

Bristol Physics in the 1930s

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In 1932, when I was a lecturer in the mathematics faculty at Cambridge and doing research on quantum theory, I was invited to fill the Melville Wills Chair of Theoretical Physics, to succeed J. E. (later Sir John) Lennard-Jones. I took up the position in the autumn of 1933, and held chairs in the Physics Department for twenty years. My memories of Bristol in the 1930s are in the main of the H. H. Wills Physics Laboratory, and particularly of Arthur Tyndall, its creator, and of the influence of the refugees from Nazi Germany who came to us at that time.

How it was that Tyndall was able to interest the Wills family in physics I do not remember very clearly, but I believe he said that he and a member of the family used to walk together across the Downs on their way to work, Tyndall talking about physics and what it could do in the world and what it could mean to Bristol. This was a time when the scientific community was tiny compared with what it is now, when Rutherford's Cavendish and Bragg's Manchester were the only physics centres in this country with an international reputation, but when at the same time the splitting of the atom, Heisenberg's uncertainty principle and Einstein's theories of relativity were bringing the subject to the attention of a wider public than before. Whatever the reason why the princely generosity of the Wills family inclined towards physics, when I first visited the University that very remarkable building, the H. H. Wills Physics Laboratory, was complete. It was of course without the additions later made to it, and standing on Bristol's highest hill, next to the charming Royal Fort gardens with the view over to Dundry Hill not yet obscured by the back of the Engineering laboratories, it was most impressive. With the building complete, the generosity of the Wills family provided also the funds to endow the second chair, which was offered to me, and as well a number of junior research positions. Nonetheless the spaciousness of the building in relation to the number of people using it was something I have never experienced before or since, with a large room to himself for every research student. For many of us there were the lightest possible teaching and administrative duties, and there could not have been a better opportunity for research. Over it all presided Tyndall - happily aided (I might add), by his secretary Alice Masters (now Mrs Terry). There were Sunday walks on the Mendips or Cotswolds led by Tyndall, and parties at his house with ping-pong, and his evident and intense pleasure in the achievement of his staff is something that we all remembered. Among my colleagues were Cecil Powell, later to achieve fame and a Nobel Prize for his discovery of the 'pi-meson', Herbert Skinner, who after the war was director of a division at Harwell and later professor at Liverpool, Harry Jones, pro-Vice-Chancellor at Imperial College before he retired, and men like Stephen Piper, awarded as was most just an *ad hominem* professorship before his retirement, who carried the main teaching load while the new men pursued their research. The honours school was small, five at the outside, but including some people who made their mark afterwards, particularly the radio-astronomer Sir Bernard Lovell and Deryck Chesterman, now Professor of Physics at Bath.

In 1933 Hitler, fortunately for us, nearly destroyed German physics by making it impossible for the Jewish element to remain. Those who came to England had a profound effect here, particularly perhaps in Oