 'rides'. There were masses of electric lights, many of them coloured. At a time when mains electricity did not exist in the village, this was magic. Of course, when one is little everything looks so much bigger and grander than it would to a grown-up.

Chapter 3: Cheshire and the Welsh Borders

The near-by rural area was pastoral and lovely, even though it didn't have mountains, large lakes or other spectacular scenery of the kind, which I nowadays so much enjoy in Wales. There was much unspoilt countryside with footpaths criss-crossing the fields - not that anybody bothered if you did not keep to the paths as long as you did not leave gates open. In fact this last point rarely arose, for there were stiles or 'kissing gates' in most places. Particularly nice was an area called 'The Lawns', which was parkland with trees dotted about. There were oaks and limes and elms, all trimmed off below to the height grazing cattle could reach, to browse on the branches.

The parish church at Wybunbury was situated on a hill. It was a fine building in the perpendicular gothic style, but not constructed on good biblical principles. It was built on sand and in the eighteenth century the tower developed quite a tilt. Somehow or other, work was done on the foundations to correct the problem. What a pity; it might have become as famous as Pisa! The church got into trouble again in my time. The east end of the church started slipping down the hill, and the nave had to be shortened. Recently a new church has been built in the village and all that remains of the original structure is the tower. It makes me sad to think of it.

When I was a little older there were many Sunday evenings when I walked with my parents over the fields to the sound of the church bells, the bellringers doing their best to make a tidy job of ringing the changes with their peal of five. Often we went quite near to Wybunbury Moss, where islands of vegetation floated over a deep and dangerous pool. There was talk, which I am sure could be true, of straying horses having been drowned, never to be seen again. This sinister reputation made it irresistible to me and my friends. There was a thin and patchy cover of small alder, willow and birch trees and in between was grass and a great variety of flowers. We trod warily and felt a bit scared. There was a stagnant smell and a bubbling of marsh gas, and the earth quaked as we walked. Now it is all very securely fenced off and there are no such thrills any more. How tame the world has become!

Mother was country-bred on the borders of Shropshire and Montgomeryshire. There was lovely parkland there too, but more cultivated fields, revealing the deep red soil. I often visited the area as a child. Mother's maiden name was Wynne and her mother was born a Davies - all Welsh, but in that border country the Welsh language had all but died out. Two generations earlier it had been spoken widely. Many of the family were

farmers. The Shropshire ones for the most part kept dairy cows, while in Wales they kept sheep too. Not so my maternal grandparents. They kept a very pleasant old inn just inside Wales. It was called the Hand and Diamond, in the hamlet of Coedway. The very name Coedway was a mixture of Welsh and English, coed meaning a wood in Welsh. In the old days it had been a drovers' inn, a stopover on the sheep drives from Wales into England before the railway came.

My maternal grandfather, who died before I was born, ran a carpentry business and also brewed his own beer for the pub. Having by these means made a living from the locals during their lifetime, he exacted a final tribute by selling them a coffin. There were six children in the family, quite usual in those days, and I got to know them all except one, the youngest daughter. She died of diphtheria at the age of 12. Bringing up such a family as a widow of meagre means gave my grandmother a pretty hard time. My mother went 'into service' at a large house quite near to where the Jodrell Bank radio telescope now stands, and it was there that she met a very shy young man with a high stiff but fashionable collar and a bristly moustache named John Ellerton. They were married in the local church at Swettenham in 1911. This was where Sir Bernard Lovell, of Jodrell Bank radio telescope fame, played the organ in later years.

Coming back to the Wybunbury area and near-by Shavington, there were two wholly different worlds around us, distinct but at the same time very close together. ln one direction lay the farmland, centred on the lovely market town of Nantwich. There were many fine old timbered buildings, mostly Elizabethan, and the town felt friendly and secure. The River Weaver passed through town and there was an old water mill. Standing close to the little square was a splendid red sandstone church with a massive octagonal tower. It peeped out from behind trees as if it was a little shy. When I was a teenager I sometimes sat in the organ loft with Mr Taylor, the organist who was also our school music master, and wondered how he managed to do so many things at once: the manuals, the stops and the pedal organ. Even his knees were busy, controlling the volume of sound from the swell organ. There were some interesting old charities based on Nantwich church. On certain days of the year the porch was filled to brimming over with loaves of bread, which the poor could collect. There was the lovely smell of new baking. Up Hospital Street, near to the magnificent, timbered Churche's Mansion, there was a group of almshouses. A condition of tenancy was that every Sunday the elderly ladies and gentlemen should dress up in a costume dating from Stuart times and process together to the morning service.

The 'wiches' - Nantwich, Middlewich, Northwich - were all salt towns. The only remaining use of the Nantwich salt was to fill the swimming pool at the

Brine Baths Hotel, though later a public brine bath was built. Most of the Cheshire cheese was sold in Nantwich market. In those days it was nearly all made in farmhouses, not in factories, and very hard work it was for the farmers' wives. Each farmhouse seemed to have its own wild collection of bacteria and fungi, so that there were many flavours of cheese, some good and some bad, and although Cheshire cheese was normally 'white' or made 'red' by the addition of anatto, a West Indian plant rich in carotene, some of it turned out to be blue. In the market hall the cheeses were piled high and the buyers had borers which they pushed maybe six inches into a cheese, withdrew the sample and then broke off the end to taste it. The rind end of the plug was then pushed back into the hole and the cheese looked as good as new. We local schoolboys used to get hold of a borer and, if we were not chased off, make ourselves nearly sick with cheese. Swiss cheese had no more holes than some of the Cheshire variety.

The shops in town were nearly all family businesses, very unlike the accumulation of chain stores, building society offices and estate agents which now occupy the town centre. The shops had character and style and we knew the proprietors and they knew us. There were some small industries: two or three small clothing factories and a very smelly tannery.

The other world was really industrial. Only two miles from home was Crewe, which didn't even exist until the railway came. They built the town, even the parish church: 'they' being the London and North Western Railway, the L.N.W. There was a steel works, a locomotive building works, large engine sheds and vast marshalling yards. Other railways came into Crewe, but only on sufferance. The L.N.W.R. even bought a large tract of land and gave it to the town as a park. A generous gesture? Not on your life: it was to prevent the Great Western coming in and establishing its own station.

For me the railway meant the distant clank-clank-clank of buffers on wagons being shunted, not only by day but during the night too, but never loud enough to be disturbing. The railway also meant standing on a bridge over the London line and being shrouded in sulphurous steam as a fast train thundered underneath. The ground shook and the din was deafening. It also meant that anywhere within half a mile of the tracks, smuts were deposited over everything. Pity the poor housewife with clean washing on the line. Although Crewe Works were nearly three miles away, if the wind was right we could hear the works hooter giving fifteen and then five minutes' warning of the start of the working day, then announcing the actual start and finally the all-clear in the early evening. In some areas they still had 'knockers-up' who carried long poles with which they tapped on bedroom windows to wake up the workers.

Just once it meant something very special. On November 11th, 1918 came Armistice Day, the end of World War I. I was only four, but I vividly remember all the engines in the area sounding long blasts on their whistles to announce the armistice. Different engines had whistles of different pitch and they even got around to trying to play tunes.

Nearly every breadwinner worked on the railway, for there was nothing much else to do unless you had a farm, kept a shop or worked as a teacher, policeman, postman, roadman or such-like. My father, both his brothers and my grandfather all worked in one way or another on the railway. Whereas mother's brothers joined the Royal Engineers and went to war and I remember them coming home on leave, in khaki uniform with puttees wrapped round their legs, railway work was considered to be essential to the war effort and was a 'reserved occupation'. Father was a carpenter and repaired freight wagons, Uncle Alfwas a fireman on the L.N.W. and Uncle Leon was a Great Western driver. The L.N.W. had not entirely excluded all other lines and there were Midland, North Staffordshire and Great Western trains to be seen. Uncle Leon often used to drive G.W. passenger trains into Crewe. The train, engine and all, had to be turned round to face the other way to return to Shrewsbury. This was done by driving round a 'triangle' and, thrill of all thrills, I was sometimes allowed to do this under my uncle's watchful eye. Climbing up to the footplate of what seemed to be a huge, clanking monster was quite a feat and when the firedoor was opened it looked like the entrance to hell. There was so much smoke and steam too. Steam engines always seemed to be alive and quite awesome at that.

Father was brought up at Hartshill in the Potteries and the family had such a reverence for Josiah Wedgwood that my grandfather was christened Josiah. Everybody called him Jesse, though. Father was christened John, but most people called him Jack. He loved to visit the museums and company showrooms in the Potteries to see the ceramics and he often took me with him. Sometimes we followed on to the Grand Theatre in Hanley to see a show. I remember seeing the famous George Robey there. The theatre was amazing, for it had a sliding roof and on dark summer nights we could look up and see the stars.

One advantage of railway work was getting free passes and quarter fares (one-eighth fares for children). I spent holidays in Cornwall and in Scotland and regularly had shorter trips. On the 'Knotty' (the North Staffordshire Railway) to the Potteries, for instance, there were little red tank engines with N.S. painted on the side, with the Staffordshire knot between the two, hence the name Knotty. The special knot, I was told, was invented for the purpose of hanging three men at once, and I used to try to imagine it happening. I certainly did not want a demonstration, though I could never quite work out

how it was done. We travelled in old-fashioned clerestory coaches with gas lighting, a clear glass half-dome over the mantles, and chains at each end of a lever, one to turn the gas on and the other off. There was a little pilot flame for ignition. Returning after dark we could see great cascades of fire on the waste tips at the Shelton Iron Works, as red-hot slag was tipped down the steep slopes from trucks pushed along the ridge. Sometimes we went to Manchester or Liverpool. Liverpool was my favourite, for there we could see the towering White Star liners preparing to leave the floating landing stage for far-distant America and we could travel on our own mini-voyage, on the ferry to New Brighton and back. From the ferry we could see all the shipping in the Mersey and also new ships being born at Cammell Laird's in Birkenhead. Manchester and Liverpool both had department stores called Lewis's and in Liverpool there was a cafe called Reece's, all of which actually sold ice cream right through the winter!

My most frequent trip, however, was to Shrewsbury. From the main line station with its elegant frontage, dominated by the red sandstone castle on a cliff above, I would walk down Dogpole and Wyle Cop (what lovely street names Shrewsbury has!) past the fine Abbey church to the Abbey Foregate station, there to join the Shropshire and Montgomeryshire railway, variously known as the 'S & M', the 'Slow and Miserable' and the 'Potteries' or 'Pots'. It had originally been planned as a line from the Potteries to north-west Wales, but only the section from Shrewsbury to Llanymynech was ever built, with a short branch to the Criggion granite quarry. All railways were wondrous, but this one was both wondrous and different. The engines dated from the previous century and had a quaint look about them and the coaches seemed equally old. They even boasted one of Queen Victoria's early royal coaches, which could be put on a train for a fee of five shillings.

The trains were mixed passenger and goods and just outside Shrewsbury there was a connection with the Great Western and wagons were shunted back and forth, sometimes for ages. The slowest journey I can remember lasted 45 minutes for the five miles to Ford, where two of mother's brothers lived with their families. In the dying days of the line the journey to Ford took twenty minutes only, because there were no more wagons to shunt and the train consisted of two Ford buses on flanged wheels, tied back to back. Another route I sometimes followed was to Whitchurch, then on the Cambrian line through Oswestry to Welshpool, there to transfer to the narrow-gauge Welshpool and Llanfair Caereinion railway, owned by the Great Western, which travelled through the streets of Welshpool. The engines, 'Earl' and 'Countess' had a Great Western look about them. They still exist, in the hands of the railway preservation society which now operates the line.

A cousin of my mother's had a hill farm called Tirnewydd up-country from Guilsfield. The name means 'new land' but it would seem that it had been given that name centuries before. We used to be met at a halt on the narrow-gauge railway and taken over the hill to the next valley, where the old timbered farmhouse was backed by steeply rising fields. Jogging along on a narrow, rough and often steep road with the smell of horse and leather and the cloppety-clop of the horse's feet was a rare treat. At the farm they made their own delicious butter, pressed into moulds with a wooden die with a carved pattern bearing a design and the farm name. In this way customers got to know the marks and sought out the butter with the best reputation for flavour. Another lovely feature was a great stone cavity in one wall of the kitchen, in which a fire of sticks would be made and finally raked out and replaced by dough which became the most delicious, crusty loaves of bread. This household was very different from mine, for there were no less than twelve children ranging at the time I remember best from four to 22 years old, all living a healthy, vigorous life in the country. 'Aunt' Laura used to say that after the first six, things got easier, for the older children looked after the younger ones! Surprisingly, I found that when one of the twelve was away on holiday, their mother missed him or her just as much as if he was the only one. With such a large family to feed and farm prices not too high, they used to eke out their income by taking their fresh farm produce to be sold in Sale and Altrincham, on the south side of Manchester.

Little Aunt Rose, mother's unmarried elder sister, used to help for some of the time and it was nice to meet her again. She was tiny. She never married, but everybody liked her and she lent a helping hand wherever she could. She had the swollen neck characteristic of goitre, as had my mother to a much lesser extent. That would not have happened nowadays: such a simple remedy as iodised salt would have prevented it.

Living on a farm in the midst of such a large family was a new experience for me and there was a lot of fun to be had. The steep slopes up behind the house were grassy and in one hot summer they were slippy enough to encourage us younger ones to try tobogganing. Control was not so easy and once the run ended in a large, dense clump of nettles. The stings were not a question of little raised lumps, but rather a continuous swelling of the whole surface of the skin. Short trousers left a lot of bare skin showing and that was the end of tobogganing for that day! At the top of the slope ('Y Fron') was some flatter land and there were some small fields of oats, which were cut with a scythe and the sheaves were bound by hand with little bunches of straws. In these days of large combine harvesters, this now seems incredible.

These visits, like so many others, started and finished with a railway journey. Every such journey remained an event of excitement. Jogging along to a

regular rhythm punctuated by clanking as we passed over points or the sudden, short whoosh under a bridge was something in itself. Sometimes there was a sudden roar as a train coming the other way rushed by and more rarely there was a tunnel. Then there was a panic to shut all the windows to keep out the very smelly smoke. On lines well known to me, such as that from Crewe to Shrewsbury it was fun to close the eyes and try to work out where we were just from the sounds. There were the notices in the carriages too, and a kind of wish to be wealthy enough to pay the five pounds fine so as to be able to pull the communication cord to see if it really worked! Hanging out of the window was almost irresistible, but usually ended in a painful cinder in the eye. Engines and coaches had colours which differed according to the line and on the visit to Scotland it was exciting to see, for the first time, blue Caledonian and green Highland engines. This was before all the smaller lines were grouped into four large units in 1922. There were the Southern and the London and North Eastern. The London and North Western was swallowed up in the London, Midland and Scottish and only the Great Western kept its old name.

There was a special trip in 1924, my first visit to London. My father took me, by train of course. First to look around the centre of town and, among other things, to have a sight-seeing ride on the open top deck of a General bus. Impressions were mixed. In the city were the very solid-looking commercial buildings, calculated to instil an impression of wealth and stability and so to impart confidence to potential customers. This feeling was enhanced by the fact that there were still quite a lot of business men walking around in morning coats and top hats. They would have been an astonishing sight back home. Even stationmasters at the London termini were dressed like this, with flowers in their buttonholes. The opposite extreme could be seen up side streets, little groups of grubby children, shoeless and in tattered clothes, though still having fun together as children do.

The particular reason for going to London was to travel on the Underground to Wembley to visit the great British Empire Exhibition. There had been nothing like it since well before the war, probably not since the Great Exhibition in Hyde Park in 1851. We were still in the days when the map of the world was splodged all over with red patches, large and small, and the Empire looked as if would last for ever.

At Wembley there was so very much to see, exhibits from all over the world, from Great Britain itself to little dependencies in far-distant parts of the Pacific. I remember the Indian exhibit as huge, varied and wonderful. After all, we did own the place! The exhibition ran for a second season in 1925 and in a way it was the last fling of the old Empire.

Chapter 4: The Bangor Years

Every change of school is an important step in life, involving new friends, new places, new teachers and is still more of a break when it involves, for the first time in life, living away from home. Often there are choices to be made too. My university scholarship, 'in agriculture', limited that choice to places with an agricultural department. The decision, Bangor, was an easy one for me. I had known parts of the North Wales coast since early childhood, having made many trips to the seaside at Rhyl, Colwyn Bay and Llududno. A little later, with my parents, I had a couple of summer holidays in Holyhead, and explored Anglesey and parts of Snowdonia. The whole area was most attractive and held happy memories for me.

So I went to Bangor, a college of the University of Wales, in October 1932, to do an Honours course in Botany with Agricultural Botany. Having previously known and very much enjoyed visiting the area, leaving home for the first time was much less of a plunge than it would otherwise have been, but it was still an adventure and I was more than a little awestruck by it all. The surroundings were lovely, the view of the mountains of Snowdonia in the distance, of the Menai Straits and Anglesey and, closer in, many pleasant walks. The town centre was rather ugly, but you can't have everything!

The University of Wales, with its four colleges at Aberystwyth, Cardiff, Swansea and Bangor, was pretty new, indeed Bangor celebrated its fiftieth anniversary when I was there. It had started by taking over a hotel at the east end of the town. This had been demolished after the stone buildings at the top of the hill overlooking the city centre had been completed, together with the science departments, of much cheaper and simpler design, at the bottom of the hill. To the students they were known as 'top coll' and 'bottom coll' and it was quite a climb from one to the other.

There were no Halls of Residence for the men students except for a very few budding school teachers. They stayed in Plas Menai, a hostel on the Holyhead Road in Upper Bangor. It was in the care of 'Daddy' Archer, the eccentric professor of education. He was tall, moustached and slightly bent and had a glass eye, so that you never knew whether he was looking at you or not. His twin enthusiasms were rugby and cats, and he was not a believer in feline birth control. He combined his two passions by naming his latest kittens after the players who scored rugby points for Bangor in the annual inter-college sports week in February.

Sometimes he had more kittens than point-scorers and then he had a problem. One year, when the Bangor rugger players had done particularly badly, he was reduced to asking whether the women's hockey team goal scorers would mind having the kittens named after them. His room had a very strong smell and anyone going to see the professor usually had to remove a cat from a chair before sitting down. I suppose a lot of the smell was ammonia, but the cats seem to have some very special additives of their own. Sitting on a cushioned chair, there was a certain anxiety as to what one was absorbing through one's rear.

For the women students it was very different. They were all in Halls sternly supervised by the formidable Miss M.O. Davies and were normally pretty securely 'gated' at 10 p.m., extended a little on Saturdays, when the college dance went on until 10:30 and there was an hour's reprieve. 'M.O.' was tall and massive, the archetype of the hospital matron, and she guarded her charges like a large and overpowering mother hen. Sometimes she would turn up at college dances and some of the braver men would ask her to dance, but I am sure that they would never get any favoured treatment. She always seemed fair and impartial though stern, and commanded a good deal of respect.

I had to stay in 'digs', in my case a private house in a terrace near the top of Glanrafon Hill. It was a narrow house, one room wide, three rooms deep and three storeys high. Mrs Turner, the landlady, was a widow and she prepared most of our meals for a weekly charge which, at 12s 6d (62p), now seems derisory. My bedroom was shared with another student and we ate our meals together in the sitting room downstairs. The 'digs' were opposite the side entrance to the Caernarfonshire and Anglesey Infirmary. The hospital mortuary was on that side and I used to see the medical failures being taken out feet first. It was a little damaging to one's faith in the infinite powers of medicine! There was another lodger, Miss Clare, who lived somewhere at the back of the house, a middle-aged lady who professed a strange religion called theosophy and was given to attending table-tapping séances. She had almost been overtaken by technology. The mighty Wurlitzer had not yet reached the smaller cinemas and she belonged to the dying race of cinema pianists, pumping out music in the mood appropriate to the ever-changing pictures above. Glanrafon Hill led down to the science departments. It was steep and narrow, but most traffic avoided it for that very reason. It was a new and grand feeling, walking down to lectures in one's own university.

At the time Bangor had about 600 students, small enough to form a community with a pleasant social atmosphere. Being so close to mountains and the sea, it was a wonderful place for outside sports. For outside studies too, such as field botany, geology and marine biology. Many botanical field trips were with Dr R Alun

Roberts (‘Bob Alun’), who was a philosopher as well as an agricultural botanist, and taught us much about the history of the area which was certainly not in the syllabus. He imparted enthusiasm to us all. He loved his Wales and was able to point out all sorts of little traces of the distant past, still visible in the landscape. At the time he was giving weekly radio talks which were much treasured. I think I was as lucky to have Bob Alun as a teacher in college as I had been to have Bern Mills in school. We kept pretty fit scaling the peaks to see the alpine vegetation.

Exploring the area between the tides for algae of all kinds, seeking out the very varied and distinct vegetation on the carboniferous limestone areas on the edge of the Straits, and going up into the high mountains to look at the plants which had uniquely survived there from the days of the last ice age, all this was a real bonus for Bangor. I liked it so much that one Easter I went back to take a two-week vacation course, doing much of the same thing.

On these trips we became very much aware of the slate industry, which has been so important to North Wales and which was still active, though past the peak. The huge open-cast quarries near Bethesda and Llanberis were the largest anywhere and there were other places where the slate was mined underground, as can be seen today at Blaenau Ffestiniog. The major industry of the area, now almost completely a thing of the past, exacted a terrible toll on the work force, through accidents and lung disease. The quarry owners, on the other hand, lived like princes in mansions such as Penrhyn Castle, Vaynol Park and Plas Tan-y-Bwlch. We went on one of our agricultural trips to Vaynol, to see the herd of white cattle kept there. We saw the dairy and stables too, maintained in their original condition. In the dairy the floor and benches were marble and the pans, in which the milk was poured for the cream to rise and be skimmed off, were Wedgwood. In the stables all the woodwork was teak and the metalwork silver.

Of course there was more to it than lectures, laboratories and field trips. There was a reception and dance for ‘freshers’ on the first Saturday of term. There I saw and briefly talked to a certain Lilian Davies. She was pretty, soft-spoken and looked a dream in her pale blue, lacy ball gown. We chatted a while and I only afterwards learnt that it was more or less her duty to do so, for she was on the student welcoming committee for new recruits! I was captivated but also very diffident, for she was in her third year, very senior as compared with my raw newness. I went on attending the Saturday dances in the Pritchard Jones Hall and managed to get a few dances with her, and she was good enough to coach me in my fumbling inefficiency. Dancing was good in those days. For nearly all the dances you held your partner in your arms. None of this silly modern stuff! By the end of term I

was seeing her home from the dances. She sent me a nice Christmas card, and in the following term things got a lot closer.

When Lilian died in 1991 we had enjoyed more than 51 years of happy married life. She was in her last year in college when we met and by the time I started my second year she had gone to teach in France. It was seven years before I had completed my various courses and got a job. Marriage before a career had been established was just not on in those days and on marriage the wife nearly always had to give up her post. So we neither married in haste nor repented at leisure.

My course was ‘Botany with Agricultural Botany’: fairly tough as it turned out, because it embraced very nearly all the Honours Botany course and a great deal more besides. They were good days, though. In the first year some time was spent on straight agriculture, indeed that part of the course coincided with the Diploma in Agriculture course taken by many farmers’ sons. It included Saturday mornings at the University Farm or some similar venue, usually with ‘Long Archie’, E.J. Roberts, height 6ft 7in. He was rather a benign character, generally popular, much absorbed at the time in learning Russian. Agricultural practice and history were included in the course, taught by Prof R.G. White, tall and skinny, with a rather thin, quavering voice. He was English. It was curious how Welsh professors of agriculture happened to be English. The more famous example was George Stapledon at Aberystwyth. Then there was the red-haired G.W. Robinson, the agricultural chemist: soils, geology, fertilisers and so on. A good deal of this was of practical use, but we never in a thousand years would have thought that the course was going to enable one of my fellow-students, Bob Innes, to discover large deposits of bauxite in Jamaica and found a new industry there. Bob was a Scot, as was another fellow-student, Duncan Cameron. Their families had moved to Wales and they both spoke Welsh like natives.

J.O. Thomas mostly looked after the agricultural botany laboratory work. While a junior lecturer, he was at the same time studying for a post-graduate degree. The ‘pure’ botany was much more academic with Norman Woodhead, (translated into Welsh as his nickname, ‘Pen Pren’!), Miss Davey, and Professor Thoday. Woodhead had also come from Nantwich Grammar School and took me under his wing to some extent. He was a bustling little bachelor, with glasses, often to be seen in Boy Scout uniform, for he was a scout leader. He played the piano as a hobby, particularly J.S. Bach. At the beginning of term he took me for a Sunday car ride, up the Nant Ffrancon pass and down through Llanberis, to have a look at the mountainous hinterland. Later, I often used to go to Sunday morning service in Bangor Cathedral with him. His specialty was algal blooms, a very topical subject today. Miss Davey was into algae too, specially the marine variety, and the ‘Prof’

was a physiologist. He had previously been in Cape Town University and had a habit, in lectures, of starting with ‘When I was in South Africa’, whereupon all his students pounded their desks vigorously. He was interested in the chemical secrets of succulent plants and also in host-parasite relationships. A year or two later I was at his request digging into hard hawthorn branches with a scalpel, in Loton Park right by the little village where my mother went to school. I was removing the ’roots’ whereby mistletoe extracted nutrients from its host plant. The scalpel slipped, went right through my finger, and I was off to the village nurse to get a dressing and a tetanus jab.

After the first year all the purely agricultural studies were left behind, but the practical initiation did no harm at all. It was not always easy to study for exams in the lovely summer weather we seemed to get and a good deal of my ‘swotting’ was done in the open air, overlooking the Menai Straits and watching the pleasure steamer, *St. Tudno*, docking on Bangor Pier or at Menai Bridge, and sometimes seeing a school of porpoises moving through the water, jumping clear and, with their curving backs, straightaway diving in again.

There were a few famous visitors to Bangor when I was there. The Chancellor of the University, the Prince of Wales (later King Edward VIII) came along, as did the former Prime Minister David Lloyd George and many others of lesser renown. They made a change!

Social life in the college meant a lot. In the first year I spent time with Lilian, of course, but she was in her last year and the looming exams were a serious matter, so we met for no more than two evenings a week, for about 2½ hours each, for she was ‘gated’ at 10. In the winter terms there was a college dance in the Pritchard-Jones (‘P.J.’) Hall on Saturday nights, with Harry Perry and his band playing very competently. It was the era of the saxophone rather than the guitar and one of the hits of the day, still much played, was ‘Smoke Gets In Your Eyes’. When the band took a break a fellow-student, ‘SOS’ Williams would take over and play the piano brilliantly. Then there were the various societies – music, amateur dramatics and many others. I played chess for the college and also, for a while, exposed myself to grievous bodily harm by standing in a hockey goal. I used to sign up in October for the 30 chamber music concerts, fee half a crown, or one old penny per concert. They must have been the cheapest concerts ever. There were occasional big concerts, in the P.J. Hall, oratorios and such-like, with nationally known soloists and E.T. Davies, the Professor of Music, on the rostrum.

For amateur dramatics (there were English and Welsh clubs, but I kept strictly to the English) I was involved, as I had been in school, with the stage lighting. We

did Galsworthy's The Skin Game, The Barretts of Wimpole Street and others. Once there was a Nativity Play in Bangor Cathedral just before the college broke up for Christmas, and that led to one of my biggest panics, for the power failed just before the concert was due to start. We got it back just in time.

At Easter came my first visit to Barmouth, to Lilian's home. Three hours by rail, via Caernarfon to Afon Wen (near Pwllheli) and then down the lovely coast of Cardigan Bay. Now even the county town, Caernarfon, has no railway, though the line down the coast from Pwllheli to Aberystwyth still maintains a precarious existence. Lilian's father had died several years before, but her mother lived in a fine stone home, Compton House, on the High Street in the middle of town. How times change: it was later demolished and a branch of Woolworth's now stands on the site. Meeting the girlfriend's parent or parents for the first time must always be scary, but I need not have feared. All the music hall jokes about mothers-in-law were strictly inapplicable to Lilian's mother, who was universally liked. She seemed to know everybody and would chat with them equally in English or Welsh. The only disadvantage was that, if she walked along the High Street with us, the repeated stops for chats made the journey seem interminable. There was another member of the family, Jim. He was a large retriever dog, first found by me munching lettuce under the dining room table. It turned out that it was not the lettuce, but the salad dressing he liked. He liked fruit too. When Lilian and I went blackberrying on Barmouth Mountain, and sat down and digressed a while as young lovers do, we found after a few minutes that Jim had eaten all the fruit we had gathered.

Surnames are a problem in Wales, being so repetitive. Lilian's name of Davies was one of the common ones and, after the local fashion, she was known in Barmouth as Lilian Compton, living as she did in Compton House. This persisted long after the house had been demolished and Lilian had changed her surname on marriage. She had a younger brother, Wyn, around 13 years old at the time. He tended to tag along with us when we went walking, but I discovered quite soon that he could be bought off with chocolates.

I was in Bangor on a Cheshire County Education Department scholarship of £80 a year, which was enough with careful budgeting. It was supplemented in the first year, to my surprise and everybody else's, by £10 from an endowment set up by Sir Delves Broughton, the squire who lived at Doddington Hall, not far beyond Wybunbury. The award was for 'religious knowledge'. Doddington was often the venue of my early cycle rides. There was a park, a lake and a fine house. Also, in season, conkers. The Delves Broughtons used to go on safari in various parts of the world and sometimes they brought back animals, not always securely confined.

There was a church on the estate, and on one famous occasion, during morning service, a brown bear walked up the aisle and the worshippers jumped up on to their seats very scared. I suspect that they had never before prayed so fervently.

Gradually, an idea of what I might want to do in life began to crystallise out. I felt that the academic world of pure science had an air of unreality about it and I felt I should do something more clearly of practical use. This is just a point of view, of course, since many if not most of the great discoveries in science have their roots in pure research. I talked to Bob Alun about this and he arranged for me to spend part of the summer vacation doing voluntary work at the plant breeding station of Gartons Ltd at Little Leigh in Cheshire, not far from Northwich.

Dr John Garton, in the 1890s, before the re-discovery of Mendel's Law, had worked out the pedigree method of cereal breeding which remained substantially unaltered for many decades. In fact he really didn't need Mendel as he had worked a lot of it out well beforehand. Much of his method is in use today, though there are some modern refinements. I used to cycle to Crewe, put my bike on the stopping train to Liverpool and get off at Hartford. Taking to my bike again, I cycled over the swingbridge which spanned the then busy River Weaver and past the chemical works of Brunner Mond, later the I.C.I., where they used Cheshire salt as a raw material. Little Leigh was out in the country and day after day I worked with the breeders, principally on wheat.

John Garton did not get it all quite right, of course. He would grow 500 rows of each new variety side by side and I spent days looking for off-types and weeding them out. That was very good, but he thought that inbreeding would weaken races of wheat as it did with many organisms and he ran a big programme intercrossing identical progenies of the same inbred, which would be multiplied up and eventually marked as 'New Regenerated Breeds'. We know now, of course, that crossing identical lines was no different from self-fertilisation. There was a great deal going on which was very sound, however, and Gartons gave me an experience which influenced me for the rest of my life.

There was another diversion late in the summer. I had been awarded a prize consisting of a trip to the Norwich meeting of the 'B. Ass.', the uncomplimentary nickname for the British Association for the Advancement of Science. It was my first view of East Anglia and I loved Norwich. I went by rail as always, to Rugby and then by the long-deceased Midland and Great Northern Joint line through Market Harborough, Brandon and Thetford. Thetford Chase, that great extent of coniferous forest, had fairly newly been planted and looked very different from what it does today. The meeting was an opportunity to meet and listen to many

eminent scientists, some more ‘with it’ than others, of course. The sixty-year old argument between the evolutionists and the creationists could still raise quite a high temperature in the lecture room, though for the creationists it was no more than a rearguard action.

The three years in Bangor went on steadily. There were only half a dozen students taking the degree in Honours Botany in my year, and I was the only one taking it in combination with agricultural botany. Some of my classes were therefore one-to-one tutorials with Bob Alun, which was good fortune indeed for me. I had to take life pretty seriously, because I had decided that I wanted to go into research. In those days it was virtually impossible to get a research grant without a first class degree. Getting any job without a good degree wasn’t easy anyway, for the economic depression was still going strong.

In the last year came a test of aptitude in research, a ‘project’. In my case it was to study, of all things, the common dandelion. It was not without interest, because it went through a strange kind of semi-sexual reproduction, in which all was normal up to a point, when the separated cells joined up again and pretended that nothing had happened. This was called apomixis and had the effect that all the progeny of a particular plant looked alike, just as if they had been grown from cuttings. There were therefore lots of different, distinguishable races of dandelions and this led to the classic type of dispute among systematists. There were the ‘lumpers’, who called the whole lot one species, and the ‘splitters’, who forever more were giving Latin names and descriptions to individual variants. This was quite good practice for me, which was all it was intended to be, but certainly not the basis for a life’s work. My mother and father were not entirely happy when I started to fill up the garden at home with dandelions, not the easiest weed to get rid of before the days of modern herbicides!

It was now 1935. The written examination started in late May and after them there was a break of about two weeks before the practicals. During that time the examiners would mark the papers, so that almost immediately at the end of the practicals, the result was available. It all seemed to go reasonably well until the very last practical, which was absolutely vile, with material in a state of near-decomposition and all sorts of impossible questions. At the end I was called for interview with Prof. Thoday and the external examiner, the eminent Prof. Fritsch. Here I was, in the *sanctum sanctorum* of the professor’s room, with the rather dapper, dark-haired Thoday and also the co-author of the best-known botanical textbook of the day, visiting from far-distant London. They both had faces a mile long and started asking me impossible questions, and I got really scared. Then, suddenly, when I was in the deepest of deep water, they burst out laughing.

Apparently I had accumulated enough credits before the last practical for them to have a joke at my expense, the kind of thing which is very funny *after* the event! I got my ‘first’. It had never occurred to me that *professors*, occupying the unattainable pinnacles of the academic world, could be light-hearted conspirators! To the humble undergraduate they were god-like creatures and should not have stooped to such indignity.

Of course I still lived in Shavington with my parents except in term time. Lilian had taken a job in the south of France in September 1933, living with a French family and teaching Latin and English to French schoolchildren. Eventually she got a job teaching in a boarding school in Uxbridge, Middlesex and during this whole period we were able to meet during vacations.

The very last night in Bangor was memorable. With a group of friends who were also leaving, we arranged a beach party which went on into a magical, warm and still summer night. We had rowed a boat over to the Anglesey side and every movement of the water, every splash of the oars and every breaking wave were illuminated. I have never since seen a display of phosphorescence even approaching it.

Later I went back to Bangor with my parents for the degree ceremony. In those days ladies’ hats were a kind of status symbol and mother had bought an expensive new one for the occasion. I took them out in a rowing boat on the Straits and the new hat blew off. The current was strong, as it is at certain states of the tide, and it was last seen drifting away into the distance. Even the loss of her treasured hat did little to mar mother’s happiness on this very special occasion.

Chapter 5: A New Life in Cambridge

So it was time to say goodbye to Bangor, Bangor of happy memories, and to begin something new and for a while utterly uncertain. I had applied for an Agricultural Research Council Fellowship, of which only four were awarded in the whole country each year. There was an interview in Westminster with what appeared to me at the time to be a panel of incredibly ancient gentlemen. Much later in life I sometimes sat on rather similar panels and no doubt the young aspirants thought just the same about me. But they proved to be really nice guys, for they said "yes" to me, or at least the answer came through the post a few days later. The award was for £200 a year and, most unexpectedly, the Cheshire County Council extended their grant of £75 for a fourth year to show their appreciation for my success.

Where to go was the next question. I sought advice from my friend and former schoolfellow Kenneth (later Sir Kenneth) Mather. He strongly advised me to go the John Innes Horticultural Institution, then at Merton in South London. The John Innes certainly had a greater concentration of eminent geneticists and cytologists than elsewhere in Britain at the time. However, having sought the advice I ignored it and opted for Cambridge. In retrospect, I believe my choice was made for two reasons. Firstly, I had secret doubts about my possible devotion to pure science and in Cambridge there was the very practical Plant Breeding Institute, then part of the university, and I was hooked on plant breeding. Secondly I was attracted by the glamour of the ancient colleges and their surroundings, which seemed almost dreamlike to one brought up in an unsophisticated village community.

I got a little of the flavour of Cambridge by spending some weeks of the summer vacation of 1935 at the Plant Breeding Institute there, working with G.D.H.(Douglas) Bell. He was then a barley breeder and lecturer in agricultural botany in the university. Eight years earlier he also had won an A.R.C. fellowship from Bangor. He later became head of the Cambridge Plant Breeding Institute, the P.B.I., during the time when it was divorced from the university and became a large A.R.C. research institute on a new site at Trumpington, on the other side of Cambridge.

All was very simple in those days. There were two or three rooms in the old School of Agriculture downtown in Downing Street and there was Cage Field up the Huntingdon Road, a couple of miles away, near Girton. We therefore travelled, on the inevitable Cambridge bicycle with wicker basket attached, between the two. This could be abused, because it was not easy to

be sure where anybody was at any particular moment. There was one technician who was in a dance band. Staying up half the night with his band, he was not that assiduous at work. He got away with it for a long time, until a member of staff, on a day off, ran into him on the Newmarket racecourse!

Cage Field was where the field plots were situated, either in the open field or, a few of them, in the galvanised wire netting cage that gave the field its name. By the time I was there most of the zinc had weathered away, the wire was rotting and the plants near the edge of the cage were very much dwarfed by zinc poisoning. Wheat plants with thin stems six inches high were all that could be grown close to the wire, and then there was a gradient upwards to nearly normal height in the centre. The only building on the site was a long single-storied structure at one end of which was a single room with a black cast-iron 'Tortoise' stove in the middle, while the greater part was open-sided with wire netting to keep the sparrows out when sheaves of corn were stored there.

A senior member of staff was Herbert Hunter, formerly a barley breeder for Guinness in Ireland. He was a rather plump, tall, rosy-faced man, a bon viveur given to cashing in on his breeding of malting barleys by accepting hospitality from his brewer friends. We knew which pub to find them in every Saturday morning. Hunter was no great genius, as will be seen later. Professor Sir Rowland Biffen, the emeritus head of the Institute was very different, having had a brilliant career. Though recently retired when I first knew him, he was sharp as a needle. He used to wander round the trial field and chat with the newcomers like me, very informally and very helpfully. Prof. Engledow, the current head, was never there. Not quite never; I saw him looking round the plots just about once a year, a tall, slim, blonde figure with a moustache and rather thick glasses. Nearly all the time he was away, serving on some government commission or other, for which he was eventually awarded a knighthood. Then there was a head field hand, Maurice Buck and two assistants, John Palmer and Kenneth Hedge. Engledow was nominally in charge of the wheat breeding work, but Buck did it all for him. Bell, in charge of barley breeding, was both present and competent. He was also a university lecturer. George Carson, from Northern Ireland, was in charge of oats. A small amount of breeding of crops other than cereals was in hand. Red clover plants for crossing were put in netted enclosures and bumble bees were introduced to do the crossing. These were caught in the wild and there was a problem. They had doubtless been visiting other red clovers and had pollen on their bodies, so they were dipped in alcohol to kill it. Have you ever seen a drunken bumble bee? We found them quite amusing. There was other breeding as well, for instance H.W.Howard bred potatoes.

Mechanisation hardly existed and all the cereal plots were sown with the aid of a multi-pointed dibber, which was pressed into the soil with the foot to punch 22 small holes in a four-foot row. Seeds from one parent ear would be dropped individually into the holes, without mechanical aid of any sort. This was where the Tortoise stove came in, because in the late autumn it could be very cold and one’s hands became impossibly stiff for a job which required quite a lot of dexterity. The cast-iron stove had a pipe that went up through the roof-ridge, and this was an excellent hand-warmer.

In the early summer there was a part-time assistant: he appeared when the cereals began to ripen. He was 'Arthur', pretty decrepit and with a walrus moustache, a puffed-up face and a complaining look. He used to corner members of staff who had doctorates and, thinking that they were medical doctors, would ask them whether whisky would be good for this or that complaint, real or imagined. He was always assured that it would be the best thing in the world. Arthur's job was to fight a running (and usually losing) battle with the local sparrow population. They had worked out exactly how to thwart his efforts by moving to another part of the field when he got too close.

Later I learnt why the P.B.I. was run so cheaply. Biffen was one of the small group, which had also included Punnett and Bateson, who had been working on the basics of genetics in Bateson's garden in Grantchester just after Mendel's Laws had been rediscovered. They had shared one gardener between them. They did their work on a shoestring because at that time they had failed to interest the university in funding this new-fangled study. Biffen had developed the habit of parsimony and made extremely modest demands for funding for the P.B.I. and even then often did not spend it all and returned part of the grant. So when I was there the Institute was getting less than a third of the funding which went to the Welsh Plant Breeding Station in Aberystwyth. Biffen was brilliant as a breeder and was the first to produce a disease-resistant crop variety, the rust-resistant 'Little Joss' wheat. He was also the first to demonstrate the heritability of baking quality in wheat, with his variety 'Yeoman'.

The summer of 1935 was sunny and the ancient college buildings of mellow stone, in their setting of green lawns were idyllic, especially the area bordering the river not very romantically referred to as 'the Backs'. Near to the river picnics were permitted but closer to the colleges the lawns were sacrosanct. The grass was reserved for fellows of the appropriate college and even they had to behave in a decorous manner! The most impressive lawn was at King's College. Enquirers were told that the key to its perfection was quite simple. Just mow it, roll it and generally nurture it for 400 years!

The favourite recreation on the river was punting, which meant propelling a heavy teak punt with a wooden pole around ten feet long, tipped with a two-pronged metal fork. Steering was a trick to be learnt and the bed of the river varied from place to place from gravel to rather glutinous mud which held the pole quite tight. A quick and well-timed twist would release it, but newcomers sometimes held on too long and had a wetting. Usually this did not happen on the first time out, or even the second, but when the newcomer suddenly felt falsely confident. Once I was out with a friend with the splendidly Irish name Cormac O'Ceallaigh, when he fell in with his pipe in his mouth, coming up a moment later with the pipe still firmly clamped between his teeth. A tenacious lot, the Irish.

After learning the tricks, punting trips became more ambitious and the cushioned seats were ideal for taking the girlfriend up to Grantchester for a cream tea at the Red Lion or maybe for just lingering in some secluded backwater. Those of us in 'digs' could come back in the small hours of the morning, not officially allowed but widely condoned. It was harder for those with college rooms. It was a misdemeanour, with a small fine, to be out of college after 10 p.m., but a major felony to be out after midnight without previous permission. The bookshops encouraged the miscreants, however, by stocking a book that gave details of how best to climb into each college at night. This was rather tough on the students who had rooms on the route. They were prone to be disturbed by late-comers passing through at any time of the night.

Lilian was by now long since back from France and teaching at Frays College, a private boarding school in Uxbridge, Middlesex. She had a pretty thin time of it there, with endless hours of duty and a pokey room, not very good food and a derisory salary. Jobs were very hard to get in the 1930s. Her predecessor in the post was none other than 'Mr Blair', who was George Orwell of 'l984' fame. By this time he was on the slippery slope of alcoholism. Every Sunday there was a rail excursion from London to Cambridge, fare four shillings. Lilian would come as often as she could get away and I would meet her at the station, well on the southern side of town. When the railways were being developed, the town councillors of Cambridge decided that they would not have the new noisy, smoking monsters within their town. So after meeting we had a bus journey to the town centre and another up the Huntingdon Road to my rooms. Halcyon days they were. Sometimes I did the travelling and went to Uxbridge and also we spent an occasional weekend together with our friends Beth and Arthur in Harrow Weald. More often, however, the all-pervading duties of teaching in a boarding school meant that we could not meet.

But I have run on ahead. In the summer of 1935 a decision had to be made. That was to choose, and to be admitted to, a college. Cambridge, like Oxford, grew up in the days when there were a lot of separate small colleges in which all the teaching was done. The main subjects were classics, theology and mathematics, none of which needed much in the way of facilities. The 'university' was in effect a set of offices and its function was to set examinations that were taken by the students of all the colleges. This ensured a uniform and respected standard for the degrees. Almost the whole aim was the education of clergymen, so it is not surprising that many colleges had names like Christ's, Jesus, Corpus Christi, St. Catherine's. It seemed very odd for a while to hear a student say that he "was going to Jesus", merely meaning that he was going over to the college to meet somebody. Later and particularly in the nineteenth century, subjects such as chemistry, physics and biology reared their ugly, secular heads and it was then quite impractible to have all the facilities required in each of fifteen colleges. Hence the colleges gradually became little more than Halls of Residence and the University put up appropriate buildings and took over all the teaching, both of the new subjects and the old.

It didn't matter that much which college was chosen. I picked on 'Kees', officially Gonville and Caius. It had been Gonville Hall, founded in 1384 on a different site, but it had somehow got into a mess and was refounded on the present site in 1561 by John Kees. In those days students had to speak Latin during dinner in college and everybody, including even the Master, was given a Latin name as near as could be to his own. So 'Kees' became 'Caius', but the name of the college was still, quite illogically, pronounced 'Kees'. The new college was given a brand new set of statutes. One of them was that "No scholar shall be elected who is deaf, dumb, deformed, a confirmed invalid or a Welshman." In 1561 the Welsh were prone to make a nuisance of themselves by prodding away at the English on the borders and they were therefore not at all popular. Nowadays John Kees wouldn't get away with a statute like that and even when I was there the Welshman bit was circumnavigated by setting up some scholarships, the Rhondda scholarships, open only to Welshmen. Maybe they had the best deal of all in the end.

John Kees was keen on symbolism. The way into the college was through the Gate of Humility. Leading to the older buildings where the chapel, dining hall and other facilities were located was the Gate of Virtue. Finally students about to get their degrees were led out to the nearby Senate House through the Gate of Honour. The gates were inscribed Humilitatis, Virtutis and Honoris. There was another gate near the college bathrooms and lavatories, which (until it was removed by some over-zealous official) was inscribed Necessitatis! Any removal of this sign did not last long. Someone

was bound to restore it very soon. The college did have bathrooms, as did they all by the 1930's. It is said that St. John's College only got its bathrooms a few years previously. The matter had been debated from time to time by the dons and it had been decided that, since the terms were only eight weeks long, bathrooms were hardly necessary! Even in my day, many of the licensed lodgings in the older parts of town were not equipped with bathrooms and students could be seen walking through the streets in a bathrobe with a towel over their arm, whatever the weather, heading to or from the college baths. You had to be keen to be clean!

Cambridge was very much aware of its long history and held on to many old privileges and traditions, at least in symbolic form. During term time there was a Sunday afternoon service in Great St. Mary's church, which was attended by the Vice-chancellor and other university dignitaries, who processed from the Senate House to the church in full academic dress of long gown and mortarboard, the facings of the gown decorated with gold embroidery. With them were three university servants, attired in morning dress complete with top hat, carrying the symbols of office. One of them carried a mace and the other two walked behind him, side-by-side, one carrying an ancient volume of the university statutes, heavy, leather-bound and suspended from chains, and the other carrying a butter measure. This latter was a relic of the days when the town traders were notorious for cheating students by giving them short measure. Meanwhile in the tower of Great St.Mary's the bellringers drowned the whole scene with riotous sound. There were some ancient rites, and indeed rights, which would have been very difficult to observe, like practising archery on Saturday afternoons in Petty Cury, clad only in Lincoln Green. Petty Cury was then a busy one-way street; now it is a shopping precinct teeming with people.

The university was strictly an all-male society, doubtless a hangover from the days when it was a group of training colleges for catholic priests. It is true that there were two women's colleges, so there were slight signs of departure from the unsullied state of pure masculinity. However the members of these colleges, while allowed to attend lectures and take exams like the male students, were not recognised as members of the university. They received pieces of paper which were not degree certificates, but 'titles to a degree'. This indicated that they would have had a degree had they not had the misfortune to be born female! There was an almost inevitable unofficial name for these titular degrees: B.A. Tits! The men students outnumbered the women by about ten to one. It was just as well that I had Lilian! Nowadays the decay of the university is complete: there are women students in the men's colleges and men in Girton and Newnham. What a disaster!

Students had to wear academic dress of gown and mortarboard in the streets after 8.30 p.m. or dusk, whichever was the later, and when so clad were not allowed to smoke or enter the public bars of pubs. These and other regulations were enforced by a proctor (also academically attired) accompanied by two 'bulldogs' in morning dress. These were college servants, chosen as good sprinters according to their performance on their annual sports day. If spotted doing anything against the rules, the student had to make a quick assessment of escape opportunities. Getting away, or off the streets into the sanctuary of any college, meant that there was no fine. Making a run for it and still getting caught meant a doubling of the fine from 6/8d to 13/4d, i.e. from one third to two thirds of a pound. Graduates paid the double fine in any case, it being held that they should know better. It wasn't much good dodging down little lanes and side turnings, for the bulldogs knew all of them.

All this was rather fun in its way and at least some sort of acknowledgment of the long history and tradition that was Cambridge. It was of course secondary to the business of getting started on a Ph.D. course. I had declared an interest in plant breeding and its attendant sciences of genetics and cytology. I was therefore allocated to the School of Agriculture, specifically to A.E. Watkins, who became my supervisor. He was sound if not brilliant, but was a really pleasant person to work with. He gave time generously to his research students. In his forties, of medium height and fresh complexion with fair and slightly ginger hair, he lived out at Wendens Ambo, near Saffron Walden, about 15 miles out of Cambridge. He commuted in a Lanchester car, rather superior and of a make long since extinct. After a while I was to be invited to his home for the odd weekend. He had a lovely, charming wife to whom he was devoted and a son who was then in school in Bishop's Stortford. His life ended in tragedy. His wife died of cancer, his son was killed in the war, and he ended his days in a mental home.

There were several other research students with Watkins at the time. One, an Irishman named J.C. Cullen, was to impinge on my life some years later. Another was H.W. Howard, who became a potato breeder of note and had a genetical hobby. He had rows of jars of woodlice, the kind which roll up into balls when alarmed, and studied the peculiar sex ratios of their progeny. There were two or three other students too.

Mixed with the research there were a number of courses to be taken, such as experimental design and statistics. The more academic aspect of this was taught by a Scottish mathematician named Wishart. The very practical methods of setting up field experiments were the province of Garner and Sanders, joint authors of a book on the subject. They ran a lot of experiments on the University Farm. One of the more amusing ones then current was the

conversion of margarine to butter. It was found that, if you added margarine to the diet of dairy cows, you could get about 80 per cent of it back as additional butter! The point of this was that butter cost about four times as much as margarine in those days, so that there was a profit of 300 per cent on the deal.

There were courses in cytology and genetics too, and a bit more science German. I was able to do just a little teaching too, as a demonstrator in the laboratory sessions for students taking the Estate Management course. Most of the students were sons of the landed gentry. Titles were everywhere! I remember compiling a register, and it went something like this: "Name?"..... "Grafton"....."Initials?"....."Duke of '! Most of the time was free for the research project but it was in no way regimented and there was time to enjoy Cambridge. In the summer there was the river as well as cycling and walking around the countryside. This was flat and open and strange, at least to the north. It was fenland with black soil, soil which quaked like jelly, as became very clear if you stood anywhere near the path of a tractor plough. Having very few trees and wide-open horizons it was bitterly windswept in the winter. The Isle of Ely was only 15 miles away from Cambridge, and was an island of 'high' ground in the middle of the old marshland. 'High' could mean a very few feet above the marsh and there were place-names like 'Shippea Hill', where the 'hill' was imperceptible to the eye. Only when the land was flooded would it be noticeable. Ely itself was an interesting little town, with one of Britain's finest cathedrals. I cycled there with Cormac O'Ceallaigh on the day of King George V's funeral and took a picture that was awarded the challenge cup in the University Camera Club's annual exhibition.

To the south it was different, with the low Gog Magog hills and rolling chalk country around Saffron Walden. On the slopes were thin soils, where the plough had often brought up raw chalk. Lower down, this country was well wooded with oaks and beeches. The area was good for walking, especially along routes like the old Roman road across the hills. The thing to do was to go to Jeremiah's in Abingdon for refreshments and then walk back along the chalk ridge. There were all sorts of rare chalk-land flowers, orchids, Pasque flowers, little spiny wild rose bushes and so on. There was no wheeled traffic of any kind.

A curiosity of the Cambridge system was that each student had a tutor, quite distinct from his supervisor. It would be fair to assume that the tutor knew something about the student's research, but nothing of the kind was true. Mine was a very dry lawyer named Wade, and he would invite me and other students along to a very stiff and formal meeting in his rooms once every year. A glass of sherry was proffered. His alleged function was to stand in

loco parentis and to take necessary action should we be found out in too much indiscipline. For this function he received a generous fee. I do not know if he had an official sherry allowance!

In term time there was a requirement to dine in college at least four times a week. The college dining hall was oak-panelled and high-raftered, with walls displaying oil paintings of eminent past members of the college, including one of John Kees himself. The windows bore in stained glass the coats of arms of noble past members of the college. There was a minstrel gallery, but in my time never any minstrels. Two long oak refectory tables were arranged crosswise at the end of the hall, the first for the fellows and the second for the graduates. Tables for the undergraduates ran lengthwise. A long Latin grace was said, probably the same as had been used for centuries, but praise be we were no longer required to converse in Latin at table. The meals were good and in one respect very different from Bangor, where the puritanical spirit of Welsh non-conformism still ruled. In Caius there was an excellent wine cellar and beer and wines were served in the dining hall. A strong beer called Dale's Audit Ale was the favourite.

There was a college chapel, too. Not marvellously monumental like King's, nor comparable with the more modest chapels of such colleges as Trinity. It was in the renaissance style and rather small, with an apse at the east end and memorials to some of the early college members on the walls. There was an organ, perched up in an oak organ loft. We students (when we went at all) picked up a white surplice on the way in, to give us all the spurious look of angels. Well, not quite.

There was nothing like enough accommodation in the colleges for all the students and the university ran a list of approved lodgings. I stayed with the Conroys in a roomy house up the Huntingdon Road, handy for the town and for the plant breeding station. Another research student, Noel Slater was there too; his specialities were quantum mechanics and organ playing. He was rather fat with a pale and puffy face and was not very well liked. We had separate bedrooms but shared a sitting room. In later years I moved in turn to two other houses in the same area. The last one was in Oxford Road with Mrs White, fat and jolly and a first-rate cook. She produced enormous helpings of food and treated it as a personal insult if any was left. Her husband was a little shrimp of a man and he once confided to me that when they were in bed together it was like being next to a "blooming great tank"!

Everybody in Cambridge had a bicycle and a wicker basket strapped to the handlebars to carry books or shopping was de rigeur. The unscrupulous used to 'borrow' bikes, especially if they were late for a lecture. The police ran a special lost bicycle warehouse and from time to time the unclaimed machines were auctioned. I got tired of locking my bike up all the time and

painted it a hideous yellow-green in the belief that it would then be too conspicuous to steal. It went the very next day and I never saw it again.

There was a kind of overlapping community life here. There was the college, and there was the department, but also contacts in clubs and societies, with other students from the same school and in many other ways. There wasn't that much chance of meeting women students because there were so few of them and in any case hardly any of them took science.

I was especially friendly with Leighton Yates and Cormac O'Ceallaigh in the Cavendish, the world-famous physics laboratory. There, Leighton was separating isotopes and Cormac was photographing the tracks of sub-atomic particles in a Wilson cloud chamber. Professor Sir Ernest (later Lord) Rutherford, Cockcroft and others were busy splitting atoms, separating isotopes, studying radioactivity and doing many things that were soon to have enormous military significance. All this was still regarded as pure science and there was no secrecy. I used to wander in and out freely, often seeing Rutherford at work in his corner of the lab, counting scintillations or doing similar work. He could have done with a modem Geiger counter! Peter Kapitza was there from Russia, and a special laboratory had been set up for his low temperature work. When he was recalled to Russia his laboratory went with him.

In one way Rutherford was like Biffen, brilliant but brought up on a shoestring, in his case in New Zealand. His research students spent a good deal of their time building their own apparatus. Very little equipment was bought in, though I suppose that very little was available commercially in those days. When, some years later, Rutherford decided that he wanted a high tension lab with a large Van den Graaf machine costing £100,000, he had no alternative but to seek a benefactor. Luckily he knew the then Prime Minister, Stanley Baldwin, who was able to engineer a peerage for Herbert Austin in return for funding the lab. Austin was at the time consumed with jealousy because his car manufacturer rival, William Morris, had been awarded a peerage and the title of Lord Nuffield, following his very generous bequests to hospitals. Austin got his peerage much more cheaply.

Dining in College was a requirement, but having lunch in college was entirely voluntary. Four of us, Leighton Yates, Cormac O'Ceallaigh, Freddie Hoyle and I would take it in turn to entertain the little group in Caius, St John's and Trinity. Many and varied were the discussions, but we were very far from being serious all the time. Cormac, whose surname would be spelt O'Kelly by ordinary mortals, was a cultured Irish patriot with a great sense of humour. He was to have a distinguished career in the field of particle physics. Freddie (later Sir Fred) became one of the world's most eminent cosmologists, though some knew him as a writer of science fiction. His ideas

were usually rather controversial, but he was brilliant. Leighton was always religious and this took him to a teaching post in Salisbury, Rhodesia and there I lost touch with him.

Cambridge had cinemas and also two theatres. The Arts Theatre, in the middle of town, had not long been opened and was most pleasant. Some top-rating shows could be seen there, plays, ballet and even opera. Way up the Newmarket Road was the Festival Theatre. This was a repertory theatre which had nurtured many young actresses and actors who were destined for world fame. A seat in the upper gallery, popularly known as 'the gods' used to cost a shilling (5p).

Several of the colleges had fine chapels and King's College Chapel is still, in my view, simply the finest building in the world, though I admit that I have not seen the Taj Mahal! In the perpendicular style, with huge stained-glass windows and superb fan-vaulted roof, it had been built in the time of Henry VIth. It had a first-rate choir and organist and services there were really like fine concerts. The choir and the choir school have an unbroken tradition of 450 years. The carol service on the last Thursday of term before Christmas, held in candlelight, was superb. It fully deserved, in later years, to become a regular feature of pre-Christmas radio and television, though the lighting for that purpose had to be more than candles.

I often went to the Congregational Church in Trumpington Street to listen to 'Polly' Carter. 'Polly' because he had a big, rather hooked nose. Once I dropped a clanger with his assistant minister. It did not occur to me that L.M.S. could mean anything other than London, Midland and Scottish. I would be the last to think of the London Missionary Society.

The rules for taking a Ph.D. in Cambridge were that you should be resident in 'full term' time for three years. Residence meant living within 2½ miles of Great St. Mary's Church, but there was an escape clause. It was possible to spend the third year in an overseas university of one's choice, subject to approval. So this I did, as indeed as I was required to do under the terms of my ARC award. I chose the University of California at Berkeley. I might reasonably have gone to Lund in Sweden, where Mather went, or to Cornell University in New York State. I was nervous about problems with the Swedish language, so Lund was out, and California seemed much more attractive than up-state New York. America in 1937-38, just before the war, was a rare opportunity. In those days such travel was a very much more unusual thing than it is today and it was my first trip out of Britain. Before leaving Cambridge I was called in to see the seldom-seen Professor of Agriculture, Frank Engledow. He said that he wished me to spend my year in America partly in Berkeley, as already planned, but also in visiting research institutes and universities throughout the United States and Canada,

wherever cross-fertilised plants were being bred, to study the methods in use. In America the most important cross-fertilised plant was maize, but there were also various vegetable and forage crops and ..... sugar beet. Douglas Bell gave me a letter of introduction to Harry Harlan, whom he knew well, at the U.S. Department of Agriculture in Washington D.C. This all amounted to a wonderful opportunity.

There was another experience that summer. My friend Kenneth Mather had advised me to go to the John Innes Horticultural Institution rather than to Cambridge and I turned the idea down. But in the summer of 1937 there was a remarkable two-week summer school at the John Innes. All the most eminent geneticists and cytologists of the day were giving lectures: R.A. Fisher, J.B.S. Haldane, C.D. Darlington, Kenneth Mather himself and other well-known people. It not only gave me an opportunity to listen to them, but also to spend time with them in informal conversation.

Chapter 6: The Long Journey to Los Angeles

So the great adventure of the year in America began. It was indeed exciting for me, for I had never been out of Britain before and here I was, travelling at 25 miles per hour day and night for nearly a week, realizing the immensity of the Atlantic Ocean. Travelling to the land everybody had heard about, the land of Hollywood, skyscrapers, vast prairies, mountains and deserts. The land, too, where the infamous Al Capone and his mates were busy shooting up, and being shot at by, their rivals in Chicago. What would the reality be like?

There were some lingering partings, especially with Lilian of course and then back as always to railway journeys. This time it was to London, to go to a theatre show with friends Beth and Arthur, to stay overnight in a hotel and next morning to go to Waterloo to board the crack boat train which went non-stop right to the Southampton quayside, above which towered the huge black wall of the ship's side. Then came the wait in line to go up the gangway and the search for the cabin.

The Ministry of Agriculture had paid my fare, third class. I somehow learnt that it cost then £30. The third class was no hardship, indeed it comprised most of the ship's accommodation. The public rooms were fine and the meals excellent. The cabin was rather small and shared with two others, but they were agreeable companions. In those days, when the alternative of air travel did not exist, many young Americans travelled to Europe in this way. Very few young Europeans were so adventurous or so well-heeled as to be able to go to America on a holiday trip. I even met my first live Indian aboard. She was not at all as portrayed on the 'westerns', but a rather prosperous-looking young Cherokee. The white invaders of North America were not noted for their kindness to the native Indians. Most of them were moved on to reservations in poor and apparently useless country and this was true of the Cherokees, who were moved to Oklahoma. What the U.S. Government of the day could not have known was that there was a rich oilfield below!

The ship belonged to the Cunard Steamship Company and was called the *Berengaria*. Compared with the biggest boat in my previous experience, the Liverpool to New Brighton ferry, it was indeed enormous. During the voyage I was able to visit the engine room, now oil-fired though built originally for coal. I well remember the four gigantic propeller shafts, turning slowly and silently with a fateful inevitability, turning the giant screws which left their quadruple wake all the way to the horizon and beyond.

The *Berengaria* looked pretty new, but of course all such vessels had expensive re-fits from time to time. A bit like the faces of the Hollywood stars, by all accounts. In fact, it had been built in Germany in 1912 and called the *Imperator*. It had been seized as reparations after the war. Over 52,000 tons and nearly 1,000 feet long, it really was one of the big ones. The search for prestige had some strange effects. At the time, one way to impress travelers was to have as many giant smokestacks as possible. The *Berengaria* had three, but the one at the back was a dummy. Its wind resistance must have led to enormous extra fuel consumption, all for the sake of prestige.

I did not know it at the time, but the ship was not to make many more journeys. It went on fire in New York Harbour in the following February and soon afterwards succumbed to the scrapman's torch.

After leaving Southampton and sailing close to another form of transport of the day, an *Imperial Airways* flying boat, we headed for Cherbourg. There, a tender came out to us and passengers from continental Europe came aboard. Then we set off for New York.

We left on Wednesday, September 22nd 1937 and arrived at the Ambrose Channel Lightship the following Tuesday, after 5 days, 17.5 hours, so said the log. It wasn't the smoothest crossing, two of the five days being noted as having a 'strong breeze, rough sea and swell'. There were no stabilisers then and attendance in the dining room dropped off sharply. In a letter home I said that I was surprised to find myself a good sailor, for I had no trouble with seasickness. In the same letter I remarked about the medical examination. It consisted of 'going up to the ship's doctor, declaring your nationality and having your landing card stamped on the back'.

I was to make two further trips to America by sea in later years. Comparing them, one striking difference was that I saw whales spouting not far away from the ship on quite a few occasions, and also little 'flocks' of flying fish, but the whales were certainly scarcer in later times. The greatest impact was the view of the huge Statue of Liberty as we passed, and of the unique skyline of Manhattan.

One advantage of the Ministry of Agriculture's sponsorship was that my visa was marked 'Government Official', which put me at the head of the queue for disembarking. Wonderful, except that my cases had no such priority and I had to hang about on the quay for ages, waiting for the last one to arrive. I had brought

with me, apart from ordinary luggage, a trunk full of my wheat research material, which could not be imported without all sorts of special official papers. Even then, the plant quarantine people in New York could do nothing about it and a special official of superior rank had been sent up from Washington D.C. to see it through.

In a state of great exhilaration about having reached the promised land, it was an eye-opener to see the old warehouses and run-down tenements down near the piers, with their obviously poor and mostly black people. This was worse than I had ever imagined. Soon, however, things improved. My taxi-driver found me a hotel and I walked out and had my first lesson in the American way of life. I was beginning to get hungry and I nipped into a little food shop and asked for some sandwiches, thinking of the dainty little things which graced afternoon tea tables in England. The guy looked at me and said, 'better try one first', and I was introduced to the Great American Sandwich.

Not knowing anything about costs in America, or how far my grant was going to stretch, I took advice from other young people on the boat and moved next day into a new Y.M.C.A. hostel in the city. It was exciting, being in New York. I walked at night to Times Square to see all the lights: great advertising signs heaped one above the other and ever-changing. One advertisement even puffed out smoke (I suppose it was really steam) from a giant cigarette. I travelled on buses and subways, to the Metropolitan Art Museum and to the top of the 80-storey R.C.A. building, down to the southern tip of Manhattan to the Battery and the zoo. It was all *safe* in those days, except perhaps for walking in Central Park at night, which I was warned against.

The highlight of all this was a trip round Manhattan Island in a boat, quite the best way of getting a general picture of New York City. The boatman gave a commentary and he was very good at quoting the phenomenal cost of major buildings, bridges and other structures and in saying that this or that was the largest of its kind in the world. I remember him pointing up the Hudson River and saying, apparently with pride, that the prison in the distance (*Sing Sing*) was the largest anywhere. I don't know whether he had included the U.S.S.R. in his calculations.

The next task was to get a rail ticket at the enormous and palatial Grand Central Station, with its high, cathedral-like foyer and to travel on the *B & O*, the *Baltimore and Ohio Railroad*. New York and Washington look so close together on our maps, but they are about 250 miles apart and the train did the journey in just over four hours. Having arrived, I found a cheap hotel and reported next day to Dr

Harry V. Harlan. As it turned out, being introduced to ‘Doc’ was one of the best things which ever happened to me.

Washington D.C. is monumental, at least part of it is. Everybody sees pictures of the White House and the great sweep of green lawns passing and surrounding the Washington Memorial and continuing to the Lincoln Memorial in the distance. At that time the government buildings on either side were not entirely full of administrators and politicians, as they seem to be today. The Department of Agriculture still had many of its scientific staff there, with their laboratories and, across the river in Arlington, Virginia it had field plots. These latter were on the very land on which the Pentagon was later to be built, so now the plots have gone and the scientific work too.

Harry Harlan headed the U.S.D.A. barley breeding project and he worked right there in Washington for part of the year. When I went to see him he welcomed me warmly. We chatted a bit and then he took me out some five miles through autumn-tinted parkland to his home. On the way we picked up his son Jack, we had dinner and afterwards went to see a game of American football. The local team was the Washington Redskins. I was far from understanding the niceties of the game and they still mystify me. With all the armour worn by the players, it looks more like a military operation than a game. I was intrigued with the little committee meetings which the players engaged in from time to time, stopping the game meanwhile. The Americans don’t understand cricket, so they can hardly expect others to understand their strange rituals. One surprise was seeing an armoured van, come to collect the takings. We had not yet needed such a precaution in Britain.

I continued to be looked after right royally in Washington, both at work and at play. ‘Doc’ soon discovered that I was staying in a cheap hotel and found me a guest room in his club, at the phenomenal price of $1.25 (then five shillings or 25p) a day. It was the Cosmos Club, the gracious former home of President Monroe, in the little square right at the back of the White House. Membership was for people eminent in science of the arts and I was able to meet and talk to many of them.

On the first weekend I went with Jack about 70 miles south to a house in the forest on the shore of Chesapeake Bay. It belonged to his girlfriend Jean Yocum’s father, who was botany professor at George Washington University, and about 15 students were there. It wasn’t all botanising. Swimming in the warm waters of the Bay and yarning round the campfire was great fun. Many strange plants were there: wild persimmons, native grapes, Virginia creepers climbing up many of the trees and

very much besides. On the way back I went with Jack to see a cypress swamp, with the breathing 'knees' standing out above the water level.

Returning to Washington, we saw anchored in one of the waterways off the Bay a great fleet of 'mothballed' destroyers of the U.S. Navy. These were the ships destined to be 'lent' to the British after the second world war had broken out in 1939, supposedly for convoy protection duties.

Each weekday morning I walked round the side of the White House, across the lawns, past the giant obelisk of the Washington Monument, to the Agriculture Building. In 1936 and 1937 the 'Yearbook of Agriculture' consisted of chapters written by the head of each section on plant breeding in America as it then was. Thanks to 'Doc' I was able to spend at least half a day with nearly every one of those people, talking about their work. They gave their time generously and I still don't know how they managed it for the likes of me, for I spent very many hours with section heads, not with juniors. Sometimes a visit included a trip to the field plots across the Potomac River at Arlington, Virginia. One day I turned up and the Department was nearly empty. Everybody had all been called out to Arlington, it was said. When I got there the mystery was solved. The miscreants were listening to the radio, to the final of the 'World Series' of baseball matches. Americans are still prone to get a little cross if told that their beloved baseball and basketball are both girls' games in Britain, called rounders and netball!

On another day I went out to the U.S.D.A. building in Beltsville, Maryland, not many miles away. It was then comparatively small and unimportant, but has since, like a giant black hole, drawn into itself all that was agricultural in Washington and Arlington. It has become massive.

'Doc' had a sense of humour. He found out from me about Lilian and wrote to her saying that I had already gone native, chewing gum all day long and sticking it under chairs. He said I was developing a talk-through-the-nose New Jersey accent, ate peanuts and popcorn, and he asked her if she held him responsible for this terrible degeneration. Later he sent her a present of 'something typically American', a tin Mickey Mouse on horseback, made in Japan.

There was time to fit in visits to the Smithsonian Institution to see the American Indian exhibits, to George Washington's home at Mount Vernon and to the Federal Capitol. The latter I thought to be very impressive on the outside and an architectural shambles on the inside. There was another Sunday trip with the Harlans. Through Gettysburg, where Lincoln made his rousing speech during the Civil War, on to a forested area of Pennsylvania. There to see the woodlands in

their autumn majesty. Red oaks, bright yellow tulip trees, deep copper dogwoods and contrasting dark green, evergreen hemlocks. Not the hemlock taken by Socrates, of course, but giant conifers. There were forests spreading from horizon to horizon.

By now 'Doc' had planned the visits I was to make on the way to Berkeley. Some of them strictly scientific, visiting research stations, and others like a visit to New Orleans, to broaden my experience of America. The two objectives got nicely mixed up at times, like the fortnight in Sacaton, Arizona. There was a small cotton breeding station there, which provided me with a scientific excuse, but 'Doc's' main idea was that I should have the experience of living on a reservation with the Pima Indians.

Train journeys again, of course, but on a quite different scale. Leaving Washington at midnight on Tuesday 19th November and arriving in New Orleans, after 31 hours, at 7 a.m. on Thursday. Huge, black steam engines and Pullman sleeping coaches with a central gangway and upper and lower bunks just like the films! These ingeniously folded away in the daytime to make ordinary seats. Covered in olive green leather to match the outside of the coaches, these had a faint but characteristic smell. The stations had very low platforms if any, so that the trains looked even bigger than they would otherwise have done. There was always the traditional black train conductor, shouting 'All aboard' as we clambered up the steps into either end of a coach.

We passed through Kentucky, Tennessee and other south-eastern states and then across Lake Pontchartrain in the early morning light to New Orleans. This was fascinating, but there was the unavoidable disappointment that many hours of the journey were through the night and nothing could be seen. But before it went dark I was able to note the quaint wooden houses, often in dire need of repair, in the valleys, and fields of maize and my first ever cotton fields. The tobacco had all been harvested, but in some places it was still possible to see the leaves hanging up to cure in slatted sheds.

New Orleans was in the 'deep south' of course, and the French and Spanish influences in its history still showed. It was very warm, even in late October, and humid too. Many of the trees and even some of the power supply poles and cables were draped in long pendant festoons of greyish Spanish moss, not really a moss at all, but a flowering plant. The old city centre, the 'French Quarter' had narrow streets with French names and rows of old-style houses with overhanging balconies. They had ornate and original cast iron balustrades and supporting pillars. The central square was dominated by the St. Louis Cathedral, where some

services were still being held in French. The gardens in the square had palm trees and bananas and other sub-tropical plants. I lunched at *Antoines*, one of America's famous restaurants. A sign of the extent to which times have changed is that a splendid lunch of southern specialities cost $2, or 40p.

In taking a bus to see the broad and muddy Mississippi River, I came across a feature of the south in those days. I was asked to change seats, because the one I was sitting in was for 'blacks'. I was already getting a little used to seeing black and white waiting rooms at the railway station and rows of four public toilets, male and female, black and white. The experience shocked me, though, for I was quite unprepared for the kind of segregation which existed in the South in those days. It was very clear that the intensity of the prejudice was greatest in states which had a high percentage of blacks in their population, which suggested that it was a manifestation of fear. In the north and west there was more than enough prejudice, but it did not show in the same glaring way. It is just as well that times have changed in this respect.

Next stage was to take the night train to Houston, Texas, and the branch line to College Station, where the Texas A&M (Agricultural and Mechanical) college was situated. Such colleges were set up under a special Act of Congress and one of the conditions was that the students took military training. I saw many of them out squarebashing and somehow got the idea that the training was traditional rather than up to date.

My mission, however, was not to join the U.S. Army but to see the cotton breeding work going on there, the first plant breeding on my programme since leaving Washington. Cotton did not exactly fit into Prof. Engledow's definition of a cross-fertilised plant, but is one a few (field beans are another) which sometimes behave that way and sometimes self-fertilise. I spent some hours with the cotton and in the evening went to a cinema. After a few hours sleep in student accommodation, I got up to catch a train back to Houston in the dead of night, arriving there for breakfast. Then came another long train journey, 31 hours once more, westwards on the Southern Pacific.

First of all it was across the rest of Texas, through San Antonio to El Paso. Now the place names were often Spanish and indeed many of the people looked as if they could be Mexican. El Paso is on the Rio Grande and the opposite bank of the river is Mexico. There, in the railway station, was a Mexican train, with an engine, still of American appearance, labelled 'N. de T.'. It was dwarfed by ours.

El Paso was the last stop in Texas and now a new thrill was crossing the desert of southern New Mexico, the first desert I had ever seen. The strange vegetation, of which the most striking plants were the Joshua trees, and the bare mountains rising abruptly out of an almost level plain made a deep impression.

Then the route went into Arizona, still desert of course, and I stopped off in Tucson to see something of the grass breeding in the university. The next hop was a short one, to a tiny little station (we should call it a halt) outside the small town of Coolidge. Rail travel became very informal west of the Mississippi and here was a crack express, the *Golden State Limited*, not only stopping on request to set me down, but also waiting for the conductor to check that I was being met out there in the desert. I *was* met though, by Mr. King, the director of the experiment station and his wife and daughter. Top people again – amazing!

The experiment station community formed a small island of white people in the middle of the Pima reservation. There was a very simple but quite pleasant little guest house, which I had all to myself for two weeks. There was a pomegranate tree just outside the door, hummingbirds buzzing around in their lovely, darting, colourful way, and a few six-inch long geckos running up the walls, not all on the outside. Apart from the Kings, there were three or four young fellows living a bachelor life and also Mary Martini, a jolly fifty-year-old who was Doc Harlan's assistant. She used to say that she was the typical American, with eight great-grandparents from eight different European countries. It was pure chance that the Italian one had given her surname.

We had entertainment. There was a tennis court, too hot to use in the daytime most of the year, but equipped with floodlights so that we could play in the cool of the evening. Some of the Pimas used to watch the game and laughed uproariously when one of us slipped and fell. Not in a nasty way, it was just funny to them! There was a billiard table too, American style with a blue cloth and no pockets, but this was left alone after a few days. A skunk had got in under the floor and left the room just about untenable. A disturbed skunk is certainly memorable. What I liked best though, were the evenings. The dust high in the desert sky gave rise to wonderful sunsets. We would watch the sky and when it faded (as it did all too quickly), we could light a fire for a barbecue, listening to the sound of the coyotes in the distance.

The Pimas were a settled, agricultural tribe dependent on a water supply from the Salt River. Historically they had often been raided by the war-like Apaches. They raised their food crops and some of them also worked part-time as labourers at the

experiment station. Their philosophy was simple. When short of money you work. When you get your wages you just laze about until you need money again.

Some of the Pimas were great artists, though. They made beautiful baskets in traditional designs, all without any kind of written pattern, so that no two were quite alike. The wearing parts of the baskets, the base and the rim, were made of ‘devil’s claw’, black, hard strips split from the long, curved claws at the end of the pods of a desert legume. The soft parts were white, of cottonwood, and in the white areas the black pattern was woven. Some of the baskets were shaped like vases and were so perfect that, after being soaked, they could be used as vessels in which to boil liquids. The method was to build a fire on a flat stone, scrape it away when the stone was hot enough, and place the basket on it. Mary Martini was a great expert on Pima baskets, knew the weavers of the day, and got them to make examples specially for her. Traditionally, the Pimas had not made pottery, hence their use of baskets, in some cases in unlikely ways.

This facility for making designs without any written pattern was quite a feature of the Indians. There was a school on the reservation, run by the government Indian Service. I was shown some of the drawings done by the children, entirely from memory. There were drawings of groups of horses, realistically full of action, and of all kinds of other desert scenes. Mrs King did some dressmaking, using the usual paper patterns. She also got some domestic help from an Indian girl. The Indian just couldn’t understand the need for a pattern when the shape required was just stored in the head. Mind you, some of the Indian’s dresses didn’t fit too well.

For work, there was cotton breeding, cotton being a crop that presented some rather peculiar technical problems. Sacaton had produced the famous Pima cotton, an American Egyptian variety with long fibres, which could be woven into high quality cloth. My first visit to the plots held a surprise for me. From the middle of one patch of cotton came an ominous rattling. I knew what that was without being told, but did not see the snake. Apart from the cotton there were citrus hybrids and also some date breeding. After the war I re-visited Sacaton and the experiment station had gone, though some of the Indians I spoke to remembered the Kings and some of the other staff members.

A visit to a nearby cotton gin also held a surprise. After the seeds had been separated from the lint, they were crushed and then put into a steam press to extract the valuable oil. There was layer upon layer of crushed seeds, separated by mats. The mats were made of Chinamen’s hair. It seems that there was no better substance to have their pigtails cut off for a pittance.

There was a store on the reservation, selling everything and looking like the old stores you see in films of hillbilly country. I talked to a couple of young Indian boys there. They seemed excited and they said they had been to a circus in Phoenix, their first ever. What did they like best? They said with delight that they had seen some real live Indians! What they meant was that they had seen some Indians all dressed up in traditional style, with body painting, eagle feathers, the lot, doing traditional dances. The Pimas, a sober lot, did none of these things and wore blue jeans.

At the time the Indians lived in rectangular adobe huts. Although the desert rarely has a rain, when it does rain it can be sudden and torrential. Over the years the sides of the huts could be partly washed away, becoming more and more concave, so that they finally became unsafe and had to be rebuilt. The Pimas were superstitious in various ways. I was warned not to take their pictures, as it would distress them. The belief was that it would take part of their spirit away. I was allowed to take pictures of one family where a daughter had, uniquely, been to high school. It didn't look right, though, as they had all dressed up in their Sunday best and looked not at all like the other, everyday Indians. It would have been all right if the dress had been warpaint and feathers, but it was nothing of the kind.

Sacaton at this time, as far as the Indians were concerned, was not so very different from what it had always been. I was able to go back there several times in later years. The adobe huts had been replaced by inelegant houses of modern materials, often with an air-conditioning apparatus fitted into a window. There were old, battered cars parked outside many of them. The store had become a modest version of a supermarket and the Indians had posted advertisements along some of the roads, aimed at attracting visitors to buy their duty-free cigarettes (there are no sales or federal taxes to be paid on the reservation). As for taking pictures, there was no objection anymore, but some Indians were quite up to asking for a dollar fee for the privilege.

Just as I had been given wonderful weekend trips out of Washington, so it happened in Sacaton. Mary Martini and a couple of others took me back to Tucson and then south, past the famous San Xavier mission, across the desert to Nogales, just inside Mexico. I didn't have a visa for Mexico and Americans didn't need one, so I stayed quietly in the back of the car at the frontier. I was interested, if asked, to say that I came from Cambridge, Massachusetts, where there is said to be the nearest approach to an English accent. Fortunately, the problem did not arise, or I might have added inside knowledge of a Mexican prison to my experience.

Here was a contrast if there ever was one. The American side of a high, wire fence, was desert. People were driving around, as we were, in large American cars, looking prosperous. On the Mexican side, just south of the town, the land improved tremendously. It was rolling grassland dotted with evergreen oaks and carrying herds of cattle looked after by men on horseback. And yet this was the third world and the town looked very much poorer and there were huts clad with beaten-out oil drums and other signs of poverty. We met women returning to town with huge bundles of firewood balanced on their heads and the occasional donkey, similarly loaded. It was impossible not to notice that there was a stratification of society, the poorer people looking much more Indian and the well-to-do minority much more Spanish in type.

There was another aspect of this, however. Nogales was having a fiesta and it appeared that they had many in the course of the year. They were dancing and singing in the streets, decked in bright colours and displaying a vivacity which was not to be seen on the American side. They were having fun in a big way, which must have taken their minds off their day-to-day concerns.

Back in Arizona, briefer visits were to nearby Casa Grande, where there was a multi-storey ‘big house’ built in adobe by the Indians centuries ago, and now a protected ruin. In the nearby town, with the skilled help of Mary Martini, I bought some choice examples of Indian art: a Navajo rug, some silver and turquoise ornaments and so on. The more portable ones were sent home as Christmas presents. The prices paid would make a present-day collector of Indian art green with envy.

On another day I went to Phoenix and to a cattle-packing station, where living cattle were converted into cans of meat on a kind of Ford assembly line in reverse. The Phoenix I remember was utterly different from today’s and I remember mud in some of the streets and some boardwalks, giving the impression of an old cow-town.

Another car ride was a 250-mile trip round the ‘Apache Trail’, first of all crossing miles of desert studded with giant saguaro cacti and other desert plants, and then climbing a steeply winding road, through a tunnel and out into a precipitous mountain canyon. Carrying on through rugged country, with the bright red rocks weathered into weird pinnacles, the road rose to 5,000 feet and then descended towards the Salt River Valley. Here there was a lake created by the Roosevelt dam, but before getting there we turned off to see a prehistoric Indian cliff dwelling. It had survived well, for the adobe buildings were protected from the rare deluges by

overhanging rock. Then there was a ride down the spectacular valley and finally out on to the plains and back to Sacaton.

There was one more adventure on the way to Berkeley. This a journey (for once by myself), to visit the Grand Canyon, vast, brilliant and really unbelievable even when standing on the edge of it. I went to Prescott on a branch line and then on by bus. When I arrived in the early morning it was frosty. This was not surprising, for the rim of the Canyon is about 8,000 feet high and it was just into November. Everybody has seen pictures of the Canyon, but even on Cinerama it just cannot have the impact of the real thing. Fifteen miles wide and a mile deep, where the Colorado River has been able to cut down into a vast, rising dome of rock, it is an enormous geological section, with layer upon layer of rock going right back into the Earth's history. Each layer has its colour, bright red, white or various shades of brown. While there was frost at the top, it would be almost subtropical at the bottom. From the rim the large, rushing Colorado River looked like a quiet little brook, and no sound came from the bounding white water.

Later in the day I went back to catch the train at Prescott, to the junction with the Southern Pacific main line at Phoenix. From there I caught the train again, going westwards, hugging the Mexican border and then northwest through mountain passes to Los Angeles. There I stopped off to see my old schoolfellow Kenneth Mather, who was spending a sabattical year at Caltech, the California Institute of Technology. I was able to meet the great Dr. Morgan, who in 1910, had for the first time shown that genes dwell in chromosomes. I visited his department, famous for its cytology and genetics and spent a little time teasing salivary gland chromosomes out of fruit fly larvae. These giant chromosomes were the ones on which Morgan had first formed his most important conclusion. Mather also took me to see the 200-inch telescope reflector being polished before being installed on Mount Palomar. This was to remain the largest in the world for very many years. The next stop was Berkeley.

Chapter 7: A Student in Berkeley

The University of California had colleges in several different cities (there are still more today), but Berkeley was the most important. It had about 16,000 students in 1937, three times as many as Cambridge and about 25 times as many as Bangor. However, the number of post-graduate students was quite manageable and I did not feel at all overwhelmed by the scale.

Berkeley itself is one of a string of towns on the east side of the Bay of San Francisco, along with Oakland, Albany, Alameda and others besides. If you pronounce it Barkeley, in English style, you will soon be corrected! Down by the bay shore it had an industrial look about it, with warehouses, factory yards and other useful but not very glamorous enterprises. The main Southern Pacific railroad station was there too, so this was my first view of the town.

From these lower reaches there was a steady but slight upward grade to Telegraph Avenue, which was wide and had railroad tracks running up the middle. Freight trains used to pass by, making the harmonious wailing noise of the whistle and the continuous clanging of the bell which such urban intruders were expected to make in America. Freight cars would be left for loading or unloading. Further up was the residential area, getting steadily more exclusive as the hills were approached. These hills sprang up right behind the town, part of the Coast Range, and were attractive, being studded with the evergreen California 'live' oaks which are so often seen on the cinema screen in the westerns.

In the middle of this residential area was the great rectangle of the university campus, belonging to the State of California. It backed on to the hills, and was spacious and attractive, with wide, green lawns and groves of trees here and there. It looked fertile and lush and the classical stone-built buildings looked as if they had been there for much longer than was indeed the case. In the middle, at a crossing of paths, was a campanile rather like the one in St. Mark's Square in Venice, again built of stone. Tunes were played on a carillon at the quarter hours. The wide walks of this central area, where the main lecture rooms were located, were usually pretty full of undergraduates. Blue jeans had already taken over as regulation student dress, though at that time they were hardly known in England. At first I wondered what the numerous circular white patches on the tarmac drives were, but I eventually realised that they were not a new-style decoration but discarded chewing gum. There had to be some differences from Cambridge!

At the top of the campus, nestling against the foot of the hills, was the stadium. Berkeley was on a geological fault, a kind of branch of the infamous San Andreas fault, and I was told, tongue in cheek, that there would be no more earthquakes because the massive stadium had pinned the two sides of the fault together. Maybe they were right, for there was not a single tremor during the months that I was there.

Close to the stadium was International House, where I was to stay. It was only a few years old and was one of four such Houses built with funds from the Rockefeller Trust. The others were in Chicago, New York and Paris. There were public rooms for gatherings and for relaxation and also a restaurant. Dormitory rooms were in a block nine storeys high, men and women on separate floors with separate elevators; no hanky-panky here! The most desirable rooms were high up, overlooking the Bay and I managed to get one of them. The Bay is one of the world's finest natural harbours, and it was good to look across it at any time of day, but particularly at sunset. There was the Golden Gate Bridge straight across and the Oakland-San Francisco Bay Bridge a little to one side. As the sky faded, rows of twinkling lights came on, on the bridges and all around, on the ships in the Bay and on Alcatraz Island, still a federal prison.

The research departments, at least in the biological field, were down near the lower end of the campus. There, the arrangement was especially spacious and pleasant. Going back years later, many of the open spaces had been filled up with new buildings and the campus looked congested and had lost much of its charm. There are no days like the old days!

Up behind International House was the charming Strawberry Canyon, wooded and unspoilt, though there was an unobtrusive botanical garden at the top end. The canyon was a favourite place for walks, marred only by a slight anxiety in that it did have both poison ivy and snakes. I never heard of an actual case of snakebite there, but the university hospital would usually have a few patients who had reacted violently to contact with poison ivy. Officially called Rhus toxicodendron, a relative of the sumach tree, it was also called poison oak. The fact was that the leaf shape and general form of the plant were very variable, which added to the difficulty of keeping clear of it. Again, going back years later was a disillusionment, for by then there was a wide road going up the canyon and a huge Radiation Physics Department near the end. That's progress!

As had been intended when it was built, International House was a stimulating community to be in. There were some 300 students, all post-graduate. One third of them were Americans and the others came from every corner of the globe. Not having been abroad before, this was a fine chance to learn about life in different parts of the world, to learn that people

were people whatever their nationality, race and creed. It had to be admitted though, that the limitation to postgraduates made it pretty selective. The cosmopolitan aspect was fostered in various ways. In the restaurant, certain tables were designated for conversation in French, German, Spanish or some more exotic language and beginners were not only tolerated, but encouraged. There were talks by various members of the community and there were occasional dance festivals. Not everything was organised in this way of course, and groups of friends would go off on all sorts of trips.

A pleasant short excursion, often on a Saturday, was to San Francisco. The Bay Bridge had just been built, but the ferries still ran from Oakland and that was the best way to travel - by tramcar to the Oakland ferry terminal and then by boat to the pierhead in San Francisco. The city was unique and fascinating, and indeed still is. Its amazingly steep streets were impossible for ordinary trams, and so there were cable cars, worked by a great lever which clamped on to a cable which ran beneath the road. There were steps along each side and it was fun to hang on the outside of the tram while cars passed by within a few inches. Down near the pier was the fishing harbour, with seafood restaurants which were justly famous.

Another feature was 'Chinatown'. Chinese labourers had come over to work in the mines and to do labouring work on the construction of the railways. They got the tough jobs which nobody else wanted to do. At the outset, the part of San Francisco where many of them settled was an almost entirely male community. Later women came over and Chinatown was established. It still exists as a city enclave, though it is by no means a ghetto. Even now, there is an archway marking the entrance to the area. Street and shop signs are bilingual and the Chinese language is commonly heard in the streets. While I was in Berkeley, many of the shops were displaying garments in beautiful silk brocades, intricate carvings in ivory and fine jewellery. I also saw and photographed some crates bearing stickers which said "All made in Japan goods are bloody". At the time, the Japanese were invading Manchuria and were not all that popular with the Chinese. Nowadays many of the same shops sell little but Japanese manufactures cameras and electronic goods in particular! With various friends I used to visit and enjoy this part of town and eat in the Chinese restaurants. Gradually I gained a degree of skill with chopsticks.

Near the Golden Gate Bridge, was the Presidio park and just round the headland, a little out to sea, was Seal Rock, which was often just about covered with sealions. They barked like dogs and flopped in and out of the water, looking like shapeless sacks of fat. Not far away lived one of Lilian's cousins, Margaret, whom I visited on a couple of occasions. Her father, Lilian's uncle, had toured America several times with his Welsh Imperial

Singers and had finally taken U.S. nationality. He had died, but his two daughters were still around, both married. The other one, Cecilia, was living at Placerville, which originally had the colourful name Hangtown, up in the Mother Lode country on the way to Lake Tahoe. I was to visit her too.

Before embarking entirely on what life was like for me, it is worth looking at a more general picture. Hollywood had given the impression that America was the land of milk and honey. So it was for some people, but we were still not out of the Great Depression which followed the Wall Street crash of 1929. America never had been a Utopia for everybody. I had already seen the run-down area behind the New York docks and the poor little dwellings of share-croppers in the south-eastern states. Now, in travelling south by road in California, there were pathetic little family groups to be seen, with old jalopies piled high with their few belongings. John Steinbeck in his book 'The Grapes of Wrath' had dramatically described the lot of these people, often 'Okies' (from Oklahoma), driven out of their poor farms by a succession of dry seasons in the Dust Bowl and hoping for better things in the rich, irrigated soils of the Central Valley. This was the time of F.D. Roosevelt and his New Deal. There were all kinds of government schemes, with names like W.P.A., C.C.C. and P.W. A., aimed at spending public money to revive the economy, but it can take such schemes a long time to work. Meanwhile people need to live.

The morning after arrival in Berkeley I went to see Professor Babcock, who was most welcoming in what I had now come to recognise as the typical American manner. He and a member of his staff, Dr R.E. Clausen, had written the standard textbook of the day on plant breeding and genetics, so that their names were well known. There was quite a galaxy of talent there at the time, including one eminent Jewish figure, with the name of Goldschmidt, who had with many others been forced to leave Germany during the Hitler regime. Germany's loss was America's gain.

Within days, Prof Babcock threw a party for me at his home, so that I could meet all and sundry, and within a little while I was awarded a junior fellowship of the university. This meant that I was able to use all the university facilities without any fees to pay. Within a short time I was given a room of my own in the department, in Hilgard Hall. Thus once more I encountered a degree of hospitality which still amazes me. It almost began to embarrass me, for there was little that I could do in return. There were sometimes chances in later life and I have seized on them whenever they arose.

Now was the time for pursuing my research, for writing up sections of thesis as the work was completed and for sending these sections to Cambridge for

comments and suggestions from Watkins. It could not be fully completed, for some work remained to be done back in Cambridge on my return.

My room in Hilgard Hall was next to that of one G. Ledyard Stebbins Jr. and there was a communicating door which was always open. Stebbins was a slightly eccentric character then in his late thirties. He probably knew the flora of California better than anyone else. That is really saying something, because California is topographically the most varied state in the Union, ranging from alpine tundra to below-sea-level salt desert, from dry scrubland called chaparral to dense maritime and alpine forests and just about everything else. He used to go on field trips quite often at weekends, and I usually went with him. ln this way I visited parts of California very rarely seen by visitors and very fascinating it was. Stebbins' prestige was such that, when the decennial International Botanical Congress was held in Edinburgh not long after the end of the war, he was appointed its President.

In the spring of 1938 we launched out on a project together. Most plants and animals have chromosomes which pair and separate in a regular fashion, but as with most things there are exceptions. One had already been discovered years before in a species of evening primrose. There the chromosomes formed a big ring instead of pairs. It caused much confusion in the early days but was eventually sorted out in terms of standard theory. It seemed that the chromosomes had been swapping bits with their neighbours. In Western America there were two wild species of peony, one in California and the other further north in the Cascade Mountains. In these, the chromosomes formed all sorts of different combinations of rings, large and small. This led us to some collecting expeditions and to a lot of peering down microscopes. It later led to the publication of a joint paper in the Journal of Genetics and to my presenting an account of the work to the Genetical Society in the wonderful rooms of the Linnean Society in Burlington House in London.

Another small aspect of work in Berkeley was that I was inevitably led into giving a talk about my wheat work at a meeting there and a little later at Davis, near Sacramento, where the University had another (and at the time very much smaller) campus.

When people ask about the weather in California it is necessary to ask just where they mean. There is a cold ocean current coming down the coast from the north, and on-shore winds approaching San Francisco are cooled by it. So in the city it is often foggy and cool. Once I was there on Midsummer's Day and the temperature was 54°F. On the following Christmas Day in England it was one degree warmer. Across the Bay in Berkeley the cloud layer is usually higher and there are 'high fogs'. This gives an overcast sky and pleasantly warm, but not hot, conditions. Further east the cloud burns

off and the Central Valley can be unbearably hot. Not very much further east again are the high mountains, always cool, and deeply snow-covered in winter. Berkeley, however, is favoured with many beautiful sunny days throughout the year, never too hot and never too cold.

Many of the students lived in the Bay area and commuted to college, but on the edge of the campus were many examples of that peculiarly American institution, the fraternity or sorority house, all designated by a group of Greek letters, usually three of them. They were little, self-governing residential units, though I suspect that if any one of them got too much out of hand, the power of authority would come down upon them. Being a state university, there were some general measures of control, or at least of very half-hearted, attempted control. One related to alcohol, which is always subject to peculiar regulations everywhere. It could not be sold legally within a distance of 2½ miles from the campus. The result was a thriving circle of establishments just over the border line. Sixteen thousand students can absorb quite a volume of liquid and the slight feeling of infamy which arose from having to elude the regulations gave it an added zest.

While on the subject of alcohol, I felt impelled to do a little research too. After all, wine is a biological product and I was a biologist! At the time there were great numbers of separate small wine producers in California, so in the pursuit of knowledge I felt I should sample and evaluate their products. I found after the war that this research, pleasant though it was at the time, had little permanent value, because nearly all the small producers had joined large cooperatives or had been bought up by huge companies. It was fun, though, and it was quite cheap in those days.

The cost of living in California at the time makes strange reading now. I take these figures from a letter I wrote home right then, so they are not the result of a faulty recollection. Delicious dessert grapes at 5c (ld) a pound, ice cream at 15c (3d) a pint. Room rental about £1 per week, food about £1 .SO a week. Petrol 7c per U.S. gallon, of which lc was federal tax and 2c state tax. Breakfast 15c. Lunch and dinner 40c to 55c each. All food about $1.30 a day, which was about 5 shillings or 25p in decimal currency. With all the other expenses and due care, my £200 a year grant held out well.

Since central California has a Mediterranean climate, there are a few wet days before Christmas. The dry, brown grassland gradually turns green and the countryside looks prettier. In this quarter of the year there are two great holiday events. The first is Thanksgiving, the fourth Thursday in November. This commemorates the thanks given by the Pilgrim Fathers for their survival in their new land; something which they might not have achieved but for the help of the local Indians. The second was Christmas, which is much the same as in Britain. On both these occasions there were 'events' in

International House, but I also had the pleasure of being invited into an American home as a family guest. It was, of course, my first Christmas away from home and that was rather a strange sensation. The next such occasion was to be no less than 54 years later, also in California! One of the quieter events at International House was a reading of Dickens's Christmas Carol. I became rather heavily involved in this because of my 'English accent', which was considered appropriate.

After Christmas there was a period when winter rains really set in. It rained and rained and rained for about three weeks. It is still the wettest period I have ever experienced anywhere and was quite unusual. It began to appear that 'Sunny California' was the biggest misnomer of all time. Roads and railway lines were washed out in many places and near Los Angeles, five people standing on a bridge, watching a roaring river, were washed away, bridge and all. There were heavy snows up in the mountains and a group of us took a long weekend off to go to the Yosemite National Park. On the way, we saw some of the effects of the rains. The road went up the valley of the Merced River. On the other side we saw several places where the bank had been washed away and railroad track was hanging in mid-air. At one point, cars had to wait for a police escort. Only a rather precarious, single lane of the road remained.

The Yosemite scenery is wonderful at any time of the year and we rented log cabins in the valley, near the base of the spectacular Yosemite Falls. The Americans have masses of equipment to keep roads clear of snow in the winter, so it was possible to drive up to the ski slopes at about 8,000 feet. I was not the only one who had not skied before, but one of our group was an expert, a Norwegian named Nils Micklestad, who taught us the rudiments of the art. It was most invigorating in the dry, crisp air and bright sunshine. Performance didn't even reach mediocre, but it was great fun.

When things had dried up a bit, Stebbins and I set forth on our peony collecting trip. We drove down south to the Salinas Valley and on to King City, from whence we took roads up into the Santa Lucia mountains, part of the Coast Range. With Stebbins' prior knowledge, we soon found a canyon where a whole hillside was covered with lovely, dark red, wild peonies. We collected very young stamens from many plants and popped them into preserving fluid in little tubes. Then we went exploring a number of other canyons, but found no more peonies. But spring had come to the hills and, no doubt much helped by the plentiful rains, there were flowers everywhere. There were rocky hillsides thick with huge blue tree lupins, bushes covered with large, yellow poppy-like flowers and many others too. Whole areas of grassland were blanketed with a golden layer of Californian poppies and coreopsis. In the woods were big yellow violas and carpets of mauve and

white dodecatheons, like little cyclamens. In a few more rainless weeks all this luxuriance would disappear, to wait for another spring.

With the collecting job done, we tried to head on a mountain road for the Monterey Peninsula. As the dirt road became more difficult, with the surface washed out in many places, we encountered a succession of fords, all pretty much in spate after the rains. There was only one more to go when the car stalled and after vain attempts to push it out we trekked to a farm and were rescued by tractor. By then, though, it was beginning to go dark and Monterey had to wait for another occasion. It was a disappointment, but I have been back many times since and the Monterey Peninsula is now one of my favourite places.

The heavy rains brought a great reward. In the dry lands of the Mojave Desert millions and millions of dormant seeds lay in the ground, waiting for just such a season to spring them into life. By Easter the desert was fully in flower and again a car-load of us took off to the south and spent Easter weekend enjoying it all. It was unbelievably beautiful, with great expanses of lovely ephemeral flowers going through their short life-cycle of germinate, flower, set seed and die, leaving the seed for another year and another heavy rain. Maybe that would be next year, or maybe five years hence. The chief regret was that there were no good colour films back then, and the pictures I took in black and white gave little indication of the splendour of the scene.

From now on, writing up the wheat material and looking at peony chromosomes (and puzzling out what they were up to) occupied a great deal of time. There was a dance festival in International House and I was included in a small group dressed up in Louis XIV style, powdered wig and all, dancing the minuet. My partner was a certain Janet Hoon. Years later, at the end of the war she heard of the severe rationing we still had in England. By writing to Cambridge University she found my address and sent a food parcel! Our two families remain good friends and we have met many times since, on both sides of the Atlantic.

Another event was the university 'Commencement Exercises', a curious American term for a degree ceremony. It was very different from the formal affair in the Senate House in Cambridge, with its Latin orations. There were 3,800 students graduating and about 30,000 spectators. There was no space problem, for it all happened in the stadium, which was designed for 87,000.

In late May, Harry Harlan and Mary Martini turned up on their way from Arizona and tried to persuade me to travel with them by car to Idaho. I was not through with my work and could not accept. Harry, in particular, really organised his life. His main work was on spring barley and he could manage

to get through three generations in a year. He would sow his material in Sacaton, Arizona in January and harvest it in May. By then, southern Arizona was getting uncomfortably hot. He took his harvested grain up to Idaho and sowed it at about 5,000 feet in most pleasant conditions. Then, after harvest, he would go back to Washington DC. Seed would again be sown, this time in glasshouses, and a pathologist colleague Dr Rodenhiser ('Rody') would shoot all sorts of fungus spores at the seedlings and so sort out the resistant ones.

Before leaving Berkeley, all the members of the department's staff gave me a great send-off at a lunch in the Berkeley City Club. It was the end of a very happy relationship. On June 14th I was in a steam train heading north, through the forests of northern California, past the spectacular 14,000ft cone of Mount Shasta, covered with snow and looking not unlike the traditional Japanese pictures of Fujiyama. We stopped at stations like Klamath Falls, where groups of dour-looking Indian men sat on platform seats watching the train. I stopped off for a day at Corvallis, Oregon, to visit the State Experiment Station there. Then the destination was Portland, where I had been invited to stay briefly with a fellow-student from International House.

Next day the two of us drove up the Columbia River gorge. Here there had clearly been plenty of rain, for lots of waterfalls four or five hundred feet high tumbled into the valley. There were masses of flowers in the woods, flowers which we only knew as garden plants. Bushes of 'mock orange' (Philadelphus) formed an undergrowth and were in full flower. There were also huge patches of columbines and Sweet Williams. Upriver was the Bonneville Dam, with its locks and salmon ladders. Tugs were moving downstream towing enormous rafts of logs, felled from the forests of the area. In those days there was no talk of conservation and the supply of timber seemed endless.

Leaving Portland and heading east on the Union Pacific Railroad seemed like the beginning of the journey home, for the train was now getting nearer with every mile travelled. California had been a great experience, and the little glimpse of Oregon too. I never expected to see them again. How wrong I was!

Chapter 8: Returning Home

Heading east, heading home; it was a long way still and there were many more experiences on the way. A steam train once more, weaving its way up the valleys of the Columbia River and its major tributary the Snake. In 1948 long-distance diesel-hauled trains were beginning to run in America. They were faster, charged higher fares, and even then did not appeal to me so much as the black monsters behind which I was now used to riding. The trans-continental steam trains averaged about 45 mph day and night, and the gradients on some of the mountain passes really made them puff and blow, with an exciting, throaty sound. There were places where the track ascended in a loop and it was possible to look down the mountainside and see another part of the track curving below.

The Pacific slope in Oregon was densely wooded. Over the top, in the rain shadow of the high mountains, it was suddenly desert; no saguaro cacti or Joshua trees, for the winters are far too cold, but sparse grassland and mile after mile of sage brush. There were some smaller cacti, Opuntias, out in full bloom, with their large, showy, pale yellow or deep red flowers. They are the hardiest and most widespread of their kind. The Snake River is a source of water for irrigation, which is all that is needed to transform the desert into some of the richest farmland anywhere. At the time I was there the irrigated area was still being expanded.

We passed by Boise, Idaho, the city heated by geothermal energy, then continued across the plateau (some 4,500 feet high) with dust blowing and odd balls of tumbleweed rolling along, often a couple of feet or so in diameter, sooner or later to have their travel halted by a fence. At American Falls the Snake River had been dammed and a huge lake had formed, the source of irrigation for a large area. It was here that the train was again specially stopped for me and I was met by 'Doc' and Mary Martini. That night we had a picnic by the lake and 'Doc' found an Indian arrowhead in the sand. The Stone Age had not long passed in Western America.

This dry, high plateau, with mountains rising abruptly out of it, has amazingly clear air, at least when the dust is not blowing. Mountains 30 miles away look like walking distance and ranges 150 miles away can often be seen clearly.

The U.S.D.A. experiment station where the barley work was conducted was at Aberdeen, a community with about 600 inhabitants. Southern Idaho is not very far, as American distances go, from Salt Lake City and about 40

percent of the Aberdonians were members of the Church of Jesus Christ of Latter Day Saints, Mormons for short. Rather surprisingly, we all went to see a film at the Mormon church, Snow White and the Seven Dwarves. It was newly out and was an amazing advance on all previous cartoon films and everybody was highly enthused. There was something odd about Mormon communities. In some ways they were a very strict sect, but in the old days they certainly did not object to having a gamble. When a new settlement was projected, the land would be marked out into plots, city size near the centre and larger and larger as they moved outwards into potential farm land. On one of the central plots a general store would be built, on another a hotel, and so on, so as to provide the basis for essential services. Buyers of lots would pay a fixed price, but their particular lot would be chosen at random. For their money they might get a bit of desert, or they might be lucky enough to get, for the same price, a very valuable property. The result was that many buyers had a go, were disappointed, and went away. To this day, many such towns have scattered vacant lots in them.

For a while I helped with the crossing programme with the barleys. This was quite easy for me, as I had been used to crossing wheats. In a day or two Mrs Harlan, Jack and Jean Yocum, his girl friend, arrived by car. It was soon announced that, since the crossing programme was complete and there was nothing else to do until harvest time, at least nothing that could not be delegated, we would all go up into the mountains. What a trip that was!

We travelled about 200 miles from Aberdeen, across plains which in some areas were covered with black lava, lava so rough and full of sharp edges that it would cut your shoes to pieces if you walked on it for any distance. In one place there was a group of craters and the area had been taken over by the National Parks Service as the Craters of the Moon National Monument. Looking down inside the smaller craters it was still possible to see the remains of the winter's snow. Only two species of plants managed to survive in the lava fields. Then we drove up to Sun Valley, just getting established as a fashionable ski resort, and over a pass 8,750 feet high, only recently cleared of winter snow. It was June 23rd, which says something for the severity of the winter in those parts. We dropped down into the Salmon River valley, down to an altitude of 7,000 feet and stayed in cabins on the Running Springs Ranch at Obsidian. It was a lovely spot, with a fine view of the well-named Sawtooth Mountains, rising to a height of 10,000 to 11,000 feet. This was beautiful, remote country, basically sage brush in the valley but quickly turning to dense forest at higher altitudes. It was so remote that in going through the forest it was thought necessary to cut marks on trees so as not to get lost on the way back.

One thing should be said to salve my conscience of any guilt which I might have felt for leaving all the work and projected visits behind and simply going on holiday. Quite informally and spontaneously, usually in the evenings, 'Doc' would get around to chatting with us about plant breeding. He had many original ideas, some of which I later tested out successfully in England, and the experience was much more worthwhile than a typical lecture course. At any rate, that is my excuse for lingering in Idaho!

The younger members of our little group, which description included me, took to fishing, horse-riding and climbing the high peaks, all new experiences to me. Jack and Jean were very polite about having me join them, for we doubtless all knew the maxim “two's company, three's none”.

Quite a large trout was unwise enough to give itself up to my amateur efforts, though Jean caught the biggest. I gradually got into riding, and after a while learnt to bounce up and down in concert with the horse rather than in opposition, which was much easier on the nether regions. Some of the best days were when we rode through the forest, rode or, when it got really steep, walked behind the sure-footed horses, hanging on to their tails and finally tying them up to trees to await our return from climbing the peaks. I remember Jean getting really frightened on one occasion and hanging on to a rock and saying in a tone of terror "I wish I was back in Washington D.C."!

The Running Springs ranch, kept by the Ellis family, was a very small scale dude ranch, indeed I do not remember any other visitors being there at the time. Mr Ellis kept a small store of Indian craft work and I bought a couple of Navajo rugs and some silver-and-turquoise items. Large rugs cost about $15 (£3) but some were cheaper. They were the ones which included swastikas in the design. The swastika is a symbol which turns up in all sorts of cultures all over the world, but in 1938 it was thought by many to be the sole property of Adolf Hitler. The silver and turquoise jewellery was made by several tribes, the Navajos and Zunis being most prominent. The turquoise was mined in the south-west and the Indians had a curious privilege regarding the silver. They could legally melt down silver dollars, which were still around though fast disappearing. For anybody else, it would constitute the serious offence of defacing the coinage. The Indians had other privileges too. They could hunt and fish without limit and without paying for any licence and they paid no state or federal taxes. It seemed to be a tacit admission by the government that the land still really belonged to the tribes from whom it had been so cruelly taken.

There were a few strange people around. A very tough-looking woman riding on horseback proved to be a convicted cattle-rustler. Out on parole, she was not permitted to go outside the county boundaries. Then there was a

rather unprepossessing looking man, who obviously had a way with the ladies in spite of his appearance. He claimed the distinction of being divorced twice and married twice in one day, in Nevada of course. It was Reno then; Las Vegas came later. He had divorced wife no. 1, married no. 2 to legitimise a child she had borne him, and then divorced her to marry the favourite of the moment. Even in present-day America, where divorce is much more frequent than it used to be, that would be very newsworthy.

There were other ways of spending interesting moments. There was a large prairie dog 'city' a very short distance away, which was fascinating to watch. These ground squirrels form vast colonies and have a network of tunnels covering acres of land. They post sentinels, sitting upright to gain height, and in the event of danger they give out a squeak and dive underground to safety. A few miles' car ride through the flower-covered valley took us to a private swimming pool fed by a hot spring, very hot and also quite sulphurous. Then one evening we went to a little mining village called Stanley for their Independence Day dance. It was pretty rough and very western. We went, advisedly, without watches and pocket books and lost only the cap off the car radiator. The place was a two-roomed village hall, the smaller, outer room being full of gaming machines and the other the dance hall. Mostly in cowboy boots, the dancers got wilder and wilder and the dust rose to choking proportions. Apart from being colourful, there was beauty there too. I remember stepping out into the clear, cold night. In such dry conditions, at these high altitudes, the stars were incredibly bright. There seemed to be ten times as many as usual and they appeared to be almost close enough to reach.

Surprisingly, there was rain on a couple of days. This seemed to accentuate the aroma of the sage brush, which smelt like a huge herb garden. Sage brush species (Artemisia) were related to the 'old man' and 'old woman', species of wormwood sometimes found in traditional cottage gardens in England. Then there was the always attractive smell of the pine woods, sometimes for us made rather richer, if that is the word, by the smell of our horses and their leather harness.

It had to come to an end, and finally Harry took me back to Aberdeen and then on to Pocatello, the nearest sizeable place. I was never to see him again, but I have a copy of his interesting autobiography. He had been a plant explorer, collecting the wild relatives and primitive cultivated forms of crop plants. He had been the first westerner to visit the Gondar region of Abyssinia since the Portuguese some 400 years earlier, and published an article on this in the National Geographic Magazine in 1925. Jack went on to be a breeder of range grasses among other things. He married Jean, of course. I never met his elder brother who was plant exploring in the Andes

when I was in America. Mrs Harlan, a middle-westerner, was a homely lady. Homely in the best English meaning of the word, hospitable and kind, and not in the disparaging sense of the word as used in America.

From Pocatello I went to Logan, Utah. This trip was different, for there was no rail connection and I went by Greyhound bus, which was faster and grander than any I had previously experienced, and quite a lot faster than the train. At Logan was a U.S.D.A. experiment station, where I spent a day or two before taking another bus ride to Salt Lake City. At the experiment station there was a small team in the charge of Dr F.V. Owen. All Mormons, of course. American breeders seemed all to have been trained by Hayes in Minnesota. They were understandably greatly impressed with the success of hybrid maize breeding and tried above all else to find ways of getting other species to breed in the same way. Owen was working with sugar beet, about as awkward as any crop to adapt to the maize pattern, since each plant had many hundreds of small flowers all producing pollen as well as seeds. He was trying to make crosses by killing the pollen on the intended female plants. He had found that there was a small difference in the temperature at which the male and female parts of the flower were sterilised and he was trying to exploit this. This was in 1938. By 1948 he had developed genetically male-sterile sugar beet plants which did just what he had wanted, and did it on a large scale without any difficult stratagems such as close temperature control. He became famous as a result. I spent a couple of days with Owen. On the Sunday, some of the time was taken up by a swim in the Great Salt Lake. This was a weird experience, for the water is very nearly a saturated salt solution and people float like corks. Ordinary swimming techniques just do not work. Any of the salty water in the eyes or throat was very painful. Coming out, we were encrusted with salt, which was washed off in a fresh-water shower.

There was time to see the Mormon temple and tabernacle in Salt Lake City. Being a 'gentile' (even Jews are gentiles in Utah, only Mormons are not), I could not go into the temple, but the tabernacle was most impressive. A very large oval building with a dome so accurately made that the faintest whisper at one focus could be heard a great distance away at the other, it was built of wood carried across the country in wagons. It was constructed entirely without nails or bolts. It is the home of the famous Mormon choir.

Now I had to catch another Union Pacific train going east to Cheyenne, Wyoming, to visit another experiment station. This was open range country at one time roamed by buffaloes. Now it carried cattle and sheep at a stocking rate of one steer to 27 to 40 acres. It was also part of the great Dust Bowl of those years. There I saw the most dramatic effect of the drought. A horse had walked across some bare land and then there had been a 'blow'.

An inch or so of topsoil had blown away, but where the horse had trodden its weight had consolidated the soil, so that remained. The hoof-marks stood out, raised above the surrounding soil level.

Another train trip took me to Lincoln, Nebraska, there to stay three or four days, and then on to Ames, Iowa. There were no mountains anymore and the land was all marked out, north-south and east-west by roads or tracks into one mile squares or 'sections'. This was homesteader country, new arrivals in days gone by being entitled to own 160 acres, a quarter section, per family. They had to secure tenure by cultivating a large-enough part of it and building some sort of dwelling on it, within a year.

At Ames I met Martin Weiss, then a soya bean breeder, and that was another new crop for me to look at. For crossing purposes, I did not like the look of the very tiny flowers at all, terribly difficult to manipulate. I was with Martin over the weekend and he had promised to take his girlfriend to a dance in Des Moines. He solved the problem of having the English visitor on his hands by asking her to bring a friend along and we went as a foursome. Years later I met Martin in Washington D.C., where he had attained a very senior position. He teasingly said that he thought I was a bit of a rotter, for he had married his partner at the dance and I had done nothing at all about mine!

From then on, visits came thick and fast. Firstly to the Union Pacific terminus in Chicago and across town by road to the terminus of the Pennsylvania Railroad. All very peaceful, not a gangster in sight. It wasn't a bit like the movies. Maybe I was out of luck, just as I had been with the earthquakes in California!

After Chicago, on to Wooster, Ohio, to Cornell University in Ithaca and to State College, Pennsylvania before returning to Washington, D.C. Of all these, Cornell was the most memorable. Situated in a delightful setting in up-state New York, it was a prestigious university which I might well have elected to go to instead of to Berkeley. A single-track branch line took me there. I spent time with Marcus Rhodes and Barbara McClintock, both leaders in their field. They were concerned at the time with the heredity of a kind of maize which had mottled grains. They finally sorted it out and published the results, identifying some quite unusual jumping genes', which seemed to move from chromosome to chromosome. It was not long before McClintock had collected a Nobel Prize for this work. She recently died, aged 90.

Washington was hot, and steamy too. Air conditioning very rare indeed and official departments would send their staff home in 90-90 weather, that is over 90 degrees F. and 90 percent relative humidity. I was back in the

Cosmos Club, a neighbour of President Roosevelt once more. I went to see Merle Jenkins's corn plots and also spent time taking samples of wheat grain from the U.S.D.A. world collection, to supplement the collection in Cambridge.

Now it really was time to go home, back to New York to catch another Cunarder. Even at this stage, and from a distance of well over two thousand miles, 'Doc' had his last fling of hospitality. He had friends who lived in a penthouse apartment overlooking Central Park. There I spent my last night ashore in America, eating dinner while looking down on all the twinkling lights and flashing signs of the city.

The boat I caught next morning was the Aquitania, this time with no less than four great red funnels, tipped with black. This was no product of German reparations, but had been built on Clydebank in 1914. It was of 45,000 tons. It left on August 3rd and arrived in Southampton on August 9th, at an average speed of over 24 knots. It was a comfortable voyage, all the way, noted on the ship's log as having light winds and smooth or slight sea. The good and bad sailors were not differentiated on this voyage and stabilisers would have been quite superfluous.

Now back in Britain and to trains again, trains pulled by smaller, neater engines, not black at all and with most of their entrails hidden beneath cladding. Somehow, though, they were an anticlimax after listening to the throaty roar of the great, American engines fighting their way up the mountain passes. There, there was power and splendour.

Chapter 9: Clouds Loom Over England

It was wonderful to see the folks again and to greet Lilian. It had been a nine months' absence, an academic year. Lilian had by now got a job which she really liked, teaching at a grammar school at Lydney in Gloucestershire, just on the edge of the lovely Forest of Dean. There she got a proper rate of pay and normal day-school hours, much better than the private school in Uxbridge. She liked the place too, so close to the forest. In August, though, she was on holiday and we could have time together.

The England to which I had returned was not without problems. The Great Depression was still casting its shadow and the other shadow was that of a little spell-binder with a black moustache, who had been sabre-rattling in Germany for quite a long time and who was now getting really troublesome. There had been the 'Anschluss' with Austria, really an annexation and now it was the turn of Bohemia and Moravia, the predominantly German-speaking parts of Czechoslovakia. Britain was quite unprepared for anything as serious as this. Quite soon the Prime Minister, Neville Chamberlain, was off to Germany to do a deal with Hitler, and he was to come back, brandishing his umbrella and declaring that it was "peace in our time". Whether he was utterly credulous about all this is not certain, but a year's reprieve from war certainly gave us more time for preparation. Possibly 'appeasement' was a military necessity.

For me it was a return to Cambridge, to tie up some loose ends of the wheat work and look for a job. University funds were tight and jobs were not easy. The Association of Scientific Workers was finding it necessary to campaign against an institute in Edinburgh, which was advertising a job for a graduate at £150 a year. Such jobs as were around in Cambridge were supposed to have a starting rate of £300, but Prof. Engledow unofficially made room for one more recruit by reducing it to £250. That was where I came in, but not in the Plant Breeding Institute, where there was no vacancy at all.

There existed at the time a group of 'Imperial Agricultural Bureaux', dotted around British universities and research institutes and responsible for publishing a series of abstract journals. They were funded largely by the various countries of the Empire, large and small. They still exist, but no longer do we talk of the

old imperial days and they are now the Commonwealth Bureaux. The Imperial Bureau of Plant Breeding and Genetics (what a grand title!) was housed in a few rooms in the School of Agriculture in Cambridge and it was there that I joined the staff.

The bureau director was Dr P.S. Hudson ('Pen'), a remarkable linguist, always bustling about and being very 'arty'. He had a hobby of piano playing and this he did at concert standard. His idea of a long summer break was to go to some distant place on a foreign freighter, practising the language, whatever it might be, with the crew. He spoke pretty well all the European languages fluently and was good not only in Russian, but in Ukrainian too. When anybody turned up in Cambridge with a communication problem, they would be funnelled along to Pen's room. Since that was next to mine, with a partition wall between, I could hear most of the conversation in whatever language it might be. Welsh beat him, though, and he admitted that Estonian was also absent from his repertoire.

Then there was Miss Wilson, thin, pale, diffident, with a pinched kind of a face. Very polite, very quiet, dressed in sober browns and greys and dealing with some of the languages, Dutch, for instance. She used to come to me to ask the meaning of some of the scientific technicalities in the papers. Pen did not have this problem. His Ph.D. was in science and the development of his extraordinary skill with languages had been another of his hobbies. Some work was 'farmed out'. Most of the German was done by Mrs Ingham, though of course it could have been done internally. She lived at the Grantchester end of town. Japanese and other very exotic languages were always farmed out, though the Japanese were contributing very little to the scientific literature at that time. I did the English, by far the greater part in mere volume but also the easiest, and occasional foreign-language papers. I remember a couple of occasions when I was saddled with a Romanian paper when Pen was away. Being a largely Latin-based language, it was possible to guess a lot, and the technical terms are much the same in all languages. The numerical tables helped a lot too and, after all, an abstract was only an abstract and much of it had to be missed out any way!

There was a secretarial staff under the formidable and well-named Miss Stearn, a roundish lady of about 40, with a florid face and an air of bustling efficiency which at times tended to bossiness. Of course there was no such thing as word processing or a computerised database. The Dewey Index was used for classification. All the titles were typed out on 5" x 3" index cards, cross-indexed according to author and the Dewey numbers.

This was far from my idea of a perfect job, and I would have hated it as a career, but it did mean that for a couple of years I was closely in touch with all the plant breeding literature world-wide and that was very useful afterwards. On the other hand it taught me how few were the scientific papers which really broke new ground, and how many were 'pot-boilers', often slightly altered presentations of work which had already appeared in another journal.

During these months at the Bureau I finished my thesis, had it typed by Miss Stearn, and submitted it. In due course I was called for an oral examination. This was a strange experience. As always, there were two examiners. One was Herbert Hunter, and the external examiner was Sir Rowland Biffen, a Cambridge man but technically external because he was now retired, or 'emeritus'. The questions came. Quite soon it became apparent that Hunter did not have the slightest idea what the cytological part of my thesis was about and he asked the odd question which was embarrassing to answer in such a way as not to show him up in front of Biffen. Biffen, however, in spite of his seventy or so years, had a brain as sharp as a knife. He put a certain finger on all the weak parts of my thesis and asked searching questions about them. He was almost too good.

After a due lapse of time I proceeded with other candidates for higher degrees, to the Senate House for the ceremony. There was a separate procession from each college. My little group passed through the college Gate of Honour, as John Kees had intended, clad in new academic dress, my gown with facings of scarlet silk and worn over it a black hood also lined with scarlet. We were walking two-by-two behind one of the college fellows who was called the *praelector rhetoricus*. His duty was to introduce us with a little Latin speech. Mother, father, Lilian's mother and Lilian herself, proudly tagged along to the ceremony.

The war looked increasingly inevitable in spite of Chamberlain's trip to Germany. It began to look closer when we had to turn up at the local school to pick up our civilian gas masks. I joined up with the Civil Defence Organisation, first of all called the 'A.R.P.' (Air Raid Precautions) and among many other things we had anti-gas training, using service gas masks this time. Praise be, the training was never needed. The gases were said to have characteristic smells and one, phosgene, smelt like geraniums, or so they said. Like most things, this had its funny side. After war broke out and I was at a defence post in Cambridge, one of my colleagues came rushing in, scarily reporting a gas

attack. A look outside soon calmed things down. The post, on the edge of Sidney Sussex College playing field, was surrounded by a flower bed, mostly of geraniums.

Lilian and I were at long last able to plan our marriage, no less than seven years after we had first met. First of all, there was the question of a house. The estate agents' lists were very different from what we find today. On the list of one firm, January's, there were a hundred or so properties up for rent. We chose our favourite district, picked the houses at the top of the range which we felt we could afford, and the final choice was made on such a trivial thing as the colour of the interior paintwork. We ended up with a semi-detached house on a new estate just off Huntingdon Road. It was called Woodlark Road. Then we went around choosing furniture, to be delivered at the beginning of September, mostly from London stores. Years afterwards we wished we had chosen differently, but we felt at the time that we should be modern, and choose contemporary designs. There was a great deal of most attractive antique furniture available at the time, at much the same price, because antiques and fine workmanship did not seem to be appreciated as much as they are today. Later, when we were wiser and realised the mistake, we got around to calling the new designs contemptuous rather than contemporary.

One weekend during the summer Lilian was to come down and revisit the house we were renting, with a view to making detailed plans. She was in Lydney and Hugh Jones, a friend from Bangor days who had moved to Cardiff, was to pick her up on his way by and bring her to Cambridge. I waited and waited, but who should finally turn up at the door but a rather ponderous policeman. He told me that there had been a road accident and that Lilian was in hospital in Bedford, but that it did not seem too serious. She was badly shaken and concussed, with cuts and bruises and a broken nose. It appeared that Hugh, in his Austin Seven, had decided to assault a telegraph pole by means of a head-on collision. He had come off almost unscathed, but Lilian had been thrown forward against the windscreen. There were no such things as seat belts in those days. I forthwith went to see her, of course, but she did not even know me. In a day or so she was much improved but she had minor after-effects of the accident for the rest of her life. I used to tease her by saying that her re-made nose was a great improvement on the original.

There was another big event for me in August. Every ten years there had been an International Genetics Congress, a prestigious affair which drew people from

all over the world. This year it was to take place in Edinburgh. I was put on the organising sub-committee and was given time off from the Bureau for the occasion. It meant a number of preliminary meetings in London, especially with Julian Huxley, with whom I lunched in the famous Athenaeum Club. In Edinburgh I was assigned, for the first time in my life, a personal car with driver. The driver was the daughter of Prof. Hogben, the well-known mathematician of *Mathematics for the Million* fame. She was pretty, but I was not supposed to notice that sort of thing just prior to my marriage!

The Congress was quite a problem from the organisational point of view. It was apparent that war was just round the corner and delegates disappeared in groups, day by day. The Russians never even came, and the Italians and Germans were recalled in the middle of the proceedings. Individuals from other countries also decided that discretion was the better part of valour. So each morning our little committee used to meet over breakfast, to see who was left and to re-shape the published programme accordingly. The conference went remarkably smoothly in spite of this. One little interlude for me was to go to Edinburgh Zoo with Julian Huxley. There is a substance, PTG (phenylthiocarbamide), which tastes sweet to some human beings, bitter to others and is tasteless to a third group, the different responses being hereditary. Huxley and I went around the zoo administering a solution of this to all the primates and then watching their expressions. He was above all interested in evolution, and wanted to see whether the same taste diversity was to be found in our cousins. It was. Some of the animals screwed up their faces and spat it out, some asked for more, and others just didn't care.

At the end of the meeting people dispersed, mostly back home, but some Americans nonchalantly set out on a Scandinavian tour. The sad case was that of a young American couple, who had combined the meeting with a honeymoon, and returned on the 13,500-ton Donaldson liner *Athenia*. This was the first liner to be sunk by U-boats in World War II – on September 3rd 1939, the very day war broke out – and they both lost their lives. So did a great many London schoolchildren, who were being evacuated to a place of safety in Canada.

We were married in Barmouth on September 12th 1939, in the English Congregational chapel, which Lilian's father had helped to set up, so that the visitors from over the border would be able to worship in their own language. It would have been so much more logical for the existing Congregational chapel

to have services in Welsh at certain times and in English at others, but that was not the way it was. My best man, Leighton Yates, and I had travelled to Barmouth the day before on that wonderfully scenic railway which went through Llangollen, Bala and Dolgellau, and as tradition demanded we stayed at a hotel in Barmouth rather than at Lilian's house. Next morning we duly presented ourselves at the chapel in good time, Moss Bros suits, hats, buttonholes and all.

Lilian had more difficulty. Her mother had hired a car from a local garage and the driver, known as Gibby John, was just a bit eccentric. He had collected Lilian, decided that she looked too nice for the sight of her to be wasted, and took her on a tour all round Barmouth, hooting the horn of his ribbon-bedecked car, before getting to the chapel. Luckily, Barmouth is not all that big, and she was only slightly late. She looked a dream in her embroidered, satin gown and I felt so very, very lucky.

The reception was in a restaurant in town and then we had planned to be leaving for our honeymoon in France. War had broken out just nine days before and we had heard Neville Chamberlain giving his ominous speech on the radio. The trip to Brittany which we had booked, like all other trips to the continent, had been cancelled, so we stayed overnight in Chester. Even that was a bit ominous, for from our room we heard the sound of marching feet, as an army unit headed for the station on the way to the war.

We went to Cambridge the next day, to our new home. That was a great feeling too, but again it was not as we had visualised. Most of our furniture was to be delivered in good time from London, but all the transport had been commandeered for the previous couple of weeks, carrying sandbags to protect important buildings and working on other similar tasks. So we got to a home with carpets laid, a piano, a gas stove and nothing else in the kitchen and a mattress and bedding on the floor in a bedroom. In the circumstances, the latter was deeply appreciated! We had friends living just down the road, Bill and Nest Price (Bill's parents had been misguided enough to give him the initials W .C., so he was sometimes called 'Flush'). They lent us kitchen chairs and we used an upturned tea chest as a table. We entertained friends Beth and Arthur and Beth's parents while we were still in that condition, but in the end everything sorted itself out and all was well.

We were not prepared for what followed. The Nazi's propaganda machine had been telling us for ages of the limitless might of the Luftwaffe and we all knew the term Blitzkrieg and its implications. We were expecting to be bombed forthwith. Going down to the centre of Cambridge, we wondered how much longer the college buildings would be left standing. Nobody had anticipated the 'phony war', which lasted through the autumn, winter and spring. In King's College Chapel, the enormous, stained glass windows which covered most of the walls had been taken out, piece by piece, many thousands of numbered bits, and stored well below ground in a slate quarry in North Wales. It must have been the biggest jigsaw puzzle of all time. The gaps left behind had been filled with sheets of plywood, with small, plain glass inserts to let in some light. Particular treasures of other kinds had been safeguarded too. Nothing happened, though, and month after quiet month went by and we were in the summer of 1940, warm, sunny and beautiful. The war was now no longer phony, for the Battle of Britain had started and the odds against us were formidable.

A little problem occurred during the winter of 1939 to 1940. Lilian did not feel too well one day and after we had tried to shrug it off by a brisk walk in the snow, things looked worse rather than better. She had gone down with measles and I did my not very good best as a home nurse. Before long, her mother turned up to take charge and I was immensely grateful. Lilian managed to get a swollen face from a dental abscess at the same time. 'Polly' Carter, the congregational minister, turned up one day to meet my new wife, spotty and feverish and with a swollen face. Afterwards, when she was well, he never recognised her, at least not for a long time. She did not look at all like the person he had first met.

Meanwhile there had been a ridiculous panic in Whitehall. At least the panic was understandable, but the proposed solution was ridiculous. During the first world war we had run very short of sugar because of the German submarine blockade. Such shortage was a new experience, for sugar had always come in very cheaply from the West Indies, Mauritius and elsewhere, all red bits on the world map. After this it had been thought prudent to subsidise the building of a series of seventeen beet sugar factories in England and one in Scotland, mostly put up in 1924 and 1925. Now, therefore, we were supposed to have had a degree of independence of supply, but the whole thing had been badly bungled. We had continued to buy our seed from continental Europe, from Germany (most of it), Holland, Sweden, Denmark, Czechoslovakia and France. So now

we had an industry, founded for strategic reasons in case of another war, and no seed to sow, at least when present stocks ran out. When I was a research student with Watkins around 1936, he had spotted this problem and had written to point it out to the Ministry of Agriculture. They had replied after a long pause, to the effect that, as long as these foreign countries were willing to supply us with seed at the prevailing price, all was well and nothing needed to be done. Now, in 1940, it had at last been realised that this was not such a good argument and the panic meetings ensued. It makes you think about our rulers, does it not?

It became even more absurd, for the official reaction was to start breeding sugar beet. It is a biennial and from a nucleus of selected plants it is necessary to think of at least eight years, probably twelve, before anything in commercial quantity could possibly be expected. It was going to be a very long war, it would appear. Prof. Engledow was at these meetings and he was deputed to look for a breeder. None was available, at least none with real experience, but he must have remembered that he had sent me off to America with an instruction to study the breeding of cross-fertilised plants. Maybe he even remembered that I had mentioned sugar beet in my report. So he sent for me, and I found myself with the task of setting up a new section within the Cambridge Plant Breeding Institute. My qualification was that while I knew very little indeed about the subject, nobody else who was available knew even that.

Chapter 10: Sugar Beet Comes to Cambridge

So in 1940 it was goodbye to the Bureau, and a new challenge, sugar beet breeding. It was more than clear that starting such a scheme was no way to win the war, but if that was what they wanted I was delighted to oblige. The problem was how to start absolutely from scratch. The only source of material was the commercial crops growing in the fields. It was clearly possible to pick out large, well-shaped roots from a field, but size is only very partially genetic and indeed it is often largely a matter of chance. Roots next to a gap would be bigger, as would roots that had grown on the spot where a horse had stopped and added extra fertiliser! It had been shown long ago that the only way to find out whether any genetic merit was present was to grow selected plants for seed and test the progenies for yield. Indeed, the idea of a progeny test was first worked out on sugar beet, in France in the nineteenth century by Louis de Vilmorin. Now the concept is used throughout the whole range of plant and animal breeding.

As to the source crops, the most successful variety in recent trials in England had been Kleinwanzleben E from Germany. It was logical, therefore, to go into crops of that variety which, like all others at the time, was a broad-based population. There was just a chance that such a variety would throw up different types if grown in different environments. That way it might just be that a greater variety of superior types might be found. This idea had been put forward by the Swedish breeder Rasmussen and was behind his idea of starting to make selections in Britain in 1935. In the autumn, therefore, I made about 1,000 selections in each of several locations: south of Cambridge on the chalk, in the black fen, in the silt land at Swinefleet in north Lincolnshire just south of the Humber, in Fife, the only Scottish county with a sugar factory and in Shropshire. At Swinefleet there were a number of airfields around, from which the bombers droned away each night on their mission to Germany. In Fife there were detachments of the Polish army, escaped from Poland to continue the war. Many of the local Scottish girls acquired Polish surnames.

The selected roots were brought back to Cambridge, and the next problem was how to test them for sugar. I didn't, for that would have required facilities that were

wholly absent. Instead, reliance was placed on the known fact that the juice of beets with a high sugar content would also have a high refractive index, for sugar was by far the biggest component of the dissolved solids. This was only an approximate guide but at this early stage of a breeding scheme extreme accuracy was irrelevant. So I got two or three little Bellingham and Stanley pocket refractometers for about seven pounds each and had some little hand borers made (shades of the Nantwich cheese market!) and some hand presses. By putting a core, about the size and shape of a cigarette in a handpress a few drops of juice could be squeezed out and tested in the refractometer.

It now came to light that at the Whitehall meetings Engledow had expressed the hope that a refugee from Europe, of whom there were many, might be found with a knowledge of sugar beet breeding. Soon one turned up. He was a rather rotund Jewish Hungarian who had very wisely escaped from Hitler's grasp and had turned up in Cambridge. His name was A. B. Bauer and he had somehow got in touch with Hunter and convinced him that he was a beet breeder. That sort of thing would not be too difficult with Hunter. Bauer started by hoping that he would be my boss, but I had other ideas. It soon became clear that he had conned Hunter and that he knew nothing of breeding. Very much later, I learnt that his only previous experience of beet was as a salesman, touting an allegedly superior new beet variety, bred by a Hungarian professor named Niemitz, round the seed houses of Europe. The variety was supposed to be frost-resistant and suitable for autumn sowing. Nobody bought it.

Bauer tried to convince me of his almost psychic powers. He could, he said, by holding a beet in his hand and looking at the groove in it and at the texture of its skin, determine the sugar content. After making this claim, he reluctantly agreed to a statistical check on the next hundred roots we tested. He gave me his answer for each, in advance, and I then tested them with the refractometer and worked out something entirely strange to him, a correlation coefficient. This proved to be effectively zero, and henceforth things became a little more difficult for him. He had wandered into this test all unsuspecting. Statistical analysis had not at that time spread far outside Britain, the United States and Canada and as late as 1948, Graham Campbell of the Cambridge Plant Breeding Institute (my successor there) and I addressed a meeting in Brussels in which we propounded 'La Methode de Fisher' as a strange new thing. After all, it had only been around since about 1925!

It is interesting to recall what life was like in Cambridge during the early years of the war. In some ways it was very normal, at least until the start of the Battle of Britain in the summer of 1940. Rationing was getting established but had not yet included as many foodstuffs as it did later. One could still queue for eggs in the market-place, for instance. Fuel rationing had arrived and was quite severe. Our house was hard to keep warm, for it was brick-built without wall cavities and with the single glazing which was then almost universal in Britain. Lilian had of course given up her Lydney teaching job and had not expected to be able to teach again. Soon, however, as men were called up to serve in the armed forces, there was an edict that women below a certain age and without young children had to get a useful job. The old ban on the employment of married women disappeared, and indeed it has never returned. She got a job teaching in a primary school at Sawston, ten miles from home on the south side of Cambridge. It was winter, and a bitter winter at that, and she cycled to and fro. Even a new pair of sheepskin gloves did not fend off the chilblains and she had had no training or experience in teaching in a primary school. Fortunately this did not last long, and she got a job in the Cambridge High School for Boys, quite near the railway station and still a cold cycle ride of three miles or so. This school had previously had only male teachers, and some of the boys, for a day or two, called her "sir" from habit! It was a prestigious school and a good job. It greatly helped our slim finances too. At the time the school had its usual Cambridge pupils and also many boys from a school evacuated from the East End of London. These street-wise youngsters ran rings round the locals and were expert in all kinds of devilry previously unknown in sedate Cambridge.

Everywhere there was anxiety about fifth columnists and about German spies being dropped by parachute in the middle of the night. Even Lilian was briefly suspected. When her brother was about to be posted overseas in the army, he rang her at school and as usual they talked in Welsh. The school secretary thought that she was talking German and ran off to tell the headmaster. He thought it very funny, for he was a Cornishman who knew something about Celtic languages. Later a friend was sitting innocently on a road-side seat looking at a road map. He was investigated too. Maps were more than usually useful then, because all the road signs had been removed, so as not to be useful to invaders. Late one spring evening we went off to Madingley with three or four friends to listen to the

nightingales singing so wonderfully in the woods. Everywhere we went we were expected to take our civilian gas masks with us, in the cardboard boxes provided. We left our bicycles at the roadside and this suspicious action was reported by some assiduous local. The police read names on some of the boxes and it was our turn to be investigated.

Surprisingly, there were some advantages too, especially later, when the London Blitz had started. Some of the very best shows, plays, ballets and operas, appeared at the Arts Theatre, then pretty new and in prime condition. People like Margot Fonteyn, Frederick Ashton and Robert Helpmann were all to be seen in our local theatre. Normally most of these shows would have been in London. There were amateur efforts too, run to collect funds for the Red Cross. Our talented friend Cyril Cudworth ('Cuddy') wrote a pantomime that was fun. Believe it or not, Lilian was the fairy Ermintrude, frilly bespangled white dress, wand and all! It was performed in village colleges in the area. There were fine chamber music concerts in the beautiful venue of the Trinity College Master's lodge. The Master was the historian G.M. Trevelyan, and his daughter Marjorie played the oboe very well. She collected musicians around her, including my Bureau former boss Pen Hudson at the piano.

Most of us did some kind of Civil Defence work. Lilian and I both took Red Cross first aid courses and she became an ambulance attendant. I took up duty as an air raid warden and also did fire watching for the university. It meant many sleepless nights, but we bore up. There were frequent air raid warnings, with wailing sirens sounding all around, and the sound of many planes going over in the night hours. We reckoned that we could tell the difference in the sound of 'theirs' and 'ours'. They were not aiming for Cambridge, though. One or two stray bombs were all that fell. On one night the sound was especially loud, with many planes passing over, and that was the night Coventry was bombed and so severely damaged. Raids on Liverpool and other north western towns also gave us noisy nights in Cambridge.

The fire-watching was needed because not all the raiders carried high explosives. Incendiary bombs, individually light but dropped in large numbers caused havoc too. Fire-watching for me meant nights spent at the top of the tower of St. John's College Chapel, bitterly cold in winter. Other nights were spent patrolling the

science buildings on the Downing Street site. I was not so fond of wandering round the Anatomy School with a hand torch, past shelves stacked with bottles and jars with preserved bits of bodies in them. The one thing we did which was really valuable was to spot a fire just starting at the centre where a large amount of blood was being stored for transfusion. It was just an electrical fault, nothing to do with the war, but spotting it was very useful indeed.

There was the blackout. Everybody had to put dark curtains on their windows, so that no light shone out. A major part of the air raid warden's duty was to see that this was enforced. We also stuck adhesive tape criss-cross on some of the windows. This was supposed to stop the glass shattering in the event of a bomb blast, but the scheme did not look very effective to us, especially as in many cases some of the tape very quickly began to peel off. There was no street lighting and cars had their headlights covered with cylindrical cans of dark-painted steel, with louvred ends that directed a little light straight down on to the road. Students walking in the streets with their black gowns were just about impossible to see. During the blitz, though, there was one thing we could certainly see and that was the red glow in the sky over London, fifty miles away, night after night for weeks.

All we had to do in the first winter of the sugar beet work was to select the roots with the best combination of size and dry matter content from our 6,000 selections and store them in a frost-free place. In the spring they were planted out at Great Shelford, a couple of miles out, in long, thin strips. This way, a lot of the genetic diversity would be preserved, because nearly all the pollination would be between near neighbours. This was in 1941 and it left a lot of spare time. I busied myself with looking at ways available to stretch the limited national stocks of sugar beet seed, notably by testing a semi-precision drill invented by Dr Martin Leake, who lived in Cambridge. That was hopeless too, because no spare engineering facilities existed to make such drills on an adequate scale. The factories were all making bits for the war. Much economy would have been possible without this, because at that time beet growers were required as a term of their contract to sow 15 pounds of seed per acre.

Occasional opportunities for a trip occurred. There was an entomologist named Petherbridge in the School of Agriculture and one day he took me down to Maldon, Essex to see sugar beet breeding work being conducted there. It was an

ominous day. Hitler had broken through, or by-passed, the Maginot Line and was advancing into France with no trouble at all and was at the same time driving the small British army towards Dunkirk. Our side was engaged in a scorched earth policy and was setting fire to all the coastal oil installations. Drifting across the sky that day was a continuous procession of very black clouds, coming all the way from France. We also heard the distant, ominous rumble of explosions.

We found the sugar beet trials but not the breeder, J.C. Cullen, formerly one of my fellow-students under Watkins. He had been partaking of the bottle too heavily and had been taken away to Colchester to be dried out. We did see one interesting thing going on. It had been thought that sugar beet 'ripened' in the autumn, as the leaves often turned yellow just like birch trees. Only recently had it been realised that this was caused by a damaging virus. Another and much more genuine refugee, Dr Ripper, was busy killing the aphids which transmitted the disease. He was dragging a large tarpaulin behind a tractor while releasing nicotine gas beneath it. Dr Ripper was an enterprising immigrant from Austria who had managed to do a deal with the Ministry of Agriculture and Food that no local had ever even thought of. Virus yellows was not prevalent in certain years, being linked to the life histories of its aphid vectors. But Ripper, wishing to live through any lean years, negotiated a deal whereby he got paid even in the years when there was no work to do. After some time he married a wealthy landowning widow from Norfolk and finally ended his career after the war by flying his light aircraft into a Greek mountainside during bad weather.

The seed from our plots at Shelford was harvested by hand stripping; most of the sticks and dried-up leaves were separated in hand sieves and the seed was put in packets. Now came the problem. So far, sugar beet breeding had been light work for one. Now came the need for progeny trials. Beet was not a bit like wheat, where the produce of a single ear-to-row plot might be a few grains in a paper packet. Even at a single location, a proper trial would involve 50 to 100 tons of dirt-laden beet, which had to be harvested, washed, weighed and sampled for sugar. This would need equipment and people. When I pointed this out, there was a great coolness in high places. It appeared that even in Whitehall the truth had dawned and that the feeling of urgency that had started me had now faded. You may judge my relief when I had a telephone call from a certain Mr Clark in Maldon, Essex. He needed a breeder for a sugar beet project that sounded real. His

existing breeder had proved unsatisfactory. I could guess why and all that remained was to negotiate a salary. I pitched it at twice what I had been earning in Cambridge and was accepted.

Chapter 11: Getting Started in Maldon

I went to Maldon to start work on February 1st, 1942; leaving the academic atmosphere of Cambridge to do a job with a commercial company based in a small Essex town. However, in some ways this was not such a change, for my scientific interests in Cambridge had been directed to a practical rather than abstrusely academic end and my science would still be needed to improve plants in the world of commerce. At least this enterprise was real and meaningful, not a question of supporting the war effort by the quite absurdly long-winded process of breeding sugar beet from scratch. The Maldon company was already in commercial beet seed production when I joined it, though on a small scale and with much room for improvement.

I took with me, as an assistant, Kenneth Hedge. He had been one of Maurice Buck's two assistants at the Plant Breeding Institute and was married, with two young children. His experience had been in the very practical side of running cereal trials. For the two of us, as we arrived by train, appearances were rather inauspicious, for it was a bitter winter. The landscape was covered with snow and this persisted for weeks.

The first thing was to meet Mr Ernest Clark and learn about the company and its requirements. He was one of the many small country corn merchants who operated in those days, before the fashion for amalgamation into huge concerns with many branches had taken root. The main business was buying wheat, barley and other crops from farmers, cleaning and packaging them as necessary, and selling them mostly on the London market. He also supplied the same farmers with seed corn, fertilisers, feeding stuffs and other such requirements. The 1930's had been hard days and Mr Clark (I soon learnt that everybody called him 'Boy') had survived when others failed, because he could command cheaper transport. His warehouse was a converted maltings and was right on the tidal Blackwater Estuary, a couple of miles from the centre of Maldon. He had a small quay where Thames sailing barges could dock and be loaded or unloaded and this was cheaper than road or rail.

'Boy' proved to be a very friendly and practical person but had no pretence of being any kind of scientist. He had mastered the technique of contracting out sugar beet seed growing to his farmer clients supervising the crops with the help of his assistant and later partner Tom Young, dealing with seed as received from them and preparing for sale to the British Sugar Corporation. Improvement of beet varieties by breeding was a mystery to him and when his

breeder, J .C.Cullen, lapsed into alcoholism and let things go to rack and ruin, he was in a real fix. This was the point at which he contacted Cambridge and sought me out. I was his second dip into the Cambridge pot and he was hoping and praying for better luck this time.

Boy's arrival on the sugar beet scene had, as is the case for so many things in life, been accidental. Back in 1924 and 1925, when the beet sugar industry was founded in Britain, it happened that a government-owned institute, the National Institute of Agricultural Botany (N.I.A.B.) had newly come into existence. It had been given the task of sorting out the chaos which then existed in the naming of crop varieties and also of testing them for performance in the field. In this way farmers could be reliably informed what best to grow. When the beet industry started up, every foreign beet seed firm hoped to put its varieties on to the British market. What could be more logical than to let the N.I.A.B. sort this problem out too? To this end it started running performance trials on beet varieties in every sugar factory area, and issued a list of recommended varieties of which seed would be stocked for distribution by the factories. Without a recommendation the sugar factories would not stock seed of a variety and the growers were contracted to buy their seed from the factory. Hence it was a case of no recommendation, no sale, but the growers did have a free choice from the full list of approved sorts.

Firms from Denmark, Sweden, Holland, Germany, Czechoslovakia and a few other places entered varieties in the trials. One of these was the Polish firm K. Buszczynski & Co. and its varieties proved to be unacceptable because of a propensity to 'bolt', going prematurely to seed in the first year instead of producing a nice fat root suitable for sending to the sugar factory. They had tried to improve resistance to bolting by working on the problem back in Poland, but on retesting in England the varieties still failed to pass muster. So they decided to set up a breeding station and a seed production company in Britain in the hope of better success. They had a problem, for they had no contacts in the country. They chose to seek advice from the National Farmers' Union. It happened that the president of the N.F.U. at the time was a certain Stanley Ratcliff, a farmer from Maldon. Now Boy Clark had married a pretty red-head named Beryl, one of Stanley Ratcliff's daughters and Stanley told the Poles that he was sure his son-in-law would cooperate with them. He also correctly told them that Essex was an excellent seed-growing area, for which it had a long tradition. So it started! A breeding station, wholly owned by the Poles, was set up in one of Stanley Ratcliff's farmhouses, at Beeleigh, a mile or so out of Maldon. A seed production company, called British Pedigree Sugar Beet Seed Ltd., with a 52 percent Polish ownership, was also set up and both

were furnished with equipment of the same kind as they were already using in Poland.

The Buszczynskis appointed a Polish breeder by the name of Lutoslawski and there was never any intention that Boy would be saddled with breeding responsibilities. But the war broke out and Lutoslawski, who was in the army reserve, had to return to Poland like many Polish soldiers never to be heard of again. This left Boy with a problem which accounted for his trip to Cambridge and his acquisition of Cullen. Cullen had no previous experience of sugar beet but was intelligent and had a sound scientific training. His problem with alcohol was not foreseen and he seemed to be a good choice.

This was the background of my arrival with Kenneth Hedge in snow-covered Maldon early in 1942, after Boy had made his second trip to Cambridge.

Lilian was, of course, still committed to the school in Cambridge and we still had our house there. So I commuted between Cambridge and Maldon, spending five days a week at work and leaving for Cambridge on Saturday mornings, returning on Monday mornings. It was about 50 miles and there were two rail routes: via Witham and Bishop's Stortford and via Witham, Mark's Tey and Shelford. That was very much in the pre-Beeching days and only fragments of these branch lines remain. I used to cycle to Maldon station, put my bike on the train, and complete the journey at the Cambridge end by bike. Occasionally I would cycle the whole way. For the first few weeks the snow lay on the ground. One Saturday I remember cycling down to the Maldon East station in deeply rutted snow with much difficulty, arriving just time to see the train leave. I cycled on to Witham, six or seven slippery miles away, just in time to miss the train there too. Then on another eight miles to Braintree and finally I caught it! The trains were not really quite that slow, but that particular service waited for an hour in Braintree.

I had to find lodgings in Maldon and was very lucky, for I stayed with Mrs Collins, the mother of the local grocer. In a time of severe rationing that proved to be an excellent arrangement , for no system could be absolutely watertight! Stanley Collins, the grocer, used to complain that his mother never understood rationing. She never needed to in any strict sense. These weekend trips to Cambridge lasted for the rest of Lilian's school year, from the beginning of February to late July. Sometimes, though, she would come to Maldon instead. Kenneth Hedge's accommodation problem was solved by letting him occupy the top floor of the farmhouse at Beeleigh, above the rooms which constituted the breeding station.

Maldon was a pleasant little town with a long history, much quieter than it is today and with a population of about 10,000. Motor traffic was minimal because of the very severe rationing of fuel. Maldon had been the site of a victorious battle against the invading Danes nearly 1,000 years before. The town centre, with its old Moot Hall, is built on top of a hill. There is a road nearly straight up the hill from the flat river plain below, phenomenally steep for East Anglia. In the early days of motoring they even kept a team of heavy horses at the bottom of the hill, to give the cars and lorries help when needed to get them to the top. There is another way down, though, the gently sloping High Street with its many old buildings, terminating in the wharf on the tidal estuary of the River Blackwater. When I arrived there, the shops were still mostly family businesses and there was a good supply of pubs. Fishing boats plied from the wharf and one of my first impressions of Maldon was the freshness of the fish in at least one of the shops. As I was walking down the High street, passing the display on the usual marble slab in a fish shop, one of the flatfish jumped in the air. You can't get much fresher than that!

There was a Grammar School (high school) in Maldon and the headmaster was short of staff because of the war. He had heard, from someone who had met Lilian, that I had a wife who taught English and he asked me to go to see him. It was quite amusing, having an interview by proxy. I rose to the occasion in one small respect. Lilian had left a few things in Maldon, among them a tie of the Lydney Old Girl's Hockey Club. I wore it, because that was as close as I could get to qualifying as a schoolmistress. Arthur Ingham, the headmaster, was universally liked. He was dedicated, kind and efficient and indeed quite outstanding. He took Lilian on his staff, sight unseen!

We had to find a house, not too easy a task. We found one in the town, a semi-detached house in Cross Road. It was acceptable for a short while, but we never really liked it. It belonged to a widow lady named Rush, whose late husband had hunted big game in India. On the wall of the staircase was the outline of a spread-out tiger skin: it had prevented the wallpaper from fading as the rest had. So half way up the stairs was a rather spooky tiger, which Lilian never really accepted as a member of the family. Nor did she like, in this semi-detached house, the fact that the attics of the two houses had no dividing wall. She did not feel secure. However we did like the giant, overhanging walnut tree in the next door garden, which shed hundreds of walnuts on our side.

Maldon was closer to the war than Cambridge. Many of the local fishermen in their small boats had joined the flotilla which went out to rescue the British army from Dunkirk. The coastal zone had special security arrangements, with

check points on the zone boundary. Whenever we left, we had to stop at a check point on returning, to present a special identity card to prove that we were legitimate residents. From Maldon we could sometimes see a glow in the sky in the direction of London, as we could from Cambridge, but the big 'blitz' was over. As in Cambridge, there was very little bombing. Curiously, it was the farmland nearer the Thames Estuary which had more things dropped on it, mostly jettisoned by enemy aircraft as they were being chased by our night fighters, using the estuary as a landmark. That was a bit later though, when the fighters had been equipped with on-board radar and could locate and chase the raiders during the hours of darkness. There was a claim that the neighbouring parish of Purleigh had more bombs of one kind or another dropped on it than any other parish in England. It was so rural, though, that only one house was destroyed and that was when the owners were out at the cinema.

All this is running on a bit. The farmhouse breeding station was simply but adequately equipped to wash and weigh beets from field trials and to determine sugar content, in this way getting good data from a near by trial field provided for our use by the ubiquitous Stanley Ratcliff. But everything was in a horrible mess. The yard was full of bags of selections, not covered by straw or any other protection and mostly frozen hard. Time showed that there were survivors of this treatment, but also very many losses. There were some broken panes of glass in the house, which I was told were smashed by Mr Norfolk, the blacksmith from the next village, Woodham Walter. True to tradition, 'the smith a mighty man was he' and he did not appreciate the fact that Cullen had been having an affair with his wife. It should be mentioned that, after these sad lapses, Cullen pulled himself round and became a very worthy citizen. In due course he was to join the staff of the N.I.A.B.

So this was the start, and I was to overlap with Cullen for a month so that I could have time to find out what was what. This could have been very embarrassing, but in fairness Cullen made it as easy as he could and by the time he left I was getting into the swing of things. However, the immediate outlook for me was rather mixed. There was the exciting challenge of a new and truly significant job, but there was also the chaos, the frost damage and the snow, covering the landscape unremittingly for week after week. This was quite exceptional. I never again saw such persistent snow cover in Essex.

When it was possible to see the local farm land, it looked different from most. It was mostly heavy, clay soil and carried arable crops. It was ploughed 'on the stetch', i.e. it was put up into strips typically 7ft 6 ins (2.3m) wide and the implements - harrows, drills, cultivators and so on, and the tractors too, had

their wheels the same distance apart. In this way heavy loads did not spoil the soil structure even though the tractors and implements of the day had iron wheels. Although most of the ploughing was done by tractor, steam ploughing was not yet dead. This involved two steam traction engines, one at each end of the field, drawing a heavy, multi-furrowed, reversible plough backwards and forwards by steel cables wound on great drums. Again, the heavy tractors did not run on the area to be cropped.

Some of the local farm workers' wives worked in the lab. There was Mrs Whiting, a small, lean and sprightly sexuagenarian, and Mrs Broome, both from farm cottages at the end of the drive. There was Mrs Hermon, from Curling Tye Green, known always as 'Colickey Green'. For a while, some male workers were available too. The women, I noticed from the labour book, earned 8½d (3½p) per hour and the men 10½d (4½p). At that rate we could afford to have them cleaning up bags of seed by laborious handpicking. I soon devised a miniature carpet dresser for this purpose but other improvements were not so easy to make. It was all very odd. In a way, the firm could buy anything it wanted, effectively for nothing, for there was a thing called Excess Profits Tax. Any profit earned by a company in excess of pre-war earnings was taxed at 100 per cent, and this firm had earned very little pre-war. So effectively anything could be bought at no eventual cost, the only trouble being that supplies of nearly everything had dried up and little local engineering shops were otherwise engaged or had lost their staff.

I did get a car, though, a secondhand Riley with a heinous device called a Wilson pre-selector gearbox, which was coupled with a centrifugal clutch. It was normally a good idea, but in those days batteries had to last long after their normal spell of service had expired and then a starting handle had to be used. The position of the gear lever bore no relation to the gear the car was actually in at a particular moment. If it was not in neutral, the person with the starting handle was very liable to be run over when the engine started and the centrifugal clutch automatically engaged. I made several very quick dashes out of harm's way. Petrol was very severely rationed during the war and was allowed only for essential business purposes, so that the good old bicycle was still very much in the picture.

My previous driving experience was limited to a few tentative trials in the Arizona desert and a little bit around Berkeley, but driving tests had been suspended during the war and traffic was very light owing to the petrol rationing. So the thing to do was to go out and learn by experience. I started by

driving round some of the little country lanes. The very first time out I met a very large tank coming the other way, which I thought most unfair!

The breeding gradually got into shape and facilities were improved as much as possible. I added a second trial centre at Bridgham, on the edge of Breckland, near Thetford in Norfolk. The point of this was that the land was very sandy and sowing was possible much earlier than on the heavy land around Maldon. This early sowing exposed the germinating crop to low temperatures for a long period and this encouraged bolting. In that way it was possible to select material with real resistance to what had been the company's biggest problem. Sometimes the very lightness of the land led to difficulty for a strong wind after sowing could blow the seed (and the top layer of soil) away. Staffing was a major headache, and went through various phases. At one time I could get very fit but quite unskilled men lent from an anti-aircraft unit on the coast. They could only come on one day a week and then there were no less than eighty of them. We were required to pay them only 1/6d (7½ p) a day, though of course they still had their service pay. Imagine, with a gang like that, obviously far from dedicated to the finicky business of harvesting trials, the task of keeping all the lots separate and properly labelled! Then there was a team from the War Agricultural Committee, a small number who came daily, but they were pretty well unemployable, or they would never have been there. I specially remember one man, always neatly dressed in a dark lounge suit and bowler hat, who washed the beet in the big tank of very cold water. Every morning he showed me the picture he had painted the night before, always one of two subjects: Christ on The Cross or a train crash!

Next came the Women's Land Army. Quite a few city girls, faced with the need to do some kind of war work, opted for the outdoor life. They had a hostel just on the other side of Maldon and came and went in a special little bus. Two or three of them were real stunners. They got a bit distracted after an American airfield had been established not many miles away. They were supposed to leave at 5 p.m. but from about 4.30 a number of jeeps began to arrive to wheel them away. What did young Englishmen say about the Americans? Overpaid, oversexed and over here! Enormously appreciated none the less, at least by most of us.

The final phase with labour was prisoners of war. They came daily from a camp on the other side of Braintree, some 18 miles away. They were nearly all German and were really good until the war ended, when they very understandably became restless and just wanted to go back home. I sometimes used to think, standing in a beet trial, that there I was, surrounded by a group

of enemy aliens armed with the very sharp machete like knives used for topping beet. A potentially tricky situation. It turned out that one of them had previously worked for a sugar beet breeder, the German firm of Dippe. Another, Zantow, paid a visit to his home in Eastern Germany after being 'demobbed', did not like the look of what he saw, and came back to Britain as a free man. He worked in our seed warehouse down in Maldon, and stayed in this country to the end of his days. Lilian and I got on well with the prisoners and treated them kindly. I still have a memento of these days, a very nice work box which one of them made in his spare time and presented to Lilian.

After six months in the unloved Cross Road, Lilian and I managed to find a house we liked. How was it done? During those days, Lilian and I had again signed up for Civil Defence work, she on ambulances and I, in a rescue squad. One particular night, while I was on duty, I had a telephone call from Stanley Collins, the local grocer whose mother had looked after me when I first came to Maldon. In those days we all had to leave our ration books with a grocer and the first sign of anyone leaving was that they went to get their books back. So Stanley rang me to say that a certain family were leaving and that they were living in a nice house up the Spital Road, owned by the local Town Clerk, Mr Cloughton. At 7 o'clock the next morning I was on his doorstep and became the new tenant.

The sugar beet seed produced by the company was grown under contract by local farmers. The threshed seed was brought in as required to a processing plant which had been installed in a disused garage near the railway station. Luckily this had all been set up before the war loomed, with the expertise of the Poles. The seed was dried as necessary, sized and cleaned as far as possible on flat, reciprocating screens and finished off by trickling it down inclined, ascending belts called carpet dressers. The roundish seed rolled to the bottom while the sticks, leaves and rubbish were tipped over the top. The seed was then dusted with organic mercurial powder to control fungi and bagged in hundredweight hessian bags. In charge was a local smallholder, Charlie Rushbrook.

Looking back on it, one aspect was frightening. We were nothing like so aware of environmental hazards in those days as we are now, and the control was so imperfect that, by the end of the season, most of the flat surfaces around the plant were covered with purple mercurial dust. Much of it must have been breathed in, but the staff showed no ill effect. The dust would puff out through the fabric of the bags too, so the farmers had the benefit of some of it.

As the war neared its end, new things began to happen. One day we saw a great many large aircraft going over, each towing a glider of roughly equal size. They were taking troops out to the ill-fated Arnhem offensive in Holland. Then we began to get 'doodle-bugs' coming the opposite way, unarmed flying bombs the engines of which would stop and then they would dive to earth and explode. They were very nearly as fast as our fastest fighters and they were therefore hard to catch. I saw one flying over my trial field, chased by the fastest fighter of the day. The pilot fired at the doodle-bug with his wing-mounted cannon, but missed. The recoil of the guns slowed him down and he had to chase his target again for miles before he caught up and destroyed it. After a while, though, doodle-bugs were picked off regularly by anti-aircraft batteries on the coast, equipped with new radar-based devices called predictors, manned by women. Before this happened, though, one of them landed a couple of hundred yards from our house. It blew all the windows in and lots of tiles off the roof. It was unkind enough to send a sliver of glass right across the room where Lilian and I were sleeping in our Morrison shelter, to cut the strings on her tennis racket. The shelter was a heavy steel double-bed-sized box with a top of thick steel plate and steel mesh sides. This hit was plenty close enough! We reacted by drinking the precious bottle of sherry which we had hoarded, then went out into the garden to see if the apples were still on the trees. They were.

During this period Lilian's mother quite often used to come from her house in Wales to visit, always most welcome. She did not mind leaving her secure home far from the war zone. I remember one evening I had been talking about sugar beet to an audience of farmers on the other side of Colchester. On the way back the siren went. When I got home, there was 'Nana', nonchalantly standing close to the kitchen window, making marmalade. Her cocker spaniel Jim, who always came with her, was much less brave. He was the first in the shelter when the siren sounded. Later the V2's came, supersonic rockets. The sound of the explosion was the first thing we heard and we knew that if we had heard that we were O.K. By then we had moved the trial fields to another of Stanley Ratcliff's farms, at Woodham Mortimer. A rocket landed near enough to strip a large part of the stucco surfacing from nearby Woodham Mortimer Hall and to blow down a large section of the garden wall.

One day, returning from work on my bicycle, I saw what seemed to be a crazy, impossible thing. It was a twin-engined aircraft without any propellers, clearly an optical illusion of some kind! It was our first jet aircraft, a Gloster Meteor. Because of war-time secrecy , there had been no announcement of its existence.

Through the winter of 1944-45 the Germans had their last fling in the Ardennes and in the following summer came the capitulation, followed not long afterwards by the defeat of the Japanese. There were two great celebrations, VE (Victory in Europe) Day and VJ (Victory in Japan) Day. The end of the war brought what might have been a difficult problem for Lilian and me. We had rented our house 'Hartmoor', in Maldon on the understanding that we would vacate it when the owner's son-in-law came back from the war. In practice, though, this worked out beautifully, for Boy Clark had decided to buy Woodham Mortimer Hall farm, together with its fine historic house, from his father-in-law. Lilian and I were able to move in on VJ Day, to enjoy living there for no less than 34 years.

Chapter 12: Peacetime Adjustments

The arrival of peace led to a lot of changes and a lot of re-thinking. Some things stayed just the same, like Lilian's teaching job, at least as long as she wanted it. Others, like the rationing of food, fuel and clothing, actually got worse for a while. Our big new house, three storeys high, was only partly ours for a while, two separate flats being occupied by the families of farm workers, the Rowes and the Taylors. Three of the downstairs rooms were used as an office, a washing facility, weighing and sampling room for the beets and a lab. All this eventually sorted itself out. The other families left and the laboratory and office moved to new buildings across the road. There was another big event for us. Lilian and I had decided not to have a child in wartime, but now things were different, and in January 1946 our son John was born.

The business now faced a return to normal international competition in sugar beet breeding and seed production, though of course that would take some time. We had been lucky up to now, with an assured market for all that we could produce in a time of shortage. The continental producers in general had the advantage of scale and indeed of much longer experience. In some cases, as in Sweden and Denmark, they were owned by sugar companies, able and willing to subsidise them if need be. Some odd things happened too. The firm of Rabbethge and Giesecke, breeders of Kleinwanzleben sugar beet varieties, had been the largest single suppliers of beet seed to Britain. When zonal boundaries between the Western powers and the U.S.S.R. were agreed, the village of Kleinwanzleben found itself in the Russian sphere of influence. Very strangely, while things were still fluid, a British military expedition was organised, to go to Kleinwanzleben and bring back breeding stocks of seed and key personnel to the West. Dr Rabbethge had a farming estate at Einbeck, not very far from Hannover, and they were taken there. New facilities were built, financed by a loan from the Prudential Assurance Company. So there was another major competitor, set up on a lavish scale in Western Germany. We had no illusions about the competition and we knew we would have to fight hard. This we did in two main ways: by technical innovation and, when new and much more expensive breeding methods came along, by international co-operation. We were helped by the fact that another British firm, Johnsons of Boston, Lincolnshire, came to us for a supply of mother seed, which gave us useful additional revenue. We had been able by now to put together quite a well-equipped lab, though it would be some years before we could get adequate equipment for handling large quantities of roots

mechanically. The trial sites were extended to Scotland, where breeding against bolting was helped by the length of the summer days, to the black fenland north of Cambridge (which was a very different environment), to the rich fenland silts near the Wash and to Shropshire.

This regular travelling about Britain was interesting. The Shropshire trials brought nothing that was unfamiliar, for it was in Ford, where I had often visited my uncles through the years. It was nice to be able to sneak off for a weekend in Wales. Working in the Fen at Black Horse Drove was like living in a world apart, remote and very different while only a few miles from Littleport and the small cathedral town of Ely. Standing on the deep, black peat close to a working tractor plough was like experiencing aftershocks of an earthquake, with the ground shaking like a jelly. The old fenland families, who had years ago been marsh dwellers, were even reported to be web-footed! While visiting the trials at Holbeach St. Mark's, where the rich silt had been reclaimed from the sea, we normally stayed at the Chequers Hotel in Holbeach. There one was likely to hear more Dutch than English being spoken, for it was close to the centre of the bulb-growing area.

The Scottish trials were the most interesting to visit. At first we had a field just by the factory in Cupar, Fife, but then I thought that if we were to go north to get the effect of the long summer days, we might as well really go north. So for some years we had trials on the land of a Mr Robertson, who had some very good, light land within a great curve of the river North Esk near Laurencekirk in Kincardineshire. It was beautiful, flat, uniform land that seemed ideal for trials. One year, though, when we were ready to sow, it rained and rained and rained. We stayed in a hotel in Brechin. At the end of two weeks the river flooded and the trial site was submerged. We went back home and tried again later.

We had a visitor to our Laurencekirk trial, an enterprising farmer from Fife in the shape of Mr Frank Roger. He farmed near St. Andrews in Fife and was of some significance in the Scottish sugar beet industry, of which he was immensely supportive. He was the Scottish National Farmers' Union representative on just everything to do with beet, including the I.I.R.B., the European Institute of Sugar Beet Research. Hence I had met him at gatherings on the Continent. He was of medium height, robust and athletic, with a rosy face and a moustache. He did not entirely like our trial, for the rabbits had been at it. Rabbits galore were living in crevices in the ever-present stone walls and coming out for a nibble whenever they felt like it. So Frank generously offered us trial facilities on his land, and we were pleased to accept even though it meant going back some distance south to much the same latitude as Cupar, where we had started work in Scotland.

Frank was a fine farmer and kept his farm in tip-top condition. We stayed with him until I retired in 1979 and of course got to know him very well. At the age of eighty he could still shin over stone walls like a youngster. He was a pillar of the kirk and normally did not touch a drop of alcohol. Once I was dining at his farmhouse at Boarhills and he brought out a bottle of whisky that some ill-informed person had given him for Christmas. He didn't want to drink it but, being Scottish, didn't want to waste it either. So he plied me with whisky. He did so in a big way and, if it had been in these days of the breathaliser test, I would not have dared to drive back to St. Andrews. Frank was known to have broken down on one occasion, though. It was on one of the I.I.R.B. summer tours. On the ferry on the way back he was heard to say "To think that I was in France, drinking champagne. And the worst of it was, I enjoyed it"!

It was interesting to see how farming changed during the years we were with Frank. On my first visit he proudly showed me his team of fifteen Clydesdale horses, clearly very dear to his heart. The cereal crops he grew, mostly oats, were put up in rows of little round stacks raised on staddle stones, mushroom shaped stones which prevented rats and mice from getting into the stacks. After some years the horses had gone, combine harvesters and tractors had arrived and the cereal crops were barley and wheat for the market. There were no more stacks.

The peninsula of Fife is lovely country, gently hilly. St Andrews is historic and impressively sited by the sea. It has a ruined abbey, the oldest university in Scotland, graced by students walking about town in scarlet gowns and the most famous golf course in the world, the Royal and Ancient. The coast is dotted with picturesque little fishing villages like Pittenweem and Anstruther. One of my favourite haunts was the Smugglers' Inn at Anstruther, though it was not so good the last time I went, for the proprietor and his wife were having a battle royale.

One aspect of our innovation stemmed from my interest in field trial techniques. If it were possible to reduce lot size to a minimum, more material could be handled for the same cost. This required very different statistical treatment, which had to be invented. By a curious chance I had worked on this problem in Cambridge, with a view to getting useful yield data from single ear progenies of barley. Normally field plots are several rows wide and the outside rows were discarded because they grew next to a different variety and were therefore not under normal competition. I had aimed to calculate this inter-row competition and to correct for it. My sugar beet plots were therefore reduced to single rows: replicated, of course, just as multiple row plots would be. Another necessary invention was of trial designs that freed the breeder from the standard, textbook methods of the day for the handling of large numbers of varieties. These were unduly rigid, the standard designs being based on a

perfect cube of entries with an equal number of replications of each. There is a lot of difference between 93 and 103, 271 in fact, and the rigidity would have been most uncomfortable. Whatever the method, great masses of data had to be handled.

Data handling had got just a little easier. In Cambridge, all I had been able to use was a Brunsviga machine, in which numbers were put in by moving a slide in a slot for each digit. Multiplying was done by turning a handle. To multiply by 75 you would turn the handle five times in the unit position, move one space to the left into the tens position and turn seven times. It was essentially useless. In Maldon I had a Madas machine, electro-mechanical and made in Switzerland, which was quite useful in the intervals between breakdowns. After the war came a great advance, a Friden machine from America, also electro-mechanical. As a measure of how things have changed, this machine cost £550 in 1945, equivalent to several thousand pounds now, and if I had needed the version with a square root facility, it would have cost £890. It did nothing that could not be done more quickly nowadays on a calculator costing less than five pounds. With the Friden machine, I still taxed family patience, for I was burning the midnight oil on calculations for many weeks in the autumn and winter.

Boy Clark and I had been running the company for years and the absent Poles still had a majority of the shares. We had been paying their dividends over to an official called the Custodian of Enemy Property. Not that the Poles were enemies, of course, but they were entirely cut off from us during the war and somebody had to be legally responsible for their property in England. Now we re-established contact with the Buszczynskis in a very strange way. Poland, of course, was a communist dictatorship, but not everything was taken over by the state. Businesses with less than thirty employees could still have a separate existence, though they were heavily controlled. Buszczynskis had cut themselves down to size so as to stay alive. At this time Spain was a dictatorship too, though at the opposite political extreme under Franco. They were not on diplomatic speaking terms. The Spanish sugar industry, however, wanted to buy seed from Poland, of a variety held to be resistant to the leaf-spot disease Cercospora. The solution was that the Poles proposed to export the seed to us, so that we could then re-export it to Spain.

Boy and I saw a chance here. We told the Polish company (with more than a small degree of connivance) that we could not agree to this arrangement unless we were able to satisfy ourselves that the seed was of such quality as not to damage our reputation. On the strength of this, we got visas to visit Poland in 1948, in the middle of the anxious period of the Berlin airlift. In this way we were able to meet and discuss things together. It was an experience which, while rather scary at the time, I would not have missed.

In 1948 there was virtually no passenger traffic to Poland and the Poles had no ticket agency in London. There was, however, a Czech agency, which issued us with railway tickets printed in Czech. We went up to Grimsby to join a British freighter, the Baltavia, which was able to legally carry up to twelve passengers. Across the North Sea we went, through the Kiel Canal and into the Baltic. There we travelled between two lines of buoys, the only channel that had been swept clear of mines. We passed close to the Swedish island of Bornholm and finally into Gdynia harbour. The mouth of the harbour was still partially blocked by the sunken German battle-cruiser Scharnhorst. The British consul came aboard and told us what we needed to know about being discreet, for we would be followed around by secret police and our baggage would be searched.

The train was waiting for the overnight journey of 250 miles to Warsaw. The railway system had been badly wrecked during the war, steam locomotives awaiting repair or scrapping. Our train was terribly crowded and the prospect of spending the night packed together like sardines was not inviting. Then the train conductor came along and things rapidly improved. It happened that a few days earlier there had been a communist take-over, under Gottwald, in neighbouring Czechoslovakia. The frontier had been closed except to communist VIPs and our tickets were in Czech. So the conductor bowed to us with a great show of deference, cleared out all the other passengers from the compartment, and Boy and I got some sleep, stretched out full-length on the two long seats. It was great to be commissars!

Warsaw had been devastated and there were huge piles of rubble around. Rebuilding had hardly started. The worst area was that of the old ghetto, which had been systematically bulldozed by the Germans. There was a stench and we hoped that it was just drains and not bodies beneath the rubble. We showed up at the Hotel Bristol, where we were required to stay. It could fairly be presumed that any foreign guests would be under surveillance, indeed every time we left the hotel we were asked where we were going. We used to tell them "just for a walk" and they then had to follow us. We showed up in the Buszczynski office. The head of the firm, Konstantin Buszczynski had been run over by a Warsaw tram just before the war, and the current chairman was his son-in-law Stefan Byszewski, a charming fellow. Also present was Dr Roldolfo Ruberl, the foreign sales director of the Polish firm, who was resident in Italy. We already knew him and indeed he was a shareholder in the British company. He was there as interpreter, but most of the time Stefan spoke in his clear, rather slow, uncomplicated French and we spoke, I hope also slowly and clearly, in English.

They went as far as they could in the circumstances, for they were far from being free agents. The English breeding station, wholly owned by them, was to be

transferred to British Pedigree and new shares were to be issued in that company. This had the effect of reducing the foreign holding from 52 to 48 per cent, thereby ending Polish control. I was to have the extra shares at a nominal price. Then came the time when we had to make it appear that the declared object of the visit was the real one. I went down south to the lovely, old and undamaged city of Cracow with a Polish professor who had been advising the Buszczynski firm on technical matters. He seemed to me to be a typical academic taking on an extra job to make ends meet, but I suppose he could also have been keeping an eye on me at the request of the authorities. Near Cracow I saw their seed set-up and breeding station. I also saw some of the lovely old streets of Cracow, the university made famous by Copernicus and the castle on the hill. Then back to Warsaw to rejoin Boy, and we had a phony meeting in the Buszczynski office, with minutes taken, about the seed inspection: the Buszczynskis knew that they would have an enquiring official visit as soon as we had gone. They knew that their story had to be convincing.

The train journey south through the flat Polish countryside had been interesting. For the last time in my life I saw lines of men with scythes, cutting their way through cereal crops, and in a few places old-fashioned, horse-drawn sail reapers doing the same job. Passing close to country villages on a Sunday, we saw the local people going to church in colourful traditional dress. Poland was the country, above all others, where the Roman Catholic church had held on to its massive influence in the face of communism and this was probably the only surviving mass attendance at church in eastern Europe.

Because the mere presence of foreigners was a source of suspicion and therefore of possible embarrassment to the Buszczynskis, Boy and I went up to the resort of Sopot on the Baltic to spend a few days there until the Baltavia was ready to sail back, this time not to Grimsby but to the Pool of London. In Gdynia harbour we met the small number of other passengers. We laughed at ourselves, for we had already got into the habit of looking over our shoulders to see if anyone was listening before making any deprecatory remark about the communists. In Poland at the time censorship was all-pervading and took many forms. There was a newspaper printed weekly in Polish by the British Council and the agreement was that they could publish verbatim any speech made by a minister in parliament in Westminster. The then foreign secretary, Ernie Bevin, had been making some unkind comments about communism which were printed as agreed. It just happened that the distribution of the paper failed that week! Buszczynski's had a lady who did their foreign correspondence. Her son was interested in languages too and went to borrow a book at the British Library, which had been set up by inter-governmental agreement. He was arrested and grilled for several hours to probe his foreign leanings. In this way

the value of the library was negated, for people would rarely go if this kind of thing was the consequence. Many such examples could be cited.

This trip had been in the late summer of 1948, but it was not the first post-war trip abroad for me. Before the war the International Institute of Sugar Beet Research (I.I.R.B.) had been set up in Belgium. In 1947 it had its first post-war meeting, in Brussels in February. I joined up as a member and remained so for some forty years. It proved to be an invaluable way of getting to know the people in the industry in their various capacities. At that time, foreign currency for travel was very severely restricted and we were allowed just £35 a year each. I took Lilian with me and we were astonished by the bright lights in the shop windows, for display lighting had been banned for years at home, and by the wealth of goods in the shops. One day, Lilian was reduced to choosing between buying a pair of nylons, totally unavailable in Britain, or having lunch. I was at an official dinner of, for me at the time, unheard-of luxury. For Lilian, the stockings won.

At home we were learning the art of looking after our baby. Lilian had had a very rough time having him: she was aged 37 when he was born and that was by no means the ideal age. But now he was with us and it was a great experience and a great joy in life. Lilian still occasionally had a spell of teaching at the Grammar School, when some other member of staff was ill, and she was able to do this because her mother loved to come to Essex to lend a hand. We always enjoyed her company and we used to enjoy visiting her home in Barmouth.

We had quite fallen in love with Woodham Mortimer Hall and its fine walled garden. The other families had left by now, though part of the ground floor was still used for the sugar beet breeding work. The main part of the house, three storeys high, was built in the 1690's and just at that time Dutch engineers were draining the fen country to the north. From South Lincolnshire down to Essex, Dutch gables had become a fashionable feature of house design and these we had. At first there were stone-mullioned windows, but a century later they had been replaced with the new technology of the moment, sash windows. At the back was the old house, built about 1440, with timber framing. There was a walled garden, a safe haven for young John to play in and including a lawn which we converted to a tennis court. For many years we had weekend tennis parties which were a great pleasure. We also played tennis on a couple of private courts in Maldon, had a lot of fun and made some very good friends that way. In the winter months Lilian and I played badminton in the Grammar School hall.

The 'new' house, the 1690 part, had been built to the order of Dr Peter Chamberlen, anglicised to Chamberlain, of Huguenot origin. He had invented the obstetrical forceps which still go by his name, keeping them as a family secret. He became a

very famous 'baby doctor' and served several of the royal houses of Europe in that capacity. He must have had an unusual zest for travel. Even his frequent visits to London were not without danger, because Epping Forest was en-route, and well known for its highway robbers. Maybe he had somebody riding shotgun, just like the Westerns. Throughout our many years at Woodham Mortimer, we had visits from baby doctors from every part of the world, coming to see where the famous man had lived. The interest had been whetted because Chamberlain had cleverly hidden his original instruments, together with a few other personal odds and ends, under the floorboards in the top storey of the house. They had been rediscovered nearly two centuries later and had been taken to the museum of the Royal College of Surgeons in London.

Chamberlain's tomb in the churchyard next door bears an inscription of considerable interest. On the more important side it reads as follows:

Here lyes ye body of Docter Peter Chamberlen, who was borne on ye 8th day of May 1601 and dyed on ye 22th of December 1683; being aged 82 years 7 months & 14 days.

He had 2 wives and by ye first Jane Middleton had 11 sons & 2 daughters & amongst them 45 grandchildren, & 8 great grandchildren whereof were living att his death three sons; viz. Hugh, Paul & John, & his two daughters and 20 grandchildren and 6 great grandchildren.

By ye second Anne Harrison had 3 sons & 2 daughters whereof onely hope was living att his death who hath erected this monument in memory of his father.

The said Peter Chamberlen toock ye degree of Docter in Physick in several universities both att home & abroad and lived such above three score years being Physician in Ordinary to three Queens of England viz. King James & Queen Anne, King Charles ye first & Queen Mary; King Charles ye second & Queen Katherine and also to some forraine Princes, having travelled most partes of Europe & speaking most of the languages.

As for his religion was a Christian keeping ye Commandments of God faith of Jesus, being baptised about ye year 1648 & keeping ye 7th day for ye saboth above 32 years.

The mortality rate in a well-to-do and (for the time) medically clued-up family was very heavy. At his death he had lost 12 sons and daughters, also 25 grandchildren and 2 great-grandchildren. Of course the period referred to included the Great Plague of 1665 and this may have been a prime reason. Also note that he was baptised at age 47 and apparently he was a noted seventh-day-adventist.

Chapter 13: The Beet Breeding Story

Sugar beet breeding occupied a large part of my life and indirectly influenced Lilian and John through all my working years, so I must attempt to outline what it was all about. As in many fields of science, there was more innovation and change during the years following World War II than there had been during the previous century.

Beet breeding had existed as simple selection from the time the crop was first brought into being in the late 18th century. In those days, however, it hadn't much of a chance, for cane sugar could be very cheaply imported from a whole lot of places. However, it began to blossom in France under Napoleon. In fact, sugar beet seemed to prosper on naval blockades. Just as the German submarine blockade during the first world war had led to the establishment of a beet industry in Britain, so at the beginning of the 19th century it was the British navy who were the villains of the piece. They blockaded the French West Indies and Napoleon reacted by subsidising a domestic beet industry.

A sugar beet variety was a population, a mass of individuals each different from the others as is the case in humans. So early breeders had the task of picking out superior plants from the mass and growing them on for seed. Sounds easy but there were snags. Just picking out big roots to grow on would largely mean picking out lucky roots which had had a bit more space to grow in, a bit richer soil or some other good fortune. However, this problem was solved to a large extent by a certain Louis de Vilmorin in the 19th century. He invented the progeny test which was subsequently applied to just about every form of plant or animal breeding. The idea was that you picked out what appeared to be good plants but then grew them on to seed separately, in the next year comparing not single plants but whole progenies one against another.

There were still big problems. It wasn't enough to pick out families of big roots, for they might well be poor in sugar content and at first there was no easy way of checking that. Soon, however, came a device called a polarimeter, the same device being called a saccharimeter where the scale was graduated in sugar percentages. Juice was extracted from the beets to be tested, clarified and poured into a long tube. Polarised light, in which all the vibrations were in one

plane, was shone down the length of the tube and the plane was caused to rotate: more sugar, more rotation. There was an eyepiece at the end of the tube and some unfortunate (now and again it was Lilian) would spend hours in a little dark room, peering into the gadget and twiddling a knob until the brightness of the two halves of the field of view matched. Then the sugar content could be read off on a scale.

Even picking out superior progenies wasn't easy. You had a field full of plots but it was never uniform and special statistical techniques had to be invented to distinguish between real and chance differences. The English statistician R.A. Fisher was the great pioneer in this field, publishing in the mid-1920s.

This was the situation in the early days in Maldon. The rented farmhouse at Beeleigh, two miles from Maldon, was fully utilised. Upstairs, Kenneth Hedge and his family were installed. One of the two front rooms downstairs had many hundreds of single plant seed progenies in manila packets hanging on wires from the ceiling, the other front room being an office. The former farm kitchen was the laboratory and the pantry housed the saccharimeter. The single storey extension at the back housed a large tank of cold, muddy water in which roots were washed and scrubbed by hand and a boring machine with a Keil rasp to take samples for analysis. The drive to this was old style: there was an electric motor suspended from the ceiling with a flat belt drive down to fast and loose pulleys on the machine.

This remained the situation until 1945, when we moved into Woodham Mortimer. There a basically similar system albeit with some refinement was set up in the downstairs rooms and it was the Ellerton family who lived upstairs.

Before long things began to move more quickly by the drawing together of a number of originally quite unrelated strands, though the changes occupied ten years or so. Horticulturists had long since known that a strain of certain ornamental plants could turn up with especially big flowers. They called them *gigas* types. It appeared that these had more chromosomes than usual in every cell, four sets instead of two. They were called tetraploids. Wouldn't it be marvellous if we could produce such types to order, and have bigger and better crops? There were various strange and unreliable ways in which this might be done, but not long before the war, two Americans, Blakeslee and Avery, had discovered a good way to do it. It involved the use of a substance called colchicine, obtained from the autumn crocus and known as a treatment for gout.

When I was in America in 1937-38, polyploidy (the collective term for all plants with an increased number of sets of chromosomes) was the bandwagon of the day and most breeders I met were trying out colchicine on all kinds of plants.

In Europe, sugar beet breeders had been playing this game too, in Germany and in Scandinavia. Early hopes of instant magic were soon dashed. Tetraploid sugar beet did not prove to be an instant way to bigger crops, in fact they were rather lower than normal in sugar content and in yield. Hope soon grew that if these tetraploids were crossed with ordinary beets the hybrids (triploids, with three sets of chromosomes) would show hybrid vigour and be superior. Evidence that this was so was soon gathered, but there was no way that such triploids could be produced in quantity. All that could be done was to grow seed plants of tetraploids and diploids together as a mixture and let them interpollinate at random. The harvested seed had three components, the normal diploid, the hopefully superior triploid and the inferior tetraploid and these mixtures, called 'polyploid' varieties were put on the market and hailed as a great advance.

There was consternation among breeders who had not been working along these lines, especially when Oswald Rose, of the British Sugar Corporation, came along to tell us that we would all be stone dead if we did not get into this immediately. In Britain there were a number of seed firms which had joined together in the British Sugar Beet Seed Producers' Association. They had by no means all been doing their own breeding, some being dependent on overseas breeding firms which had not been into polyploids either. It was rather funny in some ways. Of the gathering of maybe fifteen people, only two, Kjell Lindqvist (a Swede) and I had the faintest idea what a polyploid was. What came out of this meeting was a proposal that there should be a single breeding organisation for the Association, with me in charge. Flattering, but impractical, because it was soon made clear that the single firm which at the time had nearly half of the entire U.K. sales would not come in. This was Sharpes' of Sleaford, who received their basic seed from Germany, from the Kleinwanzleben company which already had polyploids on the market.

The scheme fell apart after that, but when it had done so, Johnsons of Boston, Lincolnshire picked up the baton and asked us to supply their stock seed. They had previously been associated with a Dutch firm, Kuhn, which had a proud history in sugar beet breeding, but which had fallen from grace.

Polyploidy looked like being a modest success and we found ourselves making thousands of microscopic preparations and counting chromosomes *ad nauseum*, sometimes even in our dreams.

The difficulties had by no means all been solved. Sugar beet varieties were still mixed populations and everybody knows from human analogy that if the genetic base gets narrower and narrower (as it would in a small isolated community or from repeated selection) problems arise from inbreeding, especially a lack of vigour and consequent yield. Further selection would do no more than reach a balance between improvement and deterioration.

Now the United States comes into the picture again, right back to an idea put forward by geneticists East and Shull in 1910. They advised close inbreeding, in fact self-fertilisation (most plants are both male and female so this is possible) and said not to worry about the terrible poor vigour of the inbreds. They said that if you then crossed unrelated inbreds one with another a massive amount of hybrid vigour would be restored and the resulting varieties would be the best ever. The cross between two inbreds had the further advantage that it would be genetically uniform. This idea led to very great advances in maize breeding from the 1930s. But maize was such a wonderfully handy plant, with the male and female flowers totally separated so that crossing inbreds was dead easy. For many years it was a mostly remunerative holiday task for thousands of American school-children. Sugar beet, with many hundreds of tiny florets per seed plant and male and female parts in each flower, was not a bit like maize and about as awkward as anything could be.

Now the story goes back to Salt Lake City and to F.V. Owen's efforts to make sugar beet behave like maize. I had seen him trying to do this back in 1938, with very close temperature control to sterilise the male parts of the flowers. This was terribly difficult with single plants and quite impractical on a large scale. Later Owen hit on a form of beet which produced no pollen, without any special treatment at all, so it all looked easy.

It wasn't, though. How could you breed it, if there were only females? Here we had a sugar beet plant which produced no pollen and the only way to reproduce it was to cross it with a normal pollen-bearing plant. It soon appeared when this was done the progeny of the so-called male-sterile plants were fertile and this great new discovery seemed to be lost. However, Owen persisted, crossing his male-sterile type with many different pollinators. He finally located some

pollinators which did not carry the genes which restored fertility. These he called O-types and by using them it became possible to develop male-sterile inbreds, a sugar beet breeder's dream.

It was years before the system was quite stabilised, but eventually sugar beet could in principle be bred just like the maize which had yielded such successful hybrids. The new trick of male-sterile and non-restorer (O-type) breeding was now applied to maize and the army of students and schoolchildren formerly employed in crossing corn were no longer needed. After years of work in getting sugar beet to breed like maize, at last we had arrived!

At this point, politics came into the picture again and this time to our advantage. In the post-war years the Americans had come up with the Marshall Plan, aimed at setting Europe on its feet again after all the devastation. This help took many forms, and one of them was to supply European beet breeders with this valuable new male-sterile sugar beet, without charge or restriction.

This was just what I had been waiting for. Now the possibility existed of producing sugar beet varieties which were purely triploid. It was going to be expensive, though, for the male-steriles were very far from perfect, both in sterility and in adaptation to European growth conditions, and there was much work to be done. The other side of the coin was the production of the tetraploids, also an expensive business and the triploid hybrids needed most extensive field testing. Seed on the market at the time was all old-style, at old-style prices. The farmer paid about 10½d (4½p) per pound. No way could the new style breeding be financed by such sales, so we looked for help. This came from a Dutch company, D.J. van der Have, with exactly similar problems and we organised a joint breeding scheme. In the years which followed the Dutch breeder Ton Hendriksen and I met for a day each month, in England or in Holland, and made some very good friends in the process. The result was the production of the first triploid sugar beet in the world, which we named Triplex.

All these hybrids exacerbated an already big problem, handling enormous masses of numerical data. If you had 100 female inbreds and 100 male you already had 10,000 possible hybrids to test. A very special sampling technique had to be worked out, for it was impossible to put them all in field trials especially at a whole lot of different locations. The mass of data was further increased because the sugar companies were now demanding high quality beet which caused minimum manufacturing losses. They wanted low amino-nitrogen

content and low sodium and potassium. In came the cuprammonia test and the flame photometer. It was all overwhelming, or it would have been if computers had not turned up just in time. We managed to invent a number of new statistical techniques and we could then cope. Praise be unto the computer! How chance circumstances interact. Lilian's brother Wyn, when he returned from his long war, had not gone back to banking but got into computers at a very early date. His job was to reorganise the office systems of a succession of major companies to use the new wonder technique. We talked about it and I saw the possibilities for my work. The result was that I was using computers back in 1968 and was fully prepared for the new flood of data handling.

Now came something else. Sugar beet had just about the most awkward seed ever, a knobbly, corky, irregularly shaped thing. It wasn't really a seed at all, but a fruit which contained several seeds. This led to a major problem. When sown in rows, many surplus seedlings came up and they were not nicely, evenly spread but came in little, tight groups. The several seeds in a single 'cluster' would germinate on almost exactly the same spot. The only answer was to go after them with hand hoes and even to get down on hands and knees to do the job of thinning to just one young plant every nine inches or so. This was very costly for the farmer, but for many years the Americans could bring in cheap labour from Mexico and we had the gypsies and Irish seasonal workers. The cost was going up all the time, though, and the American labour unions felt that cheap seasonal immigrants offered unfair competition and managed to get legislation through, prohibiting their entry. So something had to be done, and done fast.

The first approach was mechanical, invented by Prof. Roy Bainer of the University of California at Davis. We used it briefly in our seed warehouse. The 'seed' was broken up (segmented) mechanically and then screened to a nearly uniform size. The plants did not like this rough treatment a bit and grew rather weakly. The next approach was to achieve the same object more gently. The seed was passed between rotating rubber pads, and graded for size as before. This was better, and precision drills, which sowed the seed at uniform intervals, were being developed and improved. It was still not perfect, though, because many of the pieces still contained more than one seed and others no viable seed at all. At this point breeding came into the picture from an unlikely source, Soviet Russia. In the Ukraine, some strange seed plants had been noticed, not by chance but after a very extensive search. These plants had tiny green flowers

occurring singly on the stems instead of in the usual little groups. Now it was possible to think of breeding the ideal seed for precisely spaced sowing. The war, not surprisingly, had created enormous disruption in the Soviet Union. The head of the All-Union Plant Breeding Institute in Kiev, and his wife had become *personae non grata* with the Russians prudently managed to get out to Germany. From there they were sought out by the Americans, who had heard of the new, monogerm seed plants in Russia and wanted them very urgently. Viacheslav and Elena (Helen) Savitsky moved to America and soon claimed to have rediscovered the monogerm type of seed plant in seed crops in Oregon. The claim was that they succeeded because they knew what they were looking for and could spot the odd plant among millions of the purely ordinary. This is very likely, but the suspicion that they might have sneaked a few of the Russian seeds over with them will, however, probably never quite be dispelled.

Again, the U.S. government was remarkably generous and, at a very early stage, supplied European breeders with some of the new seeds. They had all sorts of faults, but improvement work went on apace and in due course our company produced the first monogerm variety to go on to the British market. It also was triploid, for we could use the same tetraploid pollinators as we had used for Triplex, the monogerm character being entirely a maternal characteristic. There was still lots of room for improvement and this will presumably go on *ad infinitum*, but such seed, raised on male-sterile mother plants, is the basis of all present-day sugar beet varieties.

During these years we got involved with America too. In Europe there was the I.I.R.B., an association for research workers in sugar beet; not only breeders, of course. I had become a member in 1947. There was a similar society in America, the A.S.S.B.T. (American Society of Sugar Beet Technologists) and I became a member of that too and went over there in 1954. This led eventually to a second overseas collaboration, now three-way, for it involved our Dutch friends too. It was with what at the time was the premier beet sugar company in America, the Great Western Sugar Company of Denver, Colorado.

From this point onwards, life, both family and technical, took on an international aspect. This proved to be a great source of pleasure. It led to a continuously updated world view of developments in scientific matters appertaining to sugar beet, and it also led to many close and durable family friendships. The year in the International House community in Berkeley before

the war had prepared me for all this, and in particular, I felt completely at home in America.

Chapter 14: The Nineteen Fifties

During the nineteen-fifties the world was getting back to normality after the great upheaval of the war. At home, Lilian, John and I had the luck to be living in a fine old, historic house. It was in a pleasant country setting, though not too isolated either. As we looked down the road to the east we could see the Blackwater Estuary and Maldon, two miles away. This small town had fishing and yachting as sporting activities and a history going back a thousand years. Chelmsford, eight miles in the opposite direction, was the town for some of the more serious shopping and it had a railway station with a very frequent service, taking just over half an hour, to London. Colchester was no more than half an hour's drive in the opposite direction and was a much more pleasant town, steeped in Roman history.

When he was five, John went to the little village school and for a while perplexed the two ladies who ran it by coming out with various words in Welsh. That was the result of having Lilian's mother living with us for quite long periods. Lilian and her mother normally spoke Welsh to each other and John's young ears picked up some of the vocabulary. He grew up healthily, though he did get quite a heavy dose of measles, which can be quite serious.

When he was convalescing, in 1952, one of the I.I.R.B. summer meetings came up and we went to Spain by car, hoping that a holiday in the warm sun would set John on his feet again. There were four of us, Lilian, her mother, the six-year-old John and me and it was the last big trip for the old Riley. We had fixed John up with a 'passport' for his favourite golliwog, familiarly known as 'Woggy'. The officials at each frontier marked it with every rubber stamp they could lay hands on, but on entering Spain there was a big problem. Woggy was not allowed in because he had white hair, while his passport picture (from a Robertson's marmalade jar) showed black hair. Panic reigned for a few minutes until the whole problem dissolved in smiles.

We found a nice little hotel right by the beach in the unspoilt fishing village of Tossa del Mar, north of Barcelona. Like most things, this had its funny side too. I needed to get transport to Madrid, where the conference started. I tried to get hold of Jaime, who was the local travel man, but it was a national holiday. Next

day was a fiesta, when we all turned out to dance the sardana in the square to the very characteristic sound of a Catalan band. Jaime was not available that day either. On the third day I ran him to earth in his favourite bar. He said that there was no possibility of getting on a flight to Madrid from Barcelona and there was but one train. It went from Madrid to Barcelona on Mondays, Wednesdays and Fridays and back again on Tuesdays, Thursdays and Saturdays. Sunday was a rest day. How could I get on the train? Well, there were no reserved seats available, but if I went to Barcelona station, saw his friend Ortego and gave him the requisite number of pesetas, I would get a seat. I did not fancy it, and foresaw the same problem arising on the way back. So I went by car!

Spain had been more or less isolated since the beginning of the Civil War in 1936 and had hardly changed in all the years. There was very little traffic on the road. In some places gangs were to be seen, doing repair work. Stones were being broken up by sledge hammer and then taken to the site in baskets, mostly by women. Filling stations were as much as seventy miles apart. I was warned about this, but ran out of petrol nonetheless. Luckily it was only two or three miles short of Zaragoza, so it was no big problem. This, remember, was on the main road from the most populous city in Spain to the capital. What it would have been like on minor roads is hard to imagine.

These summer meetings were held in a different western European country each year, at least until there were no more beet-growing countries left. Then they started on a second round. The idea was that we would travel around, seeing the sugar beet crops, visiting the research stations and trial grounds; also, of course, meeting the people and partaking of the local delicacies and maybe doing a little merry-making! In Spain it was rather different, because we were treated very specially as the first international conference of any kind which had taken place in the country since the outbreak of the Civil War in 1936. In Madrid there was a government reception for us, and there was time to look around the city a little. I still think that the Prada is the finest art gallery I have ever visited and by no means only for its collection of the Spanish masters. Rembrandts, Rubens, Van Dycks and others were there a-plenty. After this we set off on our journeyings, to Cordoba, Seville, Jerez de la Frontera, Malaga, Granada and back to Madrid. Spain is a big country and our four buses covered many miles.

They did not have much to show us in terms of sugar beet science, so the programme was filled in with other activities. There were the wonderful old cities with their Moorish architecture and there was flamenco dancing to watch

and exotic Andalusian food to eat. There were bodegas to visit in Jerez, which place-name we corrupt to name the local fortified wine, 'sherry'. We saw beets in the field, with gangs of men hoeing out weeds under the supervision of a guard with a rifle. They were some of Franco's prisoners, out of jail for the day. We were taken to see a combine harvester of 1930s vintage, a great rarity, because Spain wanted to provide employment for as many people as possible in the fields and the importation of labour-saving machinery had been prohibited for years. Near Malaga we saw sugar cane too, at the northern edge of its cultivation and therefore not particularly good.

There was one trip which was concerned with breeding, though not of plants. It was of fighting bulls, which presented a special problem. How do you select such bulls for ferocity? For they must enter the ring without previous experience, or the unimaginable might happen and they might win the fight! What the breeders did was to carry out mock bullfights with their sisters (the young bulls' sisters, that is) and the ones which put up the best show were the ones which were bred from. We watched several heifers put through their paces. They looked terrifyingly fierce to me and I would have hated to be in the ring.

A rather touching thing happened on the way from Malaga to Granada. Our buses went through a small town where there was a sugar factory and the locals were upset that they had not been included in our programme. As our buses passed through, we came to a total roadblock of people, determined to stop us. They made us get down from the buses, gave every lady in the party a bouquet of flowers, and trooped us all off to a hall where a fine meal was laid out. We were booked in for dinner at Granada, but that was cancelled and we finally arrived late about 2 a.m., some six hours late.

While I was away, the family had been enjoying themselves in Tossa and on returning I was able to linger there for a few more days. John, aged six, had shown us how resilient young children can be with languages. There was a little group of them, all about the same age, who played together on the beach. Between them they spoke a variety of languages; English, French, German, Swedish, Spanish and Catalan, hardly two the same. In spite of this, they got on fine together and seemed to understand each other perfectly well. There was a little stream coming down to the beach, where some of the local women did their washing. In and around the stream were hundreds of little frogs. John was not entirely popular one day, when he collected a number of them in a paper bag and liberated them in the hotel dining room!

It was pleasant to meet our Dutch colleagues, the Hendriksens and the Van der Haves, at very frequent intervals. Ton and Lidy Hendriksen were our immediate opposite numbers and we used to stay in each others' homes rather than in hotels. This is always a delightful way to get to know people in other countries and the way they live. We would either fly to Rotterdam from near-by Southend Airport, or we would go on the night boat from Parkeston Quay near Harwich to the Hook of Holland. We got to know Holland very well and always enjoyed going there. We travelled across the dyke which had converted the Zuider Zee into a fresh water lake and through the years watched the progress of reclaiming new polders. This process was so efficiently and logically handled by the Dutch that it was most impressive. Of course we just had to go to see the tulips in the spring, both in the fields where the bulbs were grown and in the Keukenhof, where the Dutch bulb trade had planted beautifully landscaped parkland with millions of bulbs of all kinds. I went there with Ton who, in spite of having lived in Holland all his life, had never seen the bulbs in flower!

It was not so easy for our Dutch friends in 1953, when the North Sea floods had caused devastating damage and loss of life. The floods had been extensive and had caused loss of life in eastern England, but in Holland it had been much worse. For a while, no non-residents were allowed to enter the province of South Beveland, where our colleagues lived, and Ton and I met on the 'high' land of North Brabant, near Bergen-op-Zoom. The after- effects of the floods could be seen for a long time. Until the gaps in the sea-wall had been repaired, it was strange to see trains splashing their way through water as low tide approached. It was a little ominous too, to sit in a restaurant in Kruiningen and to see the mark on the outside wall, above ceiling height, indicating the level which the floods had reached. In some places, large boats had been washed up on farmland, as much as half a mile from the sea. This episode also cast a light on human nature. At the time of crisis, everybody helped in every way possible, often taking considerable personal risks. Later, when things settled down, many looked for ways in which they could make profit from the situation in carrying out restoration work.

Each summer there was an I.I.R.B. meeting in some country or another, almost everywhere west of the Iron Curtain except Norway and Portugal, where there was no beet industry. First, though, we had to do something about our aging Riley, which was a 1936 model. New cars were still utterly unobtainable, though it was possible to go on a waiting list for delivery years later. People

used to sell their place in the waiting list, sometimes for quite large sums. One possibility briefly cropped up, however. There was a temporary surplus of Austin chassis of the type used for London taxis; sturdy, reliable vehicles. We bought one and had a shooting brake body made for it by a local body builder. We fitted the back out with a removable raised, hinged floor under which were cubby holes for camping gear, and we used it in this way for several continental trips.

In 1954 came my first post-war visit to America, this time by air. It was very different from what it is today. The flight left the intercontinental terminal at Heathrow, then a collection of wartime Nissen huts, about six in the evening. The plane would be a DC6B, a little later a DC7, from which great jets of flame would shoot out from the engine nacelles on takeoff, like giant blow-torches: quite alarming at first, especially if you had not been warned about it. If headwinds were forecast and it was desirable to top up the fuel tanks before crossing the Atlantic, the aircraft would stop in Shannon. Next stop was Gander, Newfoundland, in the middle of a bitterly cold, dark night, to another uninspiring group of Nissen huts. Gander was not north of the Arctic Circle, but it certainly felt like it. After refuelling, we would arrive in New York about 9 a.m., local time, no less than twenty hours after leaving London. The planes, with their piston engines, used to vibrate uncomfortably and they were very noisy. A few years later came the 'whispering giants', Britannias with four turboprop engines. They seemed to be wonderful. To get to the West, the thing to do was to buy a little cardboard box of food at the airport (then called Idlewild) in New York for in-flight refreshment on the way to Midway Airport, Chicago. Then on out west again, in another plane, with another cardboard box. For the final section of the trip up the Pacific coast, no little box was needed, for the Convair aircraft only had first class accommodation.

The American Society of Sugar Beet Technologists (A.S.S.B.T.) had its winter meetings in late February, every other year. At first I was the only visitor from across the Atlantic, but as the years went by more and more attended. The meetings used to take place in fairly regular sequence in Denver, San Francisco, Salt Lake City and either Detroit or Minneapolis, all places near to areas of commercial sugar beet production. Each meeting took several days. There was a plenary session in which some local bigwig made a very forgettable speech and after that there was a division into sections. Naturally I went to the sessions of the Breeding and Genetics group, though there were occasional problems when

some interesting item of, for instance, plant pathology, clashed as to time. One evening the 'Breeders' Forum took place, an informal discussion which was usually very interesting. I confess that I used to enjoy playing devil's advocate with the Americans, since they were so imbued with the idea that the principles of hybrid corn (maize) breeding were the only ones to apply. That was good-natured fun. It was at these meetings that I got to know so many American sugar beet researchers, both in the sugar companies and in the U.S. Department of Agriculture, and among them were the Great Western Sugar Company research staff. I ultimately made a joint research arrangement with their company.

The Great Western Sugar Company, known simply as 'GW' was the most important beet sugar company in America at the time, with factories in Colorado, Wyoming, Montana, Ohio and elsewhere. The head office was in Denver, Colorado and the research station was at Longmont, some 40 miles to the north. It was there that I went in the following summer, to meet the folks on their own ground. Harvey Brewbaker ('Brew') was in charge, in his fifties at the time and well-liked by his staff. He had a memorable idea as to how to introduce me to them. Longmont, over 4,000 feet high, is within sight of the Rocky Mountains and we all went to the Rocky Mountain National Park and up on to Trail Ridge Road, over 12,000 feet above sea level in the midst of spectacular scenery. There were wonderful views all around, especially of the 14,000-foot high Long's Peak and of the deep, dark craggy corries on its flank. We had a barbecue meal and it was a great way to get to know each other. It was the first of many meetings, on both sides of the Atlantic.

The head of GW at the time was Frank Kemp, tall, grey-haired, rather gaunt and with an air of authority. His base was an office in what was known as the Sugar Building in Denver, a well-furnished room with a fine Frank Remington painting on the wall behind him. It was of a cattle roundup in Kemp's home state of Montana. He spent a good deal of his time in Washington D.C., lobbying on behalf of the entire sugar industry. There always had been a lot of politics in the beet sugar industry which had been founded on various forms of subsidy and still required protection from the cold winds of the open market.

Frank was not good at delegating and when he was away it was often difficult to get a decision about anything. The company was run conservatively and funds were retained to cover possible losses in the bad season which was bound to happen sooner or later. This was to be its ultimate downfall, for the take-over boys saw rich pickings in its coffers. Unlike Harvey Brewbaker, Kemp was an

American isolationist and saw little chance that the rest of the world could usefully tell America anything at all. He did thaw out one year, though. He came to see us in Essex and went over to Southminster, near Maldon, where some of his family had originated. The place was still full of Kemps, fishermen and the like. He was thrilled to have tea with the vicar and to look at the Kemp gravestones and he left a sum of money for the church. Very briefly he forgot that he was American and became more British than the rest of us. I felt sorry for him in later years. He had married Katharine, a very good-looking lady much younger than himself, who led him a real dance, getting all she could out of him while treating him with contempt. Not long after he died, she found another rich man to marry, the third. Many tales could be told about Katharine. One concerned Fifi, her poodle. The Kemps had a very nice colonial style home in South Denver, which Frank liked. Katharine, though, wanted a penthouse in a new apartment building then under construction. She went along and enquired, but was told very definitely that tenants were not allowed to keep pets. Katharine tried to exercise her charm, which was considerable, but to no avail. Then she had an inspiration. "How about owners?", she asked. Well, she was told, there did not seem to be any rules about that. So Katharine bought the penthouse at great expense, presumably with Frank's money, and Fifi was in!

In 1948, Boy Clark and I had been to Warsaw and had managed to enlarge our interest in British Pedigree Sugar Beet Seed Ltd. The next phase of this story came ten years later, in 1958. The communist government of Poland still kept its citizens pretty much confined, but Stefan Byszewski had for the first time obtained an exit visa, to visit Belgium and Britain. His wife and family had to be left behind, as hostages as it were, and he should have had a 'keeper' with him in the form of a sound and reliable party man. This man's health proved to be less reliable than his politics, however, and he conveniently fell ill too near to the time of Stefan's departure for a replacement to be appointed. So we were able to meet, keeperless, the chairman of Buszczynski's, in England. Of course Dr Ruberl had no difficulty in coming in from Italy to join us.

It was a strange meeting. Boy and I sought to buy the Polish-held shares in our company. Neither of us had enough money, but we had covered our tracks there. For some years we had been supplying mother seed to Johnsons' of Boston and now they were looking for a new arrangement. It was agreed that, having hopefully bought the Polish shares, we would sell part of them to Johnsons. After all this was done, we re-named our company Bush Johnsons.

Why Bush? Well, we had been selling sugar beet seed to British farmers for years and we had realised that they would have great difficulty with the name Buszczynski and for that reason we had shortened it to Bush.

The Poles were willing to sell and had no interest in a high price, because the money would only have gone to the communist government, which they had no desire to support. What they wanted was to sell as cheaply as would seem decent, but to have us put a much larger sum of money into a private bank account in London. We had no objection to this and could sympathise with their wish to have a nest-egg outside the communist orbit. However it was illegal, because there was a British government tax on share transfers and we were about to buy shares but at the same time to conceal a much larger payment, so evading the tax. What were we to do? We found a lawyer in London who specialised in Eastern European affairs and his solution was simply that we should approach the Treasury for guidance. The reply came that it was our government's policy at the time to liquidate Iron Curtain holdings in British companies wherever possible and we were told that we could go ahead with our plan. So that was how it was done.

Before all this happened I had been sought out by a couple of 'headhunters', one from New Zealand and one from the Caribbean. Otto Frankel was in charge of cereal breeding in New Zealand and came over to recruit a second-in-command not very long after the war. For a few years I had spent some time testing some novel breeding methods in wheat, basically developments of Harry Harlan's population studies in barley. They gave the prospect of very large-scale breeding for grain yield without too much human intervention or too much cost. It was based on the concept of letting natural selection on hybrid populations do much of the work normally done by the breeder. Frankel arrived, thinking that the new international threat of the atomic bomb would lead any one of us to rush at the first opportunity to the relative safety of the southern hemisphere. He was astonished not only that I turned him down, but that others he approached after me did likewise. He returned to New Zealand only briefly: six months later he took up an appointment in Australia. The job he offered would therefore have turned out better than it appeared at the time. Years afterwards I visited the breeding station near Christchurch in South Island, New Zealand, and felt quite pleased that I had not gone there to work.

Britain is my favourite country to live in, but sometimes there can be a succession of raw, sunless winter days which make one long for the warm sun.

On one such occasion it was even more so, for we had young John in bed with a middle ear infection, a legacy of his measles. Just at this moment came an offer of a job, sugar cane breeding in the Caribbean. It would have meant being based in Barbados and running sub-stations in Guyana, Trinidad and Jamaica. It was most tempting. The offer itself must have originated from some person who thought that sugar beet and sugar cane breeding must be much the same thing. The sugar is certainly the same, but the plant, and consequently the breeding methods, are utterly different. I suspect that the instigator was my former Bangor fellow- student Bob Innes, of Jamaican bauxite fame.

After a spell at the village school, John was transferred to the privately-owned Elm Green school, a few miles away. It had a very fine reputation and Lilian and I ran a 'taxi' service jointly with some other local parents, taking the children to school and back. Then John went a little further afield again, to a preparatory school just the other side of Chelmsford, and the parental taxi service was quite a lot longer. The alternatives of the state and the 'public' school system in Britain did not present an easy choice. They had both advantages and disadvantages. When I went to Cambridge, a majority of my fellow-students had been through the 'public' school system and they seemed so self-assured in so many ways that I felt rather disadvantaged in comparison with them. They seemed to get all the best jobs, too. This, I think, was an important factor in our sending John to Oundle, a public school which had quite a reputation in science and engineering, as against the classics for which many of them were noted. To get into Oundle, a school about 100 miles from home, John first had to pass the Common Entrance Examination, as it was called, at age 13! He passed, though we hadn't much doubt that he would. John had always been able to do extremely well anything he set his mind to not surprising for, according to an I.Q. test he was submitted to, he had a score of 147.

For me there was a curious and peculiarly British happening in the early 1950's. The first I knew about it was a letter from the Lord Chancellor's office asking me whether, should I be asked, I would be willing to serve as a Justice of the Peace. I agreed and in due course was sworn in, in the county town of Chelmsford. I joined the limited number of people, mostly armed forces, who were asked to swear an Oath of Allegiance. I mention this, because Americans are doing it all the time! I did it just this once and most people do not do it at all.

Sitting on a bench of magistrates is a curious experience. Individual attendance was usually for a day every two weeks, though sometimes there were

emergency sittings at very short notice. Of course there was no question of any pay. Usually three of us sat together, sometimes five, though whenever possible we avoided even numbers so that there would always be a majority decision. We were appointed mysteriously. There was a committee, the membership of which was not publicly known, which made recommendations. I strongly suspect that Arthur Ingham, my headmaster friend, was responsible for suggesting me. In one way or another we heard all the criminal cases in the area, which was known as a Petty Sessional Division. All such cases, from parking offences to murder, came to the court. We had no legal qualification, though there was present at all hearings a Clerk to the Court, who was qualified, and to whom we could refer on points of law. There were three categories of offence. At one end was the fairly trivial, on which we gave a decision as to guilt and determined the penalty. Then there was a whole list of intermediate offences, where the defendant could elect to be tried by us or alternatively before a jury. We also had the option of sending such a defendant to a higher court if we thought that our powers of punishment, up to six months in prison, might not be enough. Finally, there were the gravest offences. We could not try these, but had the duty of hearing the evidence for the prosecution, which was written down as 'depositions' for the help of the higher court. In theory the accused could file depositions but the defence normally preferred to keep quiet at this stage. We had the duty of deciding whether there was a *prima facie* case for trial. If we thought not, we could dismiss the case, but this would have been a very rare event.

Nowadays, new magistrates are required to take some training. In my day, it was not obligatory and much of the learning was done by sitting in court to see how cases were dealt with. I read appropriate books. I was appointed separately to the Juvenile Court panel, and to get some experience there I got permission to attend a busy juvenile court in London for a day. They had as many cases in a day as we would have in months. Permission had to be obtained because Juvenile Courts are closed to the public. The press could be represented but the name of any young offender could not be published.

I soon realised that criminal cases could really be funny, on rare occasions at least. There was a bright-looking young boy, maybe 11 or 12 years old, up before the court for throwing stones at the ducks on the lake in Regent's Park, contrary to the Bye-laws of the Royal Parks Act, paragraph etc. etc. An imposingly uniformed park keeper gave evidence. Having done so, the boy was

asked if he wanted to ask any questions. "Yes", said he, "did you actually see me hitting any of the ducks?". "Well, no", said the keeper. "So you are saying that I was aiming at the ducks and was a rotten shot?". "I suppose it amounts to that", said the keeper, rather guardedly. "Then", said the boy, "if I told you that I was a good shot and was throwing stones at the spaces between the ducks, would that be contrary to Bye-law so-and-so?". It had to be admitted that it would not and the boy got off scot-free!

A few cases stuck in the mind as different, and interesting, but it was mostly routine. There were other duties at the time. Once every year or so, the turn came round for me to sit at a higher court in the county town, along with a legally qualified chairman and a jury. Cases could take days. Also I was very often asked to be present, as the law then required, with two medically qualified people, to determine whether a person should be certified insane, and so detained against his will in a mental hospital. This was always sad, though it must be said that some of them, in spite of a history of very strange behaviour, could suddenly turn very normal when faced with a little committee of three, out on a mission which they understood perfectly well. On other occasions we would visit prisons and also institutions for young offenders, so that we could see where we were sending some of our miscreants.

I retired from these duties in 1965, when more frequent absences overseas made it difficult for me to pull my weight and too many extra duties fell on my colleagues.

During the fifties I had been making trips to America, usually by air but on one occasion by sea: by the French Line, going out on the *Ile de France* and coming back on the *Liberte*. I had made many good friends in America and had very much enjoyed the visits. The time had come, by 1959, when Lilian and John were understandably getting more insistent that they would like to join me on such a trip. I was able to organise a spell of no less than eight weeks away from home, much longer than any other such occasion during my working career. I spent a little of this time visiting Great Western and also a couple of U.S. Department of Agriculture research stations, but most of it was a wonderful holiday. We took our car, a yellow Ford Consul, aboard the Holland-Amerika liner *Rijndam* to Quebec and at the end brought it back on the *Maasdam* from Hoboken, New Jersey. We were a day late in Quebec. There had been an iceberg warning which necessitated a detour of about 500 miles. Nobody aboard wished to emulate the *Titanic*.

The trip was a real high spot. First of all, there was a glimpse of French Canada, of Niagara Falls and then a rather quick journey to Flagstaff, Arizona. This part of the trip was more hurried than intended, to make up for our extra day at sea. Across the Middle West we drove no less than 1450 miles in two days, but Lilian and I shared the driving and the roads were good and had light traffic. At Flagstaff we met our friends the Dennstedt family, Norman, Janet and their two children, Joyce and Larry. Flagstaff had its annual Indian gathering in full swing, Indians of many tribes, dressed traditionally, performing their various dances and competing in a rodeo. It was a new world for us all, but especially for the children. On the way to Flagstaff and after we left, we passed through deserts and forests and saw all sorts of wonders: the Painted Desert, the Meteor Crater and the Petrified Forest. After leaving Flagstaff we saw the Grand Canyon, Zion and Bryce National Parks, Las Vegas (a very different kind of wonder!) and then California, where our friends the McFarlanes lived. John McFarlane was director of the premier U.S. Department of Agriculture beet research station at Salinas.

We met John and Lois at Fresno, in the boiling hot Central Valley and they took us up into the mountains, to Yosemite and to see the giant redwoods. We were a shade nervous, sleeping in a tented cabin in the Yosemite Valley and hearing bears snuffling about just on the other side of the canvas during the night. I had been there before but in mid-winter, when the bears were all soundly asleep. The American national parks are just fantastic and it was great to be enjoying them together. The fact that they had been set aside for the enjoyment of the people no less than 100 years previously was one of the best examples of foresight known to me. Up in the mountains it had been delightfully cool. Back in the Central Valley at Fresno the temperature was 115 and at Salinas, close to the sea, it was around 60. Such is California. On the way through, particularly at Hollister, we had seen the effects of some of the state's earthquakes. From Salinas we went to the nearby Monterey Peninsula. I had planned to go there with Stebbins in 1938 and now I was really there, just 21 years late! At Carmel, John realised his ambition of a swim in the Pacific Ocean. It was cold, as it usually is off the Californian coast.

There were so many other things too, meeting Lilian's cousins in Reedley and Placerville, California, visiting San Francisco and Berkeley and then crossing more deserts to meet up with the Brewbakers in Glenwood Springs, Colorado. With them we visited Aspen in its outstanding mountain setting. We went

camping in the Rockies with the Oldemeyers, Bob, Shirley and their two daughters. Bob was Harvey Brewbaker's right-hand man in the breeding department at GW. Jan Oldemeyer was about the same age as John and together they built a raft which duly capsized, or rather disintegrated, in the middle of Lake Brainerd, a lake fed by icy water from melting mountain snows. That might have been serious, but proved merely to be a scare.

From Colorado we headed east, again not spending much time in the generally featureless Middle West, through the flat farm land and then into the much more pleasant countryside of Pennsylvania and Maryland. In 1959, very few foreign tourists travelled in America, and still fewer took their cars with them. The right-hand drive was a complete novelty and I remember being pulled over by a policeman who admonished Lilian for not paying proper attention when driving. Actually I was driving while she was filing her nails, a fact he had not appreciated. Another thing was that the big, traditional American car was nearly universal at that time. Cars in those days had to be serviced every thousand miles or so and our much smaller Ford Consul, though not that small by European standards, would not fit on some of the garage hydraulic lifts. The wheels were too close together.

We had a couple of days in Washington D.C. and again in New York City before driving through the tunnel under the Hudson River to catch our boat in Hoboken, New Jersey. It was the best holiday we were ever to have.

Chapter 15: Computer Programming

The outline of our programme for sugar beet improvement had been established by the end of the fifties, though much work had still to be done. There was never going to be the perfect, unimprovable variety. In fact that would have been disastrous for breeders, rather like the over-efficient rat catcher killing the last rat! We were still lacking in financial clout vis-a-vis the major companies of Germany, Sweden or Denmark, so that we still had to be as ingenious as we could in handling large numbers of trial plots and large masses of data, so as to squeeze out from them the maximum amount of information. With the development of good male-sterile lines we had (in spite of the teasing that went on at some of the American meetings) arrived substantially at the hybrid corn concept of improvement, with polyploidy added as an extra. We had to build a whole range of partitioned greenhouses ventilated with filtered air, so as to be able to produce inbred lines uncontaminated by stray pollen. We also built up a streamlined system for counting the chromosome number of thousands of plants.

At the outset these developments all concerned normal, multigerm seed, but very soon commercial requirements meant producing equivalent monogerms. We breeders worked side-by-side with selective herbicide manufacturers and the engineers who designed precision drills. In this way we jointly arrived at a product which could be grown with little or no hand labour. Our seed processing plant in Maldon and that of our colleagues the Johnsons in Boston had to be altered to cope with the new requirements. These problems were overcome and we were the first company to market a monogerm seed in Britain. At the outset it was not fully equivalent to multigerms in yield, but field labour costs were escalating and so it could still pay the farmer to use it. For one factory, Allscott, near Wellington in Shropshire, monogerms came just in time. The local labour union was holding out for such high rates for thinning the crop that beet cultivation looked like becoming uneconomic. Monogerms ended all that.

Sugar beet is a crop where the breeder has masses of numerical data to sort out. If, for instance, you are breeding a new variety of a flower, it can all be done visually. The breeder has to pick out the novel flower colour, shape or other easily visible character and he has to see whether the new variety goes down to

some disease, and so on. This can be entirely a matter of observation, keeping the best and discarding the others. Sugar beet is not like that. The plot yields must be weighed and the weights in some way corrected for the variation in fertility which occurs from place to place in any field. The sugar content gives another set of figures, as does the content of any impurity which might lower the manufacturing quality. There are other considerations too, like the perennial problem of bolting and they all add up to a mighty mass of data.

One of the ways in which we were able to improve was in this data handling. Lilian's brother, Wyn, who had worked in a bank for a while after leaving school and had then gone into the army for six years, was now working for a computer company, setting up computerised accountancy systems for various firms. He talked to me about computers and I was convinced that this was the thing for us. They were very different indeed from what they are today. At the time I did not aspire to be a programmer, because it involved handling endless strings of 1's and O's in the most tedious way, a process known as machine programming. The high-level languages which were to be so useful later were still to be invented. We went to the National Cash Register Company's London office, where they had a small scientific programming department. It was difficult to define what we wanted: until you understand just what a computer can do, it is hard to set out the right specification for any programmes. We did our best and the programmes were written for us and we re-ran the 1968 data, already worked the hard way, to check the new system. After the inevitable adjustments had been made they worked well.

The computers of those days are hard to imagine now. The Elliott computer we used occupied a large room and had row upon row of pull-out units each with a line of valves, just like old-style radios. The whole set-up took twenty kilowatts of power and the room consequently needed a cooling system that also took twenty kilowatts. They could almost have run a district heating scheme as a by-product! Programmes went in on punched paper tape, data on 80-column punched cards and the output was also on punched tape. This was fed to a teleprinter, which printed one character at a time and regularly got overheated with the effort and needed a rest period to recuperate. During the 45 minutes or so it needed to print our data, it insisted on several such pauses. Every Friday afternoon the system was shut down and maintenance men went around, pulling the valve units out one at a time, putting them on a test bed, and replacing any which appeared to be getting tired. These were taken away for servicing. In

spite of all this preventative medicine, the computer was still prone to breakdowns several times a week but even with all these limitations, its use was still well worthwhile.

After two or three years, National Cash Register closed down their science section and we looked around in vain for some other company which would provide the same service. Then we learnt that the Essex Technical College in Chelmsford had started an evening course in computer programming. Two languages were now available, FORTRAN and COBOL. There was also ALGOL, but that never quite made it. FORTRAN was clearly the one needed for handling scientific data. I had read in a copy of the Readers' Digest that programming was a young person's accomplishment and that you had a good chance of succeeding if you were under 21 and a still better chance if you were under 14. I objected, at the age of 54, to being written off by the journal known to some of my friends as Readers' Disgust! I had by then recruited as an assistant a young man named lan Mitchell, who had graduated from Kenneth Mather's department in Birmingham. He and I went to the lectures, run by the person who was in charge of the Essex County Council computer department. We listened and learnt the basics of the strange craft and then, for a fee, the lecturer agreed to come along to Woodham Mortimer on two evenings a week to help us get launched on our computerisation. lan and I used to write the programmes between his visits and he would see them, offer suggestions and generally help us to lick them into shape. The time came when he declared us competent and the evening sessions ended. He was a real friend, for he arranged for us to buy time on the County Council computer, where he and his staff were available as advisers in case of need. At first it was quite often.

Chapter 16: Reconnaissance in Pakistan

Sugar beet breeding in Britain as elsewhere was a highly seasonal pursuit, determined by seed time and harvest like any other work with crops. There were periods when there was no problem in my being away for a while. The international meetings took place in February and June, before and after the spring peak of work. Other opportunities arose from time to time and, especially if they involved travel to new places, I used to seize them if I could. One such chance cropped up at the very beginning of 1964. By very beginning I mean January 1st, though I did leave Heathrow Airport on December 31st 1963 and saw the New Year in at Athens Airport. I was on my way to Pakistan to plan a feasibility study into the expansion of a beet sugar industry there under the aegis of the British government's Department of Overseas Development.

I was very lucky indeed to have Richard Goddard-Wilson as a companion on this trip. He had had a remarkable career. At Oxford he had taken a degree in botany, but this was in 1938 and, seeing the war looming, he joined the Indian Army. Of course he got to know quite a bit of the Indian sub-continent very well and he probably did his career prospects no harm by marrying the daughter of the commander-in-chief. The war over, he had joined the British Political Service and served in places like Mosul, in Kurd country in northern Iraq and in Libya. Like Pen Hudson he was an amazing linguist and soon became fluent in whatever language was around. So I had a very knowledgeable companion and interpreter for my first adventure into the Third World and one who turned out to be a very good friend for the rest of his days.

The trip went strangely at first. Stops at Athens and Cairo on the way to Karachi were normal but rather frustrating, since I had never set foot in Greece or Egypt, and on this trip, I was confined to the transit sections of the airports. On the way into Athens I did see the floodlit Parthenon at least. From then on, things went awry. Our Qantas Boeing 707 was asked to divert to Bahrein to pick up passengers left there when a misguided Arab had driven a truck into the side of their B.O.A.C. 707. We landed in Bahrein and the engines were switched off. Unfortunately our plane had Pratt and Whitney engines and Bahrein only had a starter for the Rolls Royce variety. So there we were, stuck in the Bahrein airport for New Year's Day! I found it bare, dusty and dull and we were not even allowed to go into town. Lots of little planes flew in and out, some with oil

workers and some with Arabs, ranging from the scruffy to the sumptuous in appearance, some with their wives, covered in dark-coloured cloth like walking tents. Their husbands were wearing long, white drapings and head cloths held on by circular ropes. I was to get very used to such sights but they were strange at first. Much frantic telephoning ensued, but most of the places contacted were not operational. It was New Year's Day, holiday time. Eventually the required starter was and flown in and we finally arrived in Karachi very late indeed, after a stop at Abadan in Iran. The whole trip had taken about 27 hours. We were met in Karachi by the British Commercial Attache Tony Fryer and his wife and taken to the Metropole Hotel.

Karachi was a new experience too. The hotel had spacious rooms with many servants (locally called bearers) waiting on one's every need and calling us sahibs. It was as if the British Raj was still in its full glory. The traffic in the spacious near-by streets ranged from Cadillacs to camel carts, with the occasional, apparently unattended group of humped cattle wandering along on their return from their pasturage. There were little three-wheeled taxis, built on the basis of Italian scooters and gaudily painted. The shopping centre, where we wandered in the evening, was different. Its narrow streets were seething with humanity, selling all kinds of things from open-fronted stalls or roasting various confections over charcoal fires in the street. Above, a large number of kites were circling. These birds did not need to be protected and nurtured, as in Wales. Here they were doing just fine and had the reputation of being ever-ready to swoop down and snatch any piece of meat left on a plate.

It is said to be a small world. We had occasion to visit an office in town and, after being met at the entrance by a manservant bearing a tray on which we placed our visiting cards, very formal and old-fashioned, we were ushered into the presence. Sitting at his desk was a certain John Wright. He had my card before him and said "Ah, Woodham Mortimer, do you know George Baker?" George Baker lived just down the road from Woodham Mortimer Hall and I knew him well! That evening John and his wife Irene entertained us at the Sind Club, formerly a very exclusive club open only to the British, but now equally exclusive but open to Pakistanis too. Not quite grasping the word Sind, I thought for a while that I had been invited to the Sin Club and was wondering what was in store! When we returned to Karachi at a later date, John and Irene took us sailing in the harbour. It was warm sunny and smooth, just right for sailing, I thought. I don't like the sea to be too assertive when I'm in a boat. John

Wright was near to retirement and we were to see a lot of him and his wife in later years, for they built a house and settled in East Hanningfield in Essex, a very few miles from Woodham Mortimer.

We spent January 3rd visiting various V.I.P's in Karachi and then left for a trip to the north, to visit sugar factories and seek out possible areas for field trials. There was a small beet sugar industry in Pakistan already and the question was, should it be expanded? We left very early the following day to fly to Lahore, some 700 miles away in the Punjab. Again we visited various officials, culminating with the Minister of Agriculture, and then took a taxi ride through the city to the famous Shalimar Gardens. These are huge, and had been fantastically laid out in the Persian style in the days of the Mogul emperors. Unfortunately, in mid-winter, the hundreds of fountains were not playing. The gardens incidentally form quite a bird sanctuary, with flocks of green parakeets, also Asiatic thrushes, kites, vultures and other birds. One discordant note: a little stand with an inscription in Urdu, but on the other side the more familiar slogan, 'Ice-cold Coca-Cola'. You can't get away from it.

Also visited were the Mogul fort, with its beautiful architecture in the style which had spread west from Persia to Moorish Spain, and also east to India. Here again are secluded formal gardens, decorative brick pathways and fountains and as at Shalimar one could imagine the ladies of the imperial harem wandering around in splendid seclusion. It was nice to see that careful restoration work was going on where necessary. Nearby is the Great Mosque, the biggest in the world, with its beautiful triple domes and high minarets. We picked up overshoes at the entrance and slipped them over our own shoes. I was surprised to find that a very large part of the mosque was one big open space, surrounded by a high wall with a tall minaret at each corner.

We took a tonga, a horse trap with a canopy, and went slowly through the old town. There were masses of people intermingled with animals: humped zebu cattle, buffaloes, camels and donkeys pulling a wide variety of carts or with loads on their backs. Row upon row of open-fronted shops were concentrated into different areas where a particular commodity was sold. It must have been a bit like that in medieval London, as placenames like Haymarket and Poultry would indicate. Various tradesmen plied their crafts right out in the street: shoemakers, barbers, coppersmiths and others, and we saw men with typewriters, ready to type out letters for illiterate clients. There were water-carriers offering drinking water from goatskins (I didn't fancy it) and porters

carrying loads on their backs or heads, including one spectacularly high load of dried cow dung, presumably for use as fuel. There were beggars too and it was very disturbing to see some of them with young children with a withered limb, no doubt deliberately produced by a ligature, to make their begging more effective.

We flew to Peshawar, some 250 miles to the northwest and near to the Afghan border and next day rented a car, complete with driver. Pakistan seemed to be a home for superannuated American cars and ours was a venerable Chevrolet. We set out for our first two sugar factories, Charsadda and Mardan. It didn't feel a bit like the Pakistan I had imagined, for it had rained, rained, rained for 24 hours and the locals, wrapped up in dark-coloured blankets to try to keep out the cold, looked pretty miserable. We saw many fields of sugar cane, now being harvested and quite a few orange groves. I liked the oranges. They were sweet and convenient, for they were full-sized but had loose skins like tangerines. Fruits with a skin to peel off were safe and did not carry anything nasty to give one amoebic dysentery or any other health problem. At the Charsadda factory we were entertained by the owner, a Pathan named Col. Khalid, in his magnificent boardroom-cum-guesthouse built over the factory office block. The Prophet might have been distressed, but we drank gin nevertheless. Not very good gin of local manufacture. We nearly wept for our host in his misfortune, for his family estates had been reduced to a mere 40,000 acres or so by the land reform which followed partition. He was only allowed a much smaller area, but had managed to leave a large parcel of land each to a great many of his relatives. To keep his fortunes in good order he had a younger brother who acted as a full-time lobbyist in Rawalpindi, the temporary provincial capital. Provincial, because at that time East Pakistan had not defected and turned itself into Bangladesh. The sugar factory was built to handle beet as well as cane, the only such in Pakistan at the time, but they seemed to have little idea how to grow beet.

At the second factory, Mardan, we found well-informed, competent people, but their factory handled cane only. Richard and I were fixed up with a suite of rooms each in the factory guesthouse, with a personal servant and a cook. Next day we had meetings and then went on to the Takht-i-bhai factory. It still rained and the factory had a power failure. Outside was a long line of miserable-looking ox and buffalo carts laden with cane and another line of lorries with their ornate painting with roses and other flowers, castles, birds and now, a

newer tradition, aeroplanes. All were standing dripping on a road full of muddy puddles, waiting for power to be restored at the factory. They seemed quite used to power failures and were meeting this one with quiet resignation. In all these places Richard seemed quite at home, talking in the local language when appropriate and often swapping reminiscences about the old days in the Indian Army. Here we talked to the factory manager in his thick-walled office with windows high up on the walls and a little annexe where an assistant kept his hubble-bubble pipe going and from time to time passed it in to him for a long drag and the emission of a dense plume of pungent smoke.

Next we drove over the rugged and barren Malakand Pass, only 2,700 feet high at the summit it is true, but the rocky and barren gateway to exciting frontier country, the near-autonomous state of Swat. There was an army post at the entrance, where we had to sign papers and forts at intervals all the way up. As the valley narrowed we saw a lovely, rushing river and orange groves, rice paddies, olives and sugar cane. The villagers boil down the cane in huge pans; to produce a crude sugar called gur. The only significant town in Swat is Saidu Sharif and we stayed in the one and only hotel there, run by an English couple. In the rooms were roaring and aromatic wood fires, by which we sat while the jackals howled outside.

Next morning we were able to meet the Wali. What a title! He was the all-powerful ruler. He seemed to be progressive and benevolent, but he also held court at 11 o'clock most mornings and meted out gruesome, Islamic penalties to wrongdoers. We discussed our beet-testing project but the erudite Richard also fell to discussing the campaigns of Alexander the Great and Gunga Din in Swat!

We took a stroll round the bazaar, then drove a little further up the valley before heading back, taking soil samples on the way. We returned to Peshawar and paid off our rather dopey driver with his shaky car. Then we took to rail transport, heading east to Rawalpindi on the Khyber Mail, equipped with blankets lent to us by the British Council. I had always thought that they lent out books was surprised to find that they provided a blanket service too! The mass of people on a Pakistani railway station platform has to be seen to be believed. The track was broad gauge, 5ft. 6ins. and there were no less than five classes of carriage. We shared a roomy sleeper with a newly married couple who remained very discreet in our presence. It must have been very frustrating for them.

It was sunny in 'Pindi', but still very cool. It was the seat of government but its days as such were nearly over, as the new capital of Islamabad was being built just to the north. We saw some of the agricultural big-wigs and then headed up to the Murree Hills, up to 7,000 feet, for a sightseeing trip. There were deep snowdrifts and, in the distance, views of the high peaks of the Himalayas. Back in Rawalpindi we were booked to fly east to Lahore, but there was a little time to spare, so we took a taxi to Taxila, 20 miles away, an enormous archaeological site. There was an ancient city dating from several centuries B.C., then a Greek city founded by Alexander the Great and still later a third city with several large Buddhist monasteries. Richard knew all about it, indeed he said that he had done a good deal of his courting there!

It does not seem to take too long to get used to a new environment. City centres crowded with people and animals and full of varied, rich smells were becoming the norm, as were groups of pack-camels on the roads and carts hauled by buffaloes with their surprising pale blue eyes and long glamorous eyelashes, the rest of them being far from glamorous. Little groups of men were seen sitting around with a giant hookah between them, passing the pipe around and each in turn puffing out a dense cloud of smoke. The women, duly veiled, might at the same time be drawing water from the well, returning with one, two or occasionally three pots balanced on their heads. Compared with these hard-working women, the men seemed to be just lazy lay-abouts.

Back in Lahore, we had to stay a couple of days longer to see various officials. We then visited Lyallpur, of which more later. We also went back through Lahore and the last trip before returning home was to Sialkot, sixty miles away and right close to the border of the state of Jammu and Kashmir, which was in India though the Muslim Pakistanis believed that it should have been their territory. The whole trip was aimed at working out plans for our field trials and getting them agreed with government and the sugar industry. For me, though, this first visit to the Third World created an impact which can never quite be repeated.

So we picked on trial sites, at Lyallpur and Sialkot in the Punjab and in Swat in the far northwest. On the face of it, sugar beet is a hopeless crop in these latitudes because of the fierce summer heat. When the night temperature exceeds 80°F (27°C), sugar ceases to accumulate and beets tend to get very sick. Equally it is not very good for cane, because of liability to winter frosts or at least very cold weather. This excludes productive tropical varieties and limits

production to poorer sorts. For sugar beet, however, there is a trick, a trick I first learnt in the Imperial Valley in Southern California. You sow the beet in the autumn instead of in the spring and harvest it in the early summer before the temperature peaks. Even then, as soon as it is out of the ground it must be whipped into the factory and processed in the absolute minimum of time, or it will rapidly burn up its stored sugar and also develop all kinds of rots. Fungi and bacteria really flourish at high temperature. In California, with good roads and efficient transport, growing the crop in this way is possible. In developing countries it very nearly needs a miracle.

My job was to work out trial plans and locations, pick a range of varieties, which seemed to be worth testing and advise on the practical problems of seedtime, cultivation and harvest. This meant going out for fairly short periods; while we had people permanently out there, Nicholas Craze and Richard Constanduros.

Chapter 17: Field Study in Pakistan

Our sugar beet feasibility study in Pakistan took place in 1965 and 1966 and the problems presented were quite intriguing. Over there, full time, was Nicholas Craze, a young agricultural consultant from Wye College in Kent, aided and abetted from time to time by another young graduate, Richard Constanduros. An unusual name, but his aunt, Mabel Constanduros, had been a very well-known broadcaster during the war years, it therefore had a familiar ring. They had to keep the job moving along, while I did the planning and showed them how to handle sugar beet trials, going out on several relatively short trips. We were equipped with an Austin Gipsy, which was an alternative to a Land Rover at the time.

Our reconnaissance had almost fixed the trial locations and they were finalised with the aid of local agricultural agents, often on state-owned experimental farms. They were mostly in the Punjab, at Lyallpur, Sialkot and Gujrunwala, all not so very far from Lahore. The outlying trial was in Swat. Sugar beet was an entirely unfamiliar crop to them all, indeed when the trials were harvested the farm managers had no idea what to do with the beet. At Gujrunwala we suggested feeding the roots to cattle, but were told that, never having seen beet before, they would not know what to do with them. So we cornered some cattle and more or less force fed them with slices of beet. They soon learnt. At Sialkot it was even more difficult and we finally got exasperated and advised that they should "chuck them at the Indians". The Kashmiri border was only four or five miles away and by then war was about to break out. Beet would have been a novel form of projectile. Biological warfare, I suppose.

As mentioned previously, sowing clearly had to be in the autumn so that harvesting could be completed before temperatures got impossibly high. We tried a range of dates. October proved to be the best. Autumn sowing in Europe would have led to bolting following the cool winter, so some highly bolting-resistant material was included. We need not have been concerned about that, for the high temperatures in the following year cancelled any idea the plants might have had about going to seed. We included some American varieties. Through most of the harvest period the European varieties were better, but when it got very hot indeed, the American material stood the strain better and came out on top. The American varieties had been bred in a climate which

included hot summers and not surprisingly they showed better heat tolerance. We got some wonderful yields, though, among the highest anywhere in the world.

At one site we sowed after a rice harvest, getting two crops within a twelve-month period. It was difficult, for the heavy, puddled soil after paddy rice was almost impossible to work into a good seedbed for beet. Even then, though, we got a yield of 15 tons per acre, which is still good. So the potential was there.

This work led to many interesting experiences. We often had to drive out of Lahore on the Grand Trunk Road, which the British had built right across India from the Afghan border to Calcutta. We did not use the buses, but saw plenty. They were privately owned, one owner one bus, and many looked very well worn. The trick was to drive quite madly to pick up passengers ahead of the competition. The leading bus would ignore small groups of waiting passengers in the hope of getting more later on, and there was much passing and repassing and accidents too. We saw one place where two buses travelling opposite ways had collided with a glancing blow and neatly taken a complete side out of each other.

Lyallpur had a flourishing university and there I met N.D. Yusuf, whom I had met and very much liked in Cambridge. He arranged an *al fresco* lunch for me and the vice-chancellor. They decided to pull my leg by sending out to the market place for betel leaves, which they chewed so that their mouths, lips and teeth turned bright red. What should I do? At the last moment they saved me from embarrassment by saying that the leaves were far from hygienic and that as I was unlikely to have the bug-resistance which they had acquired, I had better not join them. They told me that the man in the market place who supplied the leaves wrapped them in sheets of paper which he sat on so that they would not blow away! On another occasion at Lyallpur I was asked to talk about sugar beet to the post-graduate students. We sat in a circle under a spreading tree and I was immediately surprised to be addressed in Welsh. The student had done his initial degree in Bangor and knew that I had been there! A surprise was to learn that I was regarded as an authority on Punjabi wheats, on the very slender ground that I had published a paper on *Triticum sphaerococcum*, a round-grained species that is native to the area.

In Lyallpur and indeed everywhere else, the people we met were very friendly. If there was a fault it was that everybody who had acquired a degree seemed

also to acquire a social status which forebade them to go out into the fields. They seemed to spend their lives in an office on their particular patch of carpet, avoiding *infra dig* things like getting muddy boots.

Among the mass of the population another matter arose. Jobs were scarce, poorly paid but very precious. If 'sahib' went into the field and got physically involved with the job, he was suspect because he could be thought to be depriving some very poor person of work. This was when we went to harvest our Lyallpur trial. I was there to guide Nicholas, who had not done it before. We were on the trial site early in the morning and had been promised a gang of workers. They had not arrived, but soon we saw a bedraggled line of men approaching us in grubby white dhotis and carrying something. As they got nearer we saw that they had two armchairs and a box. The box proved to be full of bottles of Coca-Cola. The 'sahibs' were not expected to do anything other than issue orders while sitting in state, sipping 'Coke'. However, in this case the only way of showing the men what was needed was to 'muck in' and show by example, especially as our Urdu vocabulary totalled about twelve words.

In most respects, trial harvest was a matter of raising the beet with some kind of single furrow plough behind an ox, knocking and scraping them as free as possible from soil and counting and weighing them. But then we had to measure sugar content. This was a challenge. Our Austin Gipsy had a power take-off to which we hitched the Keil boring rasp which I had discovered in use when I first went to Maldon. This gave us a bulk sample of pulp representative of the beets of each plot. Nicholas had been into town early that morning to buy 'dry ice', solid carbon dioxide, and we had insulated boxes. We put our samples in the boxes where they would soon freeze and they were taken no less than 400 miles to the nearest sugar factory for analysis.

The Punjab is not the most scenic part of the world, indeed most of it is very, very flat and some of it is pretty, well, a salt desert. Even on the better bits it was sometimes necessary to put the soil up into ridge and furrow and to sow on the sides of the ridge a little below the top. This was because, in drying out in the sun, salt would be carried up to the top of the ridge to form a white crest.

There were some monumental buildings like the tomb of the Mogul emperor Jehangir and there were attractive stretches of road lined with shady casuarina trees, or with trees from which hung dozens of weaver birds' nests. For real scenery, however, one had to move on.

Towards the end of the first trial year, war threatened and many army vehicles were about, often with loads of munitions in boxes labelled "A Gift from the American People" and decorated with the Stars and Stripes. No doubt there was similar traffic on the Indian side of the frontier. The war was over before our second year's sowing, but it gave a very unreal feeling to the project, for the result of the hostilities was to put an end to all hope of building more sugar factories as foreign grants and credits dried up. Our trial at Sialkot was in what proved to be a battle area.

We went on to Swat and my fondest memories are of the second year. We had established trial locations and had got to know quite a few of the friendly local people. One Saturday we took the day off for a trip to the north end of the valley in our Austin Gipsy: Nicholas Craze and I and also Bill Johnson, who had basically come out for a trip. The scenery is spectacular, the valley with narrow terraces of cropped land hanging on the lower slopes of rugged mountains, and behind them the towering, snow-covered peaks of the Hindu Kush. When we started it was well into summer, but as we drove higher and higher up the valley it was soon late spring and then early spring and the edge of the melting snow.

Landslips are not uncommon in such country and we encountered one. In fact it had nearly been cleared up and we did not have to wait long before we could get through. The system was interesting. The social system was essentially feudal. All the local people were bound to give a number of days of free labour to the state and when something like a road blockage occurred they turned out in masses to put the matter right. They were paid a rupee a day for refreshments.

Nicholas took care of the second year's sowing and I went there when the crop was well established. On the irrigated valley bottom there had been a problem, for the channels followed the contours and were gently curved. Our trial plots were sown in rectangular array, leaving crescent-shaped gaps between their straight sides and the channels. When we returned in the early summer, all these odd bits of land were filled with flowering opium poppies. Our unplanned contribution to the narcotics industry.

On one occasion we were visiting a trial when a thunderstorm approached and we looked like getting a real soaking. We were invited to take shelter in the little near-by village before the storm broke. We took a footpath, past the tiny mosque which we were invited to see, for they were very proud of it. The fact that we were infidels was quite overlooked. Then we walked on, past muck-

heaps in which poultry were scratching around, into a little square where there was a guest house with a couple of charpoy beds and a canopied porch where we were seated in full gaze of the entire population (the men and children in the square, the women peeping round corners). Within minutes we were brought tea in a beautiful tea service, obviously a communal treasure. We were also brought eggs, not improved by the presence of bloody veins, but we could not possibly be churlish enough not to eat them. Then a local youth arrived carrying a catapult in one hand and several brightly coloured finches tied together by the neck. The junior member of our party ought to have had more sense. He said, "Can you eat them"? Within fifteen minutes they were skinned and on our plates.

At the end of our project Nicholas and I sought audience of the Wali again. He was polite and interested but his manner indicated that he wanted to say goodbye with the utmost despatch. We learnt why. The war being over the ruler of Pakistan, Ayub Khan, was that week on the rounds of the frontier states, giving out medals to the deserving for the valour they had displayed in the national cause. Our Wali had received a distinctly third class award and was upset. In fact he was busy sacking many of his senior staff. His plight was even worse because he had married a daughter of Ayub Khan and should have upheld the family honour.

What had happened may not be found in the military history books, so deserves to be told. The steep valleys of Swat are watched over by stone forts with slits in the walls, manned by expert marksmen well able to pick off any unwanted intruders. Now, though, they were called out on a foreign war. They were loaded into army trucks, driven over the Malakand Pass for the first time in their lives and were full of exuberance. So much so that when they passed down the Mall in Rawalpindi they shot out all the streetlights just for fun. They ended up in camp not far from Sialkot, where one of our trials was located. After a day or two it started to thunder, or so they thought. The thunder sounded a bit odd and they finally realised that it was artillery fire. Some aircraft flew over too, dropping things. This was clearly utterly unfair, not their kind of war at all, so they got back into their trucks and drove home. Hence the Wali's third class gong!

Nicholas with a new assistant (he who said, "Can you eat them?") was left to complete the season and bring back the data to me for analysis. Bill Johnson and I flew down to Karachi and stayed at the Intercontinental Hotel, owned by a

consortium of prestigious Western companies. Very upper crust, very hygienic I thought. It was there that I picked up a dose of a virulent tummy bug that I found quite gruesome. I was still looking pretty green when I had to board the P.I.A. flight for London via Tehran, Moscow and Frankfurt.

This was the only time that I saw anything of Soviet Russia. It was interesting to fly over the Caspian Sea and the vast expanse of the Steppes to Moscow International Airport. There we went 'ashore' for about an hour and a half, having surrendered our passport to a very large and fierce-looking woman soldier at the top of the steps, receiving a little slip of paper in return. It was not so different from other transit lounges except that we had a free copy of the day's Pravda and a bound book of the life of Lenin in a language of our choice. The striking thing was the isolation. Domestic airports were doubtless very busy, but in this major international airport only one plane left (for Copenhagen) in the 1½ hours and none arrived. It was very different indeed in Frankfurt from Soviet Russia.

Chapter 18: Afghan Journey

Afghanistan. So remote and, as I thought, unattainable. It had fascinated me ever since I had followed the work of the great Russian botanist N.I. Vavilov. He studied the question of the origin of our crop plants. He had the idea that, if you mapped the genetic variation in a species, it would be possible to identify a 'centre of diversity', and that this was likely to be the point of origin of the crop. I had become slightly involved with this kind of work myself, for in my Ph.D. thesis there are maps showing the geographical range of certain genes in bread wheat. In some cases it was even possible to trace the spread of genes across central Asia along the old silk routes. Vavilov's work pinpointed two areas in the Old World, which appeared to have been vastly important in the origin of our food plants. Both remote mountain areas, they were Afghanistan and Abyssinia, later to be known as Ethiopia. Harry Harlan had explored an important part of Abyssinia in the early 1920's and had stirring tales to tell. I was never a plant explorer and never got to Abyssinia, but in 1965 came a chance to go to Afghanistan not as a plant explorer but engaged in a feasibility study. It was only for a couple of weeks it is true, but it was an exciting prospect. The country still appeared to be politically stable. The king still reigned and the communists had not gained control and it is sad to think of what happened to the country later. My reason for going was that our Overseas Development Administration had given a grant for a study of possible sugar beet development in the country.

I flew to Tehran, where I had previously been more than once on my way to and from Pakistan. Then there was an ancient DC6 to take me to Kabul. People used to make fun of Ariana Airlines, the Afghan national airline, saying that if you could see the ground between the floorboards, it was not wise to travel. It did look a bit tatty, but otherwise seemed to be acceptable. The weather was clear and for once there was an excellent view of the ground below, out of the window, not through the floorboards!

Northern Iran is mostly desert, with occasional inland lakes encrusted with salt. Here and there were the bright green patches of rectangular fields surrounding a village and one could trace the remarkable irrigation system: tunnels under the sand which carried water without loss by evaporation. These had been built and maintained for centuries, with a considerable loss of life through cave-ins and

other accidents. The line of the tunnel could be traced from the occasional points of access from the surface.

As Afghanistan was approached it became mountainous and the mountains got higher and higher, until the peaks were snow-covered. They looked rocky and bleak and it was easy to understand what a problem such a country would be to an invader. Down in the valleys were narrow strips of cultivation hugging the rivers and here and there a village of what appeared to be adobe houses, built each as a square looking into a central courtyard. It went on like this to the very portals of the capital, Kabul.

Afghanistan is a strange country, set up as a buffer state between Persia, Tsarist Russia and British India. The people clearly show this diverse origin: in the north, there were slit-eyed, round-faced Asiatics akin to those of Russian Turkestan. In the east there were tall proud-looking Pathans, like those in the north-west frontier areas of Pakistan. In the south and west the people were indistinguishable from Iranians. Languages were correspondingly varied. They all seemed to meet in Kabul, where there was a very clear social stratification, with the mongoloid types clearly at the bottom of the ladder. With a geography like this, the Afghans had become adept in playing one great power against another, in particular getting the Soviets and the Americans into a competition in financing all kinds of capital developments in the hope of getting a friendly ear. It was already obvious, though, that the Russians were building trunk roads to their frontier, roads that were to prove vital when hostilities later broke out.

The broad Kabul River flows through the city, bounded by some fine, though rather run-down buildings which seemed to date from around the turn of the century: buildings often with considerable style, incongruously roofed with corrugated iron. The main city centre though, was a crowded area similar to what I had already seen in Pakistani cities, with open-fronted shops cheek-by-jowl. Shops for each particular commodity were grouped together in one area and there were no general stores. There was one big difference, though, and that was that there were no draught animals, no oxen, camels, buffaloes or donkeys but only humans in the streets. The loads carried on the backs of porters could be phenomenal and if there was a cart, it was pulled by men.

I very soon went to one particular office, up some wooden steps from the bazaar where new and sometimes very decidedly second-hand tyres were sold. One does not expect to have official advice on changing money at an advantageous

rate, but I had a typewritten handout from the British Embassy which told me exactly where to go to get a much better rate than the banks would offer. I got 212 afghanis to the pound instead of 180 and, better still, 23½ Pakistani rupees instead of 13.

I stayed at the Spinzar Hotel, modern and built by the Czechs. I was pleasurably reminded that Pils was in Czechslovakia: the imported beer was excellent. At 6,000 feet, Kabul is surrounded by high mountains, covered with snow in winter. The lower slopes are densely packed with poor houses separated by muddy, unpaved streets.

The country might have been ethnically diverse, but it appeared to be uniformly Muslim. The women wore their dark-coloured 'tents', down to the ground, fitted with a strip of gauze through which they could see. As elsewhere in the Middle East there were street vendors and I was amused to see one such modestly clad woman haggling with one of them. Spread out on the pavement was a variety of women's underwear, very modern, very western and very snazzy. It was one's only glimpse of what went on underneath!

Three or four miles outside Kabul stood the British Embassy. It is (or was?) a quietly stylish building finished in white stucco, with a large traditional English garden with rose pergolas all around. No roses though, for it was winter. After paying respects to the ambassador, I met Gerry Rance, the agricultural attache, who was to accompany me on my mission. We discussed this over lunch and came to the conclusion that the location should be changed. I was booked to fly to the west, to Herat, but the Minister of Agriculture had just made a speech in which he declared that there was to be massive agricultural development in the Helmand Valley in the south-west, so that was where we went. The first step of this was to fly to Kandahar, but before leaving Kabul there was some formality. I met one of the ministers in the agricultural department, H.R.H. Sardar Wali Shah, a nephew of the king, to get his official blessing and the necessary introductions. Then we were ready to go.

Travel in Afghanistan was different. I went to the Kabul office of Ariana Airlines to get my ticket changed. "No", they said, "that would be a shame. We have an excursion to Kandahar tomorrow at a fraction of the cost. Why not buy a ticket here and cash in your existing ticket on returning to London?". "But I have too much baggage for an excursion ticket", said I. "No problem at all", they said, "just go to the airport with your baggage". This I did, as did Gerry. It

was true, there was no problem at the airport and there was a newish Fokker Friendship to take us: one of my favourite planes, a high-winged monoplane which gives an uninterrupted view all around. We sat next to the manager of Kandahar Airport, who regaled us with disturbing stories about air accidents which had occurred in Afghanistan. Like the troubled DC3, which had made a forced landing on a tree-lined road. Unfortunately the wing-span of the plane was a bit too big and both wing-tips were shorn off! Stories like this were not the best preparation for what followed.

Everybody knows that landing is the trickiest bit of flying and, when we were just beginning our descent, came an announcement. "We are sure the passengers would like to congratulate the pilot, Captain Mohammed Durrani", the lady said, "this is his first flight with passengers". There were very many rugged mountains down below and the airfield in the far distance looked to be the tiniest little patch. We all waited apprehensively for the bump but it was the smoothest landing ever.

Kandahar Airport was really remarkable (I put all this in the past tense, because who knows what havoc has been wreaked during the recent years of fighting). The terminal was built, or at least faced, largely with marble, and the locally traditional and very beautiful arch was the recurring motif. It was built by the Americans to the standard of an international airport but it had no international traffic except for a few days each year for the Haj, the pilgrimage to Mecca. Typically, to counterbalance this American largesse there was a fine multilane highway covering the fifteen miles into Kandahar, built by the Russians. This seemed to be their speciality, communications, probably as cynically built as Hitler's autobahns before the war.

I was getting used to Asiatic cities by now. Kandahar had many of the same features but was smaller and simpler, with little narrow side-streets with a smelly drain running down the middle of each. It was a city of tongas, two-wheeled pony traps which served as taxis. Some of the owners had garlanded their ponies with flowers. We did not spend long there, for we had to get out to Lashkar Gar, on the Helmand River, and we had a Jeep with a driver waiting. Before leaving, we issued a short-wave radio message to our destination, to say we were about to start out. This seemed a bit extreme, but we soon realised why. After the first few miles there was no road, only endless desert, the barest desert I had ever seen. There was no sagebrush, no cacti, nor any of the other plants I had become used to in the deserts of the United States: just nothing. It

was flat, as flat as could be, but mountains, often, of strange shapes, rose abruptly out of it. That feature, at least, was just like Arizona.

When we were many miles out, our Jeep came to a halt with nothing but desert all around, to the farthest horizon. The driver knew exactly what to do. In a flash he was out on the sand with his prayer mat, facing Mecca and asking Allah for help. After a few moments he got back in, pressed the starter button and we were off. He was a happy man. Praise be unto Allah! What he didn't know was that, while he had his head down in prayer we had lifted the bonnet and found that its support rod had slipped out of its clip and had fallen across the battery. Jerry and I soon clipped it back and the battery had a little time to recover. We did not disillusion the driver. It would have been a shame.

Back in the 1930's the Americans had built a huge, integrated scheme for irrigation and power generation in the Tennessee Valley. It had been a model of the way in which wealth could be brought to a depressed area. They had now been doing the same thing, albeit on a smaller scale, in Afghanistan, all as a part of their financial largesse or more likely a part of the business of keeping up with the Russians. It was this scheme which had drawn us there. Lashkar Gar was alongside the river, in part a miserable line of shacks, but also with some good houses and larger buildings of which quite the largest had been built to house American workers. It was the U.S. 'AID' staff guest house with room and good food provided for about £3 a day. It was there that we stayed. It was not simply because Gerry had diplomatic privilege, for all visiting foreigners seemed to be staying there too: indeed, apart from camping, there was nowhere else. We heard that a couple of weeks later there had been something of a row about all this, for the American ambassador had arrived on a visit and found the place so full of foreigners that there was no room for him.

Now I had to look at the feasibility of sugar beet growing in the Helmand Valley and to come up with a recommendation. The problem was similar to that seen in other hot climates: the crop would have to be sown in the autumn and harvested in the searing heat of summer. Harvesting sugar beet involves cutting off the tops and leaving a large exposed surface on every root, sugary and nutritious for all the fungi and bacteria which happen to be about. At the fairly low temperature of an English October or November this is not a serious problem and there is no great rush to get the beet to the factory. The hotter it is, however, the faster all the invaders multiply and even without that, the higher the respiration of the beet, burning up the stored sugar. Within a very few days

the process of sugar loss and putrefaction has advanced so far that the roots are just about unprocessable. So the harvested crop has to be rushed into the factory and extremely efficient transport is necessary. The valley was long and the irrigated zone was narrow. In the Imperial Valley of southern Arizona the Americans have this same problem, but they have fine roads and all the transport they need. In the Helmand Valley, long and narrow and with a single, not very good road and no highly developed transport system, I concluded that it just wasn't practicable and so I advised against it. We held a meeting with the local Afghan administrator to give him the bad news. I remember vividly his richly furnished house, the elaborate pieces of furniture and the ornaments made largely or wholly of onyx, with its varied patterns of soft colours, and also the fine carpets. He accepted the verdict quietly and might even have been relieved by it.

I am still slightly haunted by a strange phenomenon near Lashkar Gar. Just across the broad, swiftly flowing and rather muddy river was a town. Quite a large town with many buildings, often two storeys or more high. It looked complete and yet I was told that it was totally uninhabited and none of the limited number of people I met could tell me why. It could not have been water shortage, right by the river. Was it conflict, epidemic disease or what?

Now we had to return to Kandahar and thence to Kabul. It would so often be nice to linger on these journeys, but usually they are tightly packed with appointments. I did go to see the Minister of Agriculture to report our conclusions and revisited the British Embassy for a meeting with the ambassador and a lunch with the Commercial Secretary, but then it was necessary to catch a flight to Peshawar in Pakistan. Not even a day could be squeezed in to enjoy an experience I had been offered: a trip by road through the Khyber Pass in an embassy Land Rover. That would have got me to Peshawar in a much more interesting way.

Chapter 19: Sun and Sunflowers in Algeria

The summer season, as we have seen, often left time for some other project, always overseas. It was now 1970 and this one, in Algeria, was different. For once it had nothing to do with sugar but with oil, edible oil. Richard Constanduros, who had been involved with the research project in Pakistan, was by now a member of an agricultural consultancy called Agroplan, with offices in Thame in Oxfordshire and I was called in to plan and oversee the experimental work. With me was 'Kench', an old friend who had retired from his teaching post at the Essex Institute of Agriculture. For most of his career he had bred cotton in the Sudan and his knowledge of Arabic was very useful. He was pretty good at French too. Even his own family called him Kench, since for some reason he did not like his Christian name, which was Frank.

Attached to the project was a rather mysterious American named Shaw, who knew about oil but of a very different kind, for his oil was the kind that was at that time being discovered under the North Sea. He served no essential function in our project and Kench was sure that he was in fact a C.I.A. agent, an American spy. At that time the Americans were certainly paranoid about communism. We stayed in an apartment in Algiers, a very French-looking city with a centre of wide, well-planned streets, a smaller version of Hausmann's Paris. It had a fine harbour. I went there in the spring to help with trial planning and again in the late summer, for the harvest.

The crop was the sunflower, the *tournesol* as it was locally known. We were needed for a strange reason. There was a Ministry of Agriculture and a Ministry of Food, of which the relevant section had to do with Edible Oils and Fats. The two ministries had opposing ideas about sunflower development and we were really called in to act as referees. Algeria was pretty new as an independent state and in colonial days the French had been careful not to let the locals learn too much about the skills of administration. So we met government officials who were remarkably young for their level of seniority. The political philosophy was communist, though not so severe as the Russian variety. They seemed to be terrified, probably with just cause, of the development of corrupt practices and anybody found lining his own nest was dealt with in a draconian manner. The result was that any contact with foreigners was handled very carefully indeed and for the most part no government official would stick his neck out by giving

us information. The job of getting very straightforward climatic data for Algeria involved three ministries and much time and effort. One of the officials we met was a lawyer named Lunici. Of course we anglicised this as Lunacy.

Algeria is a huge country and is divided into five zones: the rich coastal area next to the Mediterranean, gradually rising to the second zone, the Maritime Atlas Mountains. Then there was the intermontane plateau, still with some natural rainfall. Then came the Saharan Atlas and lastly the apparently unending desert. We were to plan and conduct trials in the coastal zone and the intermontane plateau. We were able to move about freely in our Renault 16 and to meet local agricultural officials, from whom we got much help.

The coastal area had vineyards and many other flourishing tree-fruit and vegetable crops, but as the land gradually rose towards the mountains it became more arid and we saw groups of wandering bedouin with their grazing animals and goat-hair tents. We were in a Muslim country but a minority of the women went about veiled. In the villages there were usually groups of colourfully dressed men swathed in long robes and with tall, circular 'top-hats' with multi-coloured banding, sitting at tables smoking, drinking coffee and looking very solemn and self-important. They eyed us with curiosity and suspicion. In the world of farming there was a private sector and a public sector with large collective farms. These were mechanised. The government had imported tractors and other implements from politically acceptable sources, from East Germany, Bulgaria, Poland, Romania and Soviet Russia. There were so many types and so few spares that long lines of these machines, all stone dead, could be seen in many places. Probably they were short not only of spares, but of skills too.

We had variety trials in several places in the coastal area, using sorts of sunflower from America, Romania and elsewhere. In the area near the coast there were many trees about and also great colonies of a voracious seed-eating bird called the Spanish sparrow. One trial in particular I remember. One does not plant a sunflower trial on any isolated little patch of land; that would be asking for trouble. Instead, our trial area was in the middle of a ten-acre field of commercial sunflowers. In that way any bird damage would be spread over the whole field and we knew that it would be the areas near the edges which would be the first to be raided. Nevertheless we felt uneasy and ordered a sufficient quantity of poles and nylon netting to make a bird-proof cage over the entire trial. The equipment arrived in time in Algiers harbour. The red tape involved in

getting it ashore was, however, so long-winded that by the time it was released the last seed had been eaten. So we had a yield trial with no yield. We will see later how this little difficulty was overcome! Bureaucracy is a great French tradition, indeed it is a French word. It is a dearly loved feature of all communist countries too. The combination of the two in a formerly French and now communist nation really reached the acme of perfection.

The intermontane region was mostly extensive grassland, with hardly any trees. Here and there we could see a grazing herd of camels. It was sunny and dry and because of the dryness the heat was not oppressive. Owing to the virtual absence of trees we had no trouble with the Spanish sparrow. We went up to the little town of Tiaret, totally French in appearance with sidewalk cafes, boulangeries with sun awnings, a place for playing boules and all the other things to be seen everywhere in France. We met the local agricultural agent, Sadiq, and found him interesting, competent and also very pleased to see us. He had spent a good deal of his working life in another French colony, Madagascar, had acquired wider horizons and felt oppressed by the prevailing regime in Algeria. We had a good trial up there, which served two purposes. In addition to the designed use, we measured the diameter of a great many sunflower heads, threshed the seed out separately from each and made a chart relating head diameter to seed yield. Then we went back to the ravaged coastal trial, still bearing empty flower heads at the tips of gaunt stalks, did a lot of counting and measuring, and worked out the quantities of seed which had vanished into the crops of sparrows! We got consistent and significant varietal differences and this unique, yield-less yield trial really should be in all the textbooks. Whether it would have earned me fame or ridicule, I am not so sure, but it was fun.

Our friend from Madagascar found us a pleasant change from his administrative bosses from Algiers. We were sad that we could not have a longer association with him. He was with us on our trip back to Tiaret after all the work was done. As we approached town we came to a square-built house with smooth, sand-coloured walls with no windows and just a little door in one side. Sadiq asked us very casually whether we would like to "*casser une croute*" with him. Thinking that this was just a spur-of-the-moment invitation to a snack, we gladly accepted. How mistaken we were!

Ushered in through the door in the blank wall, we were first taken into a small, carpeted room with low divans lining the walls. Incongruously there was a television set in a corner, but no other furniture whatsoever. After a few

moments we were taken to a really lovely central courtyard. The rooms of the house clearly butted on to the blank outer walls, but they all faced inwards on to a lovely and quite spacious scene. There were flowering shrubs, a fountain and a little trickling stream. The ground was at two levels and Kench and I were soon seated at a table at the upper level laid with plates and a central piled-high dish of couscous. Bearing in mind the invitation to "share a crust" we tucked in and, offered a second helping, took it gladly. What a mistake. This was only a preamble and dish after dish followed and we could not possibly be so discourteous as to refuse any of them. I really do not know how we managed to eat it all and we certainly did not ask for any more second helpings. After the meal was over we moved down to a shady spot by the fountain and drank mint tea.

This was a most memorable and delightful evening but by our way of thinking it had it sad side. We heard the ladies of the house (wife and daughter, we understood), slaving away in one of the rooms, preparing the meal, but there they were, isolated. We never so much caught a glimpse of them. In Muslim countries this all seems to be freely accepted and this was doubtless a happy family but such treatment of half of the human race would not do for us.

We had another meal in an Algerian home, but there is some explaining to do first. We were able to do well enough with French. Kench's Arabic often got us by, but Arabic is spoken all the way from Iraq to Morocco and it is not surprising that there is considerable local variation. As we have said, his was learnt in the Sudan. Then there was a third language, of which we were all ignorant, Berber. This was, after all, the Barbary Coast from which the famous pirates used to ply. Because of this we needed an interpreter and we went to the University of Algiers, who supplied us with a very likeable young fellow named Said, for a stipulated and quite high salary. It was his first job and he was thrilled. It was Said who was later to invite us to a meal at his home.

Tizi Ouzou is a long way to the west of Algiers and behind it is hilly country with rocky soil, often terraced, yielding rather scant crops. It is poor country, with little villages scattered about. Said lived in one of these with his parents and pretty little sisters, aged six and four. Said himself had made local history. He was the first person from there ever to get to a university. When he got his job with us he saved every penny he could to send to his parents and with it they built a small extension to their house, which was rather touchingly re-named the Villa Tournesol.

This was still a Muslim home, but much, much simpler and poorer than that of Sadiq. It too was built in a square with blank outer walls, but inside was an unpaved yard. Our meal was served in the new room, and consisted of little besides couscous, made from wheaten semolina with cubes of watermelon mixed in. Said and his father sat with us and shared our meal, while his mother, unveiled, served at table. They were all incredibly grateful for the way we had inadvertently helped the family.

Algeria at that time preserved much of its French influence and indeed many young Algerian men took seasonal work in the fields in France, going in by boat via Marseilles. Here in the mountains, though, bitter memories persisted of the early days of French colonisation, when soldiers came into the villages plundering what they could. It the area where Said lived there was a tradition of craftsmanship in silver. As is the case among the Navajos in America today, much of the wealth of the villagers was in the form of a few precious trinkets. The soldiers took all they could lay hands on and the story goes that, when they could not get a bracelet off the wrist of a woman, they would cut off the hand to get it. Exaggerated or not, bitterness of this kind is very long lasting.

Chapter 20: Sadaam Hussein's Iraq

The last commission I took on after retirement took me to a country at war, in fact it was to Iraq in the middle of its six years' war with Iran. The British Sugar Corporation had a section devoted to overseas consultancy and they had been commissioned by the F.A.O. (the Food and Agriculture Organisation) of the United Nations to conduct a feasability study on the development of a sugar industry in Iraq. This was part of a larger project that involved several crops, but work on all the others had been completed and the reports duly submitted.

The desire of nation states to become independent often makes no economic sense at all: growing wheat in Saudi Arabia for instance, watered with desalinated sea water far too expensive ever to give a sensible return on cost. Growing beet in Iraq was more logical than that, indeed there was already a small and very inefficient beet sugar industry. What was less logical was the hope of extending the national self-sufficiency to the production of their own beet seed. This was where I came in, since the Sugar Corporation knew all about growing and processing beet, but very little about seed growing.

A very competent and likeable young man called Tony Houghton was out there handling the problems of beet cultivation on behalf of British Sugar. I joined him for two periods of two months each and Tony and I became very good friends. In fact we had known each other for years previously. Probably I should not have taken this job on, for I had not realised how very worried Lilian would be about my going into a war zone, even though the war was being conducted on Iranian, not on Iraqi soil. Communications back home were difficult. I only got one telephone call through in the whole time I was there and letters had to go in the U.N. diplomatic bag to their New York headquarters and then back to Britain.

Getting to Baghdad was not that easy. Iraqi Airlines were supposed to have one flight a week, but at Heathrow they never knew whether it was going to run or not. I finally went out by British Airways to Amman in Jordan and from there by the Iraqi line. For security reasons there were only night flights and the main landing lights at the airport were all switched off, as were the lights in the aircraft cabin, as we came in to land. It was all a bit eerie. I was met at the airport by a U.N. driver and taken to my hotel about 4 a.m.

Next day I was taken out to the office, a room at the University of Baghdad well out of the city on the road going west to Amman. This journey fell to my lot on most days and the traffic was unbelievable. In the city centre there was dense car traffic not unlike any other big city in the rush hour except for quite a bit of indiscipline. Out on the road there was a constant, head-to-tail procession of heavy trucks bringing in supplies, mostly from Eastern Europe. It was the main artery for supplies for the war effort and for the civilian population. On the way out there was a military roadblock, but the guards seemed to know the U.N. cars and never stopped us. We passed large military encampments.

The university campus was well laid out and quite pleasant, though the buildings were basic and the rooms rather spartan. There was no question of air conditioning and there was purely nominal heating for the cold weather. Our room had a two-kilowatt fire. One bar would work, except during the numerous 'power-outs'. If we put the second bar on, it would blow the fuses.

The U.N. staff at the university consisted of three people besides the two of us. The boss man was a Tamil from south-eastern India, named Rajan. A nice person with not much to do, for his scheme, originally concerned with several crops, was nearly finished. He and his wife lived on the other side of the River Tigris in a district called AI Mansour. He had learnt to find his way round government departments and round the U.N. offices and we would have been lost without that kind of help. There was a secretary, a pretty but rather sad lady, for things were going wrong for her. She came from San Luis Obispo in California and had married a brilliant and outstandingly pleasant young Iraqi out there to do a Ph.D. After returning home to Iraq with his wife he had done well, becoming head of his department and then of his faculty. The family had a house within the campus and there were two daughters, the elder of which was quite a beauty and was making a name for herself in Iraqi television. Then it began to go wrong. The authorities discovered that Ibrahim had an Iranian grandmother, which was nearly as bad as having a Jewish grandmother in Nazi Germany. When I left he had been demoted in the university and they were expecting to lose their house on the campus. His wife was forced to surrender her U.S. citizenship if she wished to stay with her family. There was also a third staff member, young Abdullah. A Palestinian, he could 'fix' almost anything, like getting supplies through customs or arranging any kind of transport.

There were other U.N. personnel based on the university. One was a Swede who gave Tony and me transport most days. He was an engineer, with the task of teaching Iraqis how to keep tractors and other machinery in working order.

Baghdad is, of course, an ancient and most interesting city. Its most famous ruler in the past had been Haroun al Rashid, the subject of various more or less apocryphal stories we heard in school, though he was certainly a real and powerful king. The most infamous ruler is probably the present one, Saddam Hussein, though there have been some pretty gruesome regimes from time to time in the past. It is on one of the two great rivers which, flowing through the Mesopotamian Plain, formed the birthplace of civilisation. Here, supposedly, was the Garden of Eden. The Tigris meanders gently through the city. There is an old town with a crowded market. This is a pedestrian area, with little open-fronted shops crowded together, with here and there craftsmen plying their skills - sometimes, as in the case of coppersmiths, very noisily. In this and neighbouring Rashid Street my biggest surprise was that it had not gone up in flames years ago, for there was the most rickety electric wiring you can ever imagine, strung haphazardly from point to point. There is a strip of gardens, then much neglected because of the war, along the river bank. There are the fish restaurants and they even have a species of fish peculiar to the Tigris. Lots of old men seat themselves at tables along here and play dominoes, apparently all day long. There are a few modern high-rise hotels belonging to international chains such as Sheridan, Meridian and Novotel. Their construction had been heavily subsidised by the government to the tune of 90 percent. There were some fine mosques and the call to prayer, blasted from loudspeakers at the top of minarets, seemed interminable. Away from this central area, residential New Baghdad stretches far in every direction, mostly well laid out with wide, straight streets, but quite without the interest of the old city.

We stayed at the Dar-al-Salaam hotel on Sadoun Street, one of the wide, modern streets near the city centre. Most of the time, that is. While we were there an international trade fair was held and in order to accommodate the organisers and visitors, most hotels, including ours, were commandeered. We went to the Adam Hotel across the road. Not all that bad, but one unusual feature I remember especially. One of the double doors leading into the dining room had a V-shaped notch cut, or rather knawed, in the bottom edge. When we were at breakfast we noted the resident rat, coming down the stairs and then

coming in to see what could be scrounged. I am sure that the Sheraton lacked such interesting touches.

The hotel food was adequate if dull. All buying was bulk buying by the state. Some days there was lamb (rather mature lamb!) in the shops, some days poultry. Spaghetti bolognaise was a great standby. What the meaty portion consisted of we never knew, but it seemed to do us no harm. The food did get very monotonous but we hesitated to be too adventurous. There was what at first sight appeared to be a Wimpy bar in Sadoun Street. Closer scrutiny showed that it was a WIHPY bar, clearly meant to deceive because the 'H' was cleverly distorted to look quite like an 'M'. We did not venture to eat one of their burgers. Beer was available and some very inferior wine, which was to be tried once and never again. The usual soft drink was Pepsi-Cola, in bottles with the familiar label on one side and the equivalent in Arabic on the other. It was expensive. In summer the water from the tap was always lukewarm. Tony and I used to fill plastic bottles and store them in the fridge. The water was cloudy when poured and when settled there was a brown sediment at the bottom. It looked ominous but did us no harm. Even the 'sons of the prophet' quite openly drank beer in the hotels and bars and indeed the regime did not be too slavish in observing Muslim customs. Tony and I developed a ritual for Friday mornings. We took a walk along the river bank and ended up drinking, believe it or not, Nescafe at the Meridian Hotel. Even that was a very pleasant change from the hotel coffee, but it must be admitted that part of the pleasure was being waited on by a young Indonesian waitress, dainty, beautiful and utterly charming.

Most women wore Western dress and seemed to be quite free. Girls seemed to have the same educational opportunities as boys. The older women for the most part wore a long black robe with a hood, very like the costume of some of our nuns. Their faces were uncovered. There seemed to be none of that vile institution called purdah. I only saw two veiled women during my stay, which included visits to some of the holy cities.

As the war progressed, more and more Iraqis were sucked into the armed forces and the shortage of labour was made good by importing many thousands of Egyptians and later Filipinos and other Asiatics. The Filipinos solved one problem. There had always been a great many feral dogs in Baghdad and from time to time shoots or poisonings had been organised to bring down their numbers. Now the problem had entirely disappeared. For the Filipinos, dog was a delicacy!

Iraq, a big producer of oil, had benefitted from the big rise in oil prices engineered by OPEC (the Organisation of Petroleum Exporting Countries). As in some of the other member countries, it seemed to have been assumed that the exponential rise in the oil price would continue indefinitely, which of course it did not. Again not alone, many massive contracts were placed for capital improvements and when the time came to pay there were problems. Some of the expenditure was quite fanciful. The footbridges over the busy road to Amman, which I traversed every day, had escalators instead of fixed stairways. They never worked because the cloud of dust stirred up by all the heavy trucks, or sometimes blown in from the desert, clogged the works in no time.

The new sewerage system was working but the manhole covers had not arrived and there were gaping holes in the streets, usually quite without barriers. Great fun at night in the black-out!

The war affected us in various ways, but it was nothing like living in the London Blitz, even though Baghdad was only a few flying minutes from the Iranian frontier. During my four months' stay there was one air raid warning and no activity followed that. Food was dull but adequate, as we have said, and easy communication with the outside world was limited to our short-wave radio. We could get the B.B.C. (just then reporting the progress of the Falklands war) and often listened in the early morning to the English-language news from Dubai. The Israelis were at that time setting up their buffer zone in Southern Lebanon and they were predictably not too popular with the Arabs. I can claim not to be anti-semitic, indeed several of my friends had been Jewish, but I would find it easy to sympathise with the Palestinians and to become anti-Israeli. There was an English-language newspaper published in Baghdad but it reflected the viewpoint of Sadaam's government. Hardly impartial.

We were issued with identity cards in Arabic and allowed to shop for goodies in the Diplomatic Shop, where most things could be bought but had to be paid for in hard currency. F.A.O. looked after us almost too well, being anxious that no diplomatically embarrassing 'incident' should occur. We all had Jordanian visas and would have been got out at the drop of a hat if things had become dangerous. British employees of commercial firms could get about much more freely than we could. If we wished to go anywhere, to a state farm for instance, we had to give notice to the appropriate ministry two weeks in advance.

For my seed-growing project only the cooler, mountainous area of the north could possibly be useful. Sugar beet is a biennial, but it does not 'realise' that it is into the second, seed-bearing year of growth unless it has been through a winter. There has to be a long enough period of cool enough temperatures, which was quite out of the question in the Mesopotamian plain. There was an immediate problem, for the north was where the Kurds lived. They had been agitating for an independent Kurdistan for many years and seized a time when the Iraqis were busy fighting the Iranians to be a bigger nuisance than usual to Sadaam. So I never saw the mountain valleys where seed might perhaps have been grown. Tony and I had one trip north, through the oil town of Kirkuk, through Arbil to Mosul. There we had a few days in a very reasonable hotel on the eastern bank of the Tigris. Then we had leave to go to Dohuk and further north again to Zakho, at both of which were experiment stations where in normal times we would have made very helpful contacts. Zakho was most pleasant, with a lovely, graceful stone bridge across the river and the mountains of Turkey a very few miles away. But the unrest was such that all visitors had to be out of the town by 4 p.m. We returned through Aqra, a small town with attractive houses spilt on the sides of several hills. Even in a marked U.N. car we were advised to drive straight through without stopping. Many of these places figured large in the world news during the Gulf War and for a long time afterwards.

The way back took us through grassland where shepherds grazed their multi-coloured flocks and I was tempted to get out of the car to take a picture. Walking nearer I was quickly called back. "These people have guns", I was told. We went along the edge of a fertile valley where rice was grown in the flat land near to the river. At a couple of places we saw ancient monasteries perched inaccessibly on the mountainside. It is easy to forget that Mahomet lived more than six centuries after Christ and that Iraq was Christian before it became Muslim. Religions other than Muslims were still tolerated in modern Iraq. Our driver grumbled about the road, which was well furnished with potholes. He particularly grumbled at us because, he said, the British built it. When asked how long ago he said "in 1924"!

The ancient sites of Iraq are in some ways more spectacular than any in Greece, certainly much older. Names like Babylon and Nineveh and their rulers Nebuchadnezzar and Senaccherib are familiar names to us all, and there are others even older. Ur of the Chaldees is justly famous, but at that stage of the

war was quite inaccessible to us. It was too near to the battle zone. It is not surprising that the Iraqi Tourist Agency was jogging along at a very low level. There was one bus leaving Baghdad each Friday (the Sabbath), alternatively for the north and the south. In this way we got to Babylon and to the Shi-ite holy city of Kerbala and to Samarra. Other visits, to Nineveh, Hatra and Nimrud were squeezed in as unauthorised side-trips while on official journeys. Apart from such visits, other cultural activity took place in the fine State Theatre in Baghdad. We saw shows of traditional dancing and a concert of music with traditional instruments. The museums in Baghdad, said to be very fine, had been stripped of their treasures to preserve them from war damage.

Babylon had been left literally high and dry. The site had been occupied for more than 4000 years but the main development was under Nebuchadnezzar around 600 B.C. It was once flanked by the River Euphrates, but in flat plains rivers wander about considerably in the course of time and now it was 18 miles away. Construction is mostly in adobe faced with weather resistant fired brick. The site is impressive and has been largely excavated and not excessively restored.

Kerbala, to the south of Baghdad and Samarra to the north are ancient holy cities, Kerbala being especially revered by the Shi'ite Muslims. The main Muslim sects are Sunni and Shia or Shi'ite, the disagreement between them hinging upon the question of who was to succeed the Prophet on his death. Iraq is mostly Sunni and the Iranians are fairly solidly Shi'ite. It was distressful to the Iranians to have some of their holy cities in enemy territory. Tony and I went to both these places by tourist bus and saw (from the outside only, since we were infidels) the beautiful mosques with their immaculately shaped domes covered entirely with gold leaf. In Kerbala we saw what happened when a Shi-ite died. The family would hire a taxi with a roof rack and put the coffin (usually a very simple box) on top. It would be driven to the holy city and the coffin would be carried into the mosque for a blessing. The wealthy families could have their dead buried within the limits of the city, but most took them right back to their village to be buried there.

Of the Samarra mosques, one was enormous, with capacity for a congregation of 10,000 persons. It had a conical minaret 170 feet high, with a spiral footpath winding around it to the top, with a handrail attached to the wall and a sheer drop on the other side. It was a very hot day, so I let Tony climb it while I took pictures from a shady spot below.

Nineveh, near Mosul, dated from around 700 B.C. and had a massive perimeter wall, partly restored, ten miles long. It had water ducted from a distant river and an elaborate irrigation system at the time of Senaccherib. There are impressive remains.

Nimrud, for us another detour on an official trip, was the one-time capital of the Assyrian empire and preceded Nineveh as such. It had been impressively excavated and partly restored. A whole history was engraved on its rocks, if only one could read cuneiform. Hatra, another impressive site built in limestone and with many Greek architectural features, flourished in the first three centuries of the Christian era.

Present-day schisms in the Muslim religion had occasional funny results. Sadaam Hussein, a lover of grandiose memorials to his over-developed ego, built a new airport at Baghdad which was opened while I was there. It was absolutely splendid, with what seemed to be acres of polished marble. On top rose an enormous illuminated sign which read SHIA, standing for Sadaam Hussein International Airport. The sign did not last long, for it was quickly realised that SHIA was the name of the rival sect, Iraq being very largely Sunni.

Sadaam, of course, became very much a world figure during and after the Gulf War and has fully proved his remarkable staying power. There seemed to be two main sources of this: ruthless elimination of dissidents, a process which put deadly fear of any backsliding into his followers, and skilled handling of public relations. This included the media. Sadaam could be seen on Iraqi T.V. nearly every evening, pinning medals on soldiers, visiting hospitals or waving to cheering crowds in Baghdad. Thus there was a carefully cultivated picture of a kind and caring leader who was the subject of popular adulation. We knew how it worked. When a big 'spontaneous' demonstration was planned in Baghdad, all the schools, colleges, government offices, state farms and other state enterprises were closed down for the day. Every available bus or lorry was commandeered to bring all the personnel into Baghdad and each person was given a packet of sandwiches and a flag to wave. The apparent enthusiasm was easy to explain: it would have been dangerous to act otherwise. There was a sting in the tail too: since all these people had taken a day off to demonstrate their zeal, they were required to do their normal work on the following Friday, which should have been a day off.

On the farming front, the private sector seemed to be doing well. Composed mostly of small family farms, they grew fruits and vegetables that sold at a high price in the town markets. The state farms were utterly hidebound by bureaucracy. We found some competent people on the sites, but every decision had to be sanctioned by a distant office. We heard of crazy happenings, like a number of combined harvesters being requested in good time, but only arriving weeks after the barley crop had ripened. By that time the grain had mostly shed on the ground. Cropping plans were often imposed without any regard to local differences in soil salinity, which is a major factor in an area which has been irrigated for thousands of years. Even on one farm the soil could vary from high fertility to salt desert.

So there it was, a most interesting but quite futile activity for us. Our report was completed, approved by F.A.O. and doubtless shelved by the Iraqi government. They were to go on with the Iranian war for several years more and then, having brought that to an inconclusive end, before much longer they were to invade Kuwait. This had consequences known to all.