"Who in the world am I? Ah, that's the great puzzle."[1]

Chapter One

Early Years

Gravesend, where I was born, is about 25 miles east of London on the River Thames. The river there is about a mile across, and at that time ships from all over the world came by on their way to the London docks. As a ship would come up the river, three tugs would hurry across to its side and accompany it while it moved on. From the first of these, you could watch the pilot climb aboard; then, from the second, the health officer; and finally the customs officer. There were occasionally large vessels coming from the Far East, Australia, New Zealand, or India that could not travel further, and so they were moored in the middle of the river. Thus, Gravesend was very much concerned with the sea, and people such as pilots, lightermen, and customs and health officials abounded (Figure 1.1).

My grandfather, also named George, was a grocer and an "oil and color" merchant—that is, one who sold paint. My father, Harry, was the youngest boy. My father's oldest brother, whom we called "Uncle Bertie," attended private school and took degrees in theology and semitic languages at Oxford. He became a rector, wrote a number of esoteric and scholarly books, and was rarely heard from again.

In 1892, Pelham, the second son, was lured under false pretenses to make his fortune in the United States. He was about 20 when he got off a train in Nebraska to find nothing but the howling wind, but

[1]All quotations appearing above chapter titles are from Lewis Caroll, *Alice's Adventures in Wonderland*, originally published in 1865 by Macmillan.

An Accidental Statistician: The Life and Memories of George E.P. Box, First Edition. George E.P. Box.

FIGURE 1.1
Pilot leaving Terrace Pier, Gravesand, Original by Anthony Blackman.

he later returned and stayed in the United States, becoming a citizen and eventually working for the railroad in Chicago. When he retired, he moved to Florida where he had a small citrus grove.

Over the years, my family fell on increasingly difficult times. My father had hoped to go to engineering school, but by the time he was a young man, the family had little money and he had few career choices. Two sons had already left, so my father stayed and found work as a "clothier's assistant." He had a hard life. When I was growing up, he still worked in a tailor shop, at Tilbury docks, across the river from Gravesend. To get to work from our house on Cobham Street, he had to walk about a mile to the Town Pier at the bottom of High Street, cross on the ferry, walk some more, get on a train that took him to Tilbury docks, and then walk again to get to the shop. In the evening, he would face the same journey in reverse, sometimes in the pouring rain. He was poorly paid—two pounds ten shillings a week was barely a living wage.

Because people had to use coal for heating and cooking, the resulting fog could sometimes be so thick that objects four or five feet away were invisible. My father got across the river then in a small boat. On foggy

days, lightermen (who transferred goods between ships and docks) made extra money by taking people across.

When I was about nine, I learned to use stilts, and walking on these, I would meet my father at the end of our road. He would sometimes have a pennyworth of roasted chestnuts in a paper bag that he would share with me.

From the time I was about five years old, I sometimes went with him to Tilbury. I liked perching myself at the very front of the ferry and watching it cut through the water. My father had a friend called Mr. Launder who kept a tobacconist and barber shop at Tilbury docks. Mr. and Mrs. Launder, who did not have any children, liked for me to come and visit them. I provided some entertainment to the people waiting at the barber shop by reciting poetry. I remember one poem that began, "Great Wide Beautiful Wonderful World," and a line I liked was "World, you are beautifully dressed." I enjoyed poetry and tried writing some myself.

Despite his hard life, my father was a happy man. With the help of my sister Joyce, he would frequently organize picnics and parties. Our parties were not like parties now. There were no alcoholic drinks. (It wasn't that we were teetotalers; we just didn't have any money.) We gathered around the piano and sang sentimental Victorian songs; most of these sound pretty silly now. We also played all kinds of party games: musical chairs, hunt the slipper, "murders," and so forth. In addition, we performed plays of our own invention. And there were mysteries when my father demonstrated the power of the magic wand.

When we wanted to go somewhere for a picnic, we walked. Cars were for rich people. Although we did not have a car, we did have a "barrow," which we pushed. This was my father's invention. It could be steered with two pieces of rope, and in the back, it carried supplies: cricket bats and picnic things. We would walk with the barrow to some pretty place we liked, perhaps about three or four miles away.

The countryside was lovely. Cobham village was only four miles away, and the church and the two pubs there were old, unspoiled, and beautiful. One pub was called the Dickens Inn because Charles Dickens had written some of his books there, and he chose this locale for some of his stories. In his book *Great Expectations* (1860, Chapman & Hall), you will find, for example, that the prison ship from which the convict

Magwitch escaped was just below Gravesend, and it was near Gravesend, that Magwitch was finally caught. Close at hand inland was the village of Meopham (pronounced "Meppam"), with a fine cricket field, and a lovely place for picnics called the Happy Valley. There we sat in the grass, made a fire for cooking and heating water for tea, and we sometimes played cricket.

My mother had a difficult life, with such meager resources, trying to provide for a family. She fed and cared for not only our immediate family but also for various relatives who lived with us while I was growing up. And she also had to contend with my father, whose kindness and generosity knew no bounds. I am afraid her life was often one of quiet desperation.

But it was not all gloomy. Sometimes we went to the park on Windmill Hill, where we would play and my parents would have a beer at the pub that backed up to the park. On other occasions, my mother and my father would go out together in the evening, perhaps to see a movie, and my sister Joyce would take care of my brother and me (Figure 1.2).

Joyce was ten years older than me. Her mother, my father's first wife, had died in an influenza epidemic. Joyce could always come up with an exciting game, and we often played cowboys and Indians. Joyce had a lot of responsibility within the family but was a very good sport about it. In addition to watching over my brother and me, she was also my father's chief helper around the house. My father was a wonderful handyman, and this was fortunate because we had so little money. He could do most things that others hired people to do: roof mending, gas fitting, paper hanging, and so on. But every now and again, he and Joyce quarreled and Joyce would run downstairs very upset and say, "I won't help him anymore!" After about ten minutes, my father would come downstairs and apologize. Then they would make up and things would go along quietly for a bit (Figure 1.3).

In 1926, a man called Alan Cobham became famous when he flew from England to Australia and back, landing his plane in the River Thames in front of the Houses of Parliament. He was promptly knighted. Later, Sir Alan formed Cobham's Flying Circus, a group of fliers that went around England showing off their skills and giving plane rides to the public.

FIGURE 1.2
Growing up, Clockwise from left to right, me, my brother Jack, and my sister Joyce.

In the early 1930s, Cobham's Flying Circus was performing in a field close to Gravesend and Joyce and I went to watch. Plane rides were part of the show, and to my astonishment, Joyce said, "Come on, Pel, let's go up in an airplane!" I said, "But Joyce, it's *five shillings*!" Five shillings seemed a huge amount of money. "Just this once," she answered, and so up we went in this small plane and thrilled to the views of town and countryside. Although it wasn't a very long flight, it was my first and I never forgot it.

FIGURE 1.3
My father and Joyce.

Joyce worked at Woolworth's, where she eventually became an overseer. I realized much later how she had contributed substantially to the family budget for many years and, in particular, how her sacrifice had made it possible for my brother Jack and me to get an education. I know if she had had the chance, she would have done just as well.

My brother Jack was three years older than me. He could not have been more than 13 when he became very interested in amateur (ham) radio. He designed and built a transmitter, and as he couldn't apply for a ham radio license until he was 17, for some years, he had a "pirate" station. The town had many ham radio enthusiasts, and they used to communicate with others throughout the world. When you made a

contact, you exchanged "QSL cards." These were decorated postcards showing your amateur station's designated call sign in large letters (G6BQ in my brother's case). You might be particularly proud, for example, of a QSL card from some remote part of China. The cards were often used by hams to decorate the walls of their "shacks." Jack used a small shed that my father had constructed at the back of the house for his shack. Thinking about it now, my father, sister, and I formed a cohesive group. Jack was always happy with his radio (Figure 1.4).

Behind the houses on Cobham Street, there was an extensive area of allotments. These were rectangular plots of land that you could rent for growing vegetables. They also proved useful for erecting antenna poles to achieve long-range radio contact. Erecting an antenna pole was quite a task, so friends and other hams came and helped. Reception depended to some extent on the direction in which the antenna was pointing, so Jack managed to persuade a number of allotment holders to allow poles to be erected on their plots so that he had antennas facing in all directions. From the nearby railway station, you could see the various antennas, and stories got around, especially during the Cold War, about

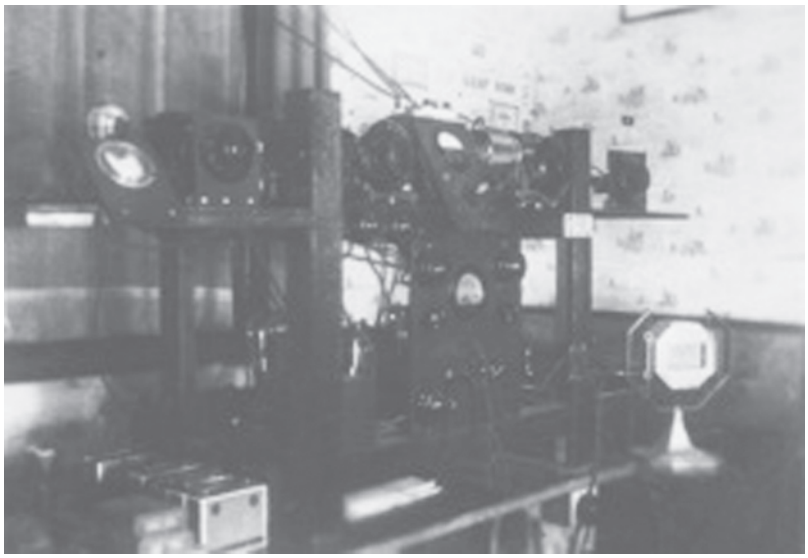

FIGURE 1.4
Jack's radio.

their purpose. I remember one ham radio colleague complaining to me about the number of Jack's poles. He said, "I don't mind helping him with *one* pole, but he wants them all over the place."

There was a scheme to take over the allotments to build a car park for the many people who took the train to London. This plan didn't suit Jack, and for weeks he went around collecting signatures opposing the car park, arguing disingenuously that the allotments were needed to grow food. His scheme worked for a number of years, but I have seen in a recent photograph that the car park is now firmly established.

When I was about ten I came a cross a book called *The Boy Electrician*.[2] The fascinating thing about it was that it was a "can do" book. The apparatus and experiments that the author described could all be constructed from components which were readily available. He told for example how to make an electric bell or burglar alarm, a morse telegraph, an experimental wireless telephone and an electric motor.

From the first day I saw it, the book was seldom in the library. I had a friend, Jim Tatchol, who was equally interested and we spent hours together making, or trying to make, the things in the book. In doing so we learned a great deal. We were also fortunate in having a very sympathetic physics teacher who after school spent hours with us helping to make things work.

When I was about eleven years of age, I used *The Boy Electrician* to build myself a crystal set. With this I would listen to the BBC on headphones after I went to bed. From about 10 p.m. until midnight, the station transmitted live dance music from one or another of the big hotels in London. They all had dance bands, one of the most famous being the Savoy Hotel Orpheons. Others were named for the dance bandleaders: Jack Payne, Harry Roy, Geraldo, and so on. I can still sing many of the songs that were popular then. My antenna was looped around the ceiling, and I could get good reception provided that my brother was not on the air.

The establishment of the BBC as an independent entity was largely due to its first director, Sir John Reith, to whom we remain forever grateful. Sir John, however, was very religious, so on Sundays, the station carried only religious programs. On those days, we listened instead to Radio Luxemburg and Radio Paris, which were commercial stations that

[2]Alfred P. Morgan, *The Boy Electrician*, Lathrop, Lee & Shepard, 1913

carried special programs in English. I can still remember the jingles that accompanied the commercials, such as:

We are the Ovaltineys,
Little boys and girls;
Make your request, we'll not refuse you,
We are here just to amuse you.
Would you like a song or story?
Will you share our joys?
At games and sports we're more than keen;
No merrier children could be seen,
Because we all drink Ovaltine,
We're happy girls and boys!

[Citation: Harry Hemsley, "We Are the Ovaltineys," 1935; theme song on Radio Luxembourg show, "The Ovaltineys Concert Party" from 1935 to 1940.]

My family lived in a rather large, semidetached house at 52 Cobham Street, which as I mentioned, we often shared with relatives and friends. When I was small, there was Mr. Strickland, a lodger, who lived downstairs in the basement. My mother told me that as a child I walked in my sleep and on one occasion had walked down three-and-a-half flights of stairs and said to Mr. Strickland, "Go away, Stricky, I'm in the middle of a dream." After Mr. Strickland died, we took over the two basement rooms for a kitchen and dining room.

As a child, my best buddy was my maternal grandmother. I used to sit on her bed, and she told me stories and read to me. This was when I first heard what is still my favorite book, *Alice in Wonderland*. Except for the kitchen, the rest of the house was not heated, but there was always a fire in Grandma's room and I used it to make hot buttered toast for both of us. When she died and I couldn't find her, an aunt told me that she had "gone to live with Jesus." I said, "I don't want her to live with Jesus. I want her to live with me."

Aunt Lina, my father's sister, lived in a room on the ground floor of our house when I was about ten years old. (She is pictured at lower right in the 1893 Box family photo locates in the Preface.) Aunt Lina read a lot, but she was stone deaf. I could only communicate with her by writing things down, and she enjoyed this. I must have realized how lonely her

life was because I taught both of us sign language, and from then on, we communicated with our hands. One game that greatly amused her was when the family was gathered around the table for a meal. I would sign a funny message with my fingers, such as "Uncle So and So makes a terrible noise when he's drinking soup," and she would go into fits of laughter. The joke was, of course, that normally she was entirely cut off from what was being said, but *this* message only she and I could understand.

After I went to grammar school, I had a friend, Cyril Jones, whose parents had a car. One day we drove down to a place called Tudely-cum-Caple near Dover to see Aunt Daisy, who was my father's other sister. She and her husband had a small holding that did not look very prosperous. Soon after this, her husband died and Aunt Daisy came to live with us. She also was deaf, but not totally, and she had a very primitive hearing aid. She liked to dance, and I was frequently recruited as a partner (Figure 1.5). Like my father, she was a happy person and liked to play the piano and sing.

And then there was Uncle Willy, who was actually my father's first cousin. He lived 12 miles away in Gillingham and, to my mother's dismay, would turn up unexpectedly and expect to be fed. He had money, which we didn't, so we did our best not to offend him. He had worked for the Admiralty on airship design and had helped design the airship R33, which crashed. He had also been on a trip up the Amazon River, and he had composed a long lecture, "One Thousand Miles Up the Amazon," which he illustrated with lantern slides. He endlessly rehearsed this at our house, consulting my father on the text. I can remember my father coming home from a hard day's work and my mother's cry of despair, "Uncle Willy's here." He was very mean with his money, and I recall him telling my mother how he had once saved a penny by changing buses on his way to see us.

Uncle Willy eventually died, and we inherited his musical instruments, which included a banjo, a guitar, a violin, an organ, and a player piano. My father could produce a tune from almost any musical instrument, but what he liked best was what we called the organ, which was really a souped-up harmonium.

Willy had been a keen photographer, so we also inherited a very nice set of lenses. As a boy, I very much wanted a camera, but we didn't have any money to buy one. I saw an advertisement for a new newspaper,

FIGURE 1.5
Dancing with Aunt Daisy.

The Daily Herald, that was to begin publication. To encourage circulation, they printed a coupon with each issue and after you had collected 100 consecutive coupons, you could get a free camera. My father was already receiving a different paper, the *Daily Chronicle*—we called it the *Daily Crocodile*—which was more aligned with his political views. With his typical kindness, he switched to the new paper (although he much preferred the other), during the time it took to collect the coupons and I got my camera.

I used Uncle Willy's lenses to build an epidiascope projector so that I could put on "shows" of the photos that I took of family picnics and

outings (Figures 1.6 and 1.7). I built it of wood, painted the inside black, and used two 100-Watt bulbs that heated up to the point that those in attendance experienced some rather strong fumes. To make it a proper show, I hung a white sheet on the wall for a screen. I also wrote and projected commentary cards to accompany the photos that said things like, ''Hello Uncle Jack and Aunt Maggie. Many happy returns of the day.''

My father also inherited some money, but here Uncle Willy's meanness was catastrophic. To save money, he had not employed an attorney to help him write his will. Instead he had purchased a form for sixpence. The will said that his money was to be divided into six parts, one of which was to a charity. On the strength of this, my father bought the house for which we had previously been paying rent. However, one of the intended recipients of the proceeds of the will had died and the lawyer for the charity disputed the will. The lawyers for the various parties argued about

FIGURE 1.6
A family picnic. From left to right, my brother Jack, his wife Gladys, Joyce with her husband Alfred, and cousin Vera.

FIGURE 1.7
Uncle Jack and my father bringing tea from a local house to the rest of us picnicking at Happy Valley.

this until most of the money was gone, leaving my father a debt that was a great worry to him.

In England, an elementary education was available to all but you were taught very little—mostly how to read and write and to do simple arithmetic. The classes were very large, and you left when you were 14 years old, usually to get a menial job. There was no possibility of escape unless your parents could pay for you to go to a grammar or secondary school, which of course mine couldn't. It was possible to get a scholarship, but there weren't very many of these. The class system based on money was heavily entrenched.

Mr. Spencer, the headmaster of the elementary school I attended, by some means or other, became aware of a poem I had written. To check me out, he told me to sit at a table next to his desk and write poetry. I wrote four poems. After this, he had me stay after school to prepare under his guidance for the scholarship examination.

I remember that during the oral exam I happened to say the word "chimney," which I pronounced "chimley." The examiner asked, "How do you spell chimley?" I spelled it correctly, so he said, "Well why do you say chimley?" I passed, and soon after I went to the new school, which

FIGURE 1.8
Second form at Gravesend County School. I am the first left in the back row.

was called the County School for Boys. I started in the second form, at age ten (Figure 1.8). There was another boy of about my age whose name was also Box (Ronald Box). He was on his bicycle when, unfortunately, he was hit by a truck and killed. The whole school of about 500 boys gathered together in the auditorium each morning with the youngest boys at the back. The headmaster announced from the platform that *I* had been killed. This, I think, was the only time that he said nice things about me. I am told that I walked all the way from the back to just below the platform and said, ''Please, Sir, I'm not dead.''

My brother Jack and I were among the very few scholarship boys in the school. Although almost all of the students came from families that had more money than mine did, I made friends. But there was one student whose mother would not allow me in the family home when her son and I played together. By contrast, the mother of my friend, ''Ginger'' Harris, thought I was a good influence on her son. I was never particularly strong, but I made up for my lack of physical prowess by inventing games that the other boys enjoyed.

The second form started immediately with French, Latin, English grammar, English literature, physics, and chemistry. We also began mathematics—first algebra and then geometry—and we began calculus in the upper fourth form. My first math teacher nobody liked. He was sarcastic and unresponsive to questions. But later we had a different math teacher, Mr. Marshall, who for some obscure reason was nicknamed "Banners." He was genuinely anxious that everyone in the class understand the lessons, and he was tireless in explaining difficult points. With his guidance, I quickly moved ahead in the class.

I remember one incident with Banners when one of the boys had brought his pet mouse to school in a little box. During class he was showing his mouse to a friend when it jumped loose and started to run about in the front of the room. Banners pursued it with the pointer, and after a number of near misses, the mouse took refuge under a radiator. The little boy who was owner of the mouse remarked, "Please, Sir: that's my mouse!" Banners replied very apologetically, "Oh I beg your pardon. I didn't know it was a *private* mouse."

Unfortunately, before I could go to the new grammar school, I had been subjected to a "health examination" and it was decided (on what grounds I never understood) that I had to have drops in my eyes for *six months*. As a result, for much of the first year, I couldn't see what was written on the blackboard and had difficulty reading the printed page. I missed such things as the beginning of French, algebra, and English grammar. My father did his best to help and wrote out my homework for me as I dictated. It took a very long time to catch up with my studies, so whereas in elementary school I had been close to the top of my class, at the new school, I had to get used to being close to the bottom. By age 16, when one or two of the boys got to go to a university, I was not among them.

During all this time, Mr. Spencer from the elementary school remained my friend. He was also head of the Sunday school, and our house was on the way to his, so each week after Sunday school, we would walk home together and we discussed just about everything.

One thing I made which was a success was what was called a shocking coil, which was a watered down version of an induction coil. This consisted of a core, which was made of slives of iron wire, and this was wrapped with primary and secondary insulated copper wires.

Each year at our school there was a "prep fair" that raised money for the town hospital. My project for the fair was to make a shocking coil. The coil had two handles, one of which was in a tub of water. The other handle was held by the "client" who was visiting the fair. The client paid sixpence, which was dropped into a locked box. At the bottom of the tub were coins.

The client would reach into the tank to pickup some of the coins, but I had a dial under the table that was connected to a rheostat, and as the customer grasped for the coins, I turned up the dial which gave the person a substantial shock. No one managed to get any of the money until this woman came along, and when it was her turn to reach into the tank, I turned up the dial as usual, but she wasn't the least affected by the shock.

She took all of my coins and she deposited these into the locked hospital box. This left me with no coins with which to lose more clients. Finally Banners, the math master, gave me some money so that I could continue.

I wasn't much good at learning French, but a boy in my class called Newton was, and he wrote a play in French. The French teacher liked it and decided that we should put it on in the school auditorium with parents invited. I had a small part as an "Englishman who didn't know much French," which suited me very well. The French teacher and his wife were very kind, and while rehearsing the play, we had refreshments at their house.

Because my lack of French limited my participation as an actor, I wanted to help all I could in other ways. For example, in the play, someone got shot. I found a realistic-looking toy gun for the actor to flourish, and after much experimentation, I found that a hollow pencil box struck against a plywood panel sounded very much like a pistol shot. I had to watch carefully to synchronize it with what was happening on stage to make it sound genuine.

There was one scene where people were sitting around a table having dinner. To make this look real, I persuaded my brother Jack to ride his bicycle to get six helpings of fish and chips. He arrived a bit early, and the intense smell of the fish and chips was evident for a long time in the theater before and after the actual scene.

Later I had a small part in a *school* play, Shakespeare's *Macbeth*. This was a much more serious affair. My scene occurred at night inside the gates of Macbeth's castle. The audience knows that Duncan, the king, has been murdered, but this is not known to Macduff and Lennox, who are outside the gate knocking to gain admittance. I played the part of the porter who, instead of opening the gate, engages in a long drunken harangue in which he imagines himself porter at the gates of hell. He admits a series of imaginary visitors—a farmer who hanged himself in the expectation of plenty, and so on. Finally he opens the gates to Macduff and Lennox, but the action is further held up when the porter gossips, humorously, with Macduff, a device that effectively increases the tension. At one point Macduff asks the porter, "What three things does drink especially provoke?" to which I replied:

> Marry, sir, nose-painting, sleep, and urine. Leachery, sir, it provokes, and unprovokes; it provokes the desire, but it takes away the performance: therefore, much drink may be said to be an equivocator with leachery: it makes him and it mars him; it sets him on, and it takes him off; it persuades him, and disheartens him; makes him stand to and not stand to; in conclusion, equivocates him in a sleep, and giving him the lie, leaves him.[3]

I was keen on chemistry, and when I left school at 16, I got a job as an assistant to a chemist who managed the sewage treatment plant at Gravesend. I became very interested in the activated sludge process responsible for producing a clean effluent that would not pollute the river, and the first article I ever published was about this topic.[4] While at the plant, my goal was to get an external degree in chemistry from London University. I wasn't paid much, but I was allowed two free afternoons a week to go to Gillingham Technical College where I could attend the necessary courses.

To get to Gillingham, if I had the money, I sometimes took the train, but most often I rode my bike 12 miles along the hilly and busy road

[3]William Shakespeare, *The Complete Works of William Shakespeare*, Vol. 2, Garden City, NY: Nelson Doubleday, Inc., nd, p. 799.

[4]Ronald Hicks and G.E. Pelham Box, "Rate of Solution of Air and Rate of Transfer for Sewage Treatment by Activated Sludge Process," *Sewage Purification, Land Drainage, Water and River Engineering*, Vol. 1, June 1939, pp. 271–278. Hicks was my supervisor but did not take part in writing the article.

that passed through Stroud, Chatham, Rochester, and Gillingham. One day my plans almost came to a sudden end when a truck driver's error sent my bicycle and me skidding under his vehicle. His back wheel just missed my head, and my bicycle was a wreck I spent about eight months writing to his insurance company trying to get them to pay to replace it. After months of arguing, they finally did.

To get an external degree in science at London University, you had first to pass the Intermediate Science Exam. After that, with a year or two of further study, you could attempt the Bachelor of Science degree exam itself. I had to go to London to take the intermediate exam, which included a two-day practical exam as well as a week-long written part. My subjects were pure and applied mathematics, physics (heat, light and sound, electricity, and magnetism), and chemistry (organic and inorganic). These were the most difficult exams I ever took, but I passed and they helped me get a grounding in science that has been invaluable ever since.

I believe that it was this basic scientific knowledge that helped me later on to come up with ideas in the development of statistics. It would, I think, be tremendously helpful if, before taking a degree in statistics, there was a requirement to pass a similar preliminary exam in science. A serious mistake has been made in classifying statistics as part of the mathematical sciences. Rather it should be regarded as a catalyst to scientific method itself. Proper preparation for a degree in statistics should be like that for the intermediate science exam described above, which would include running real experiments.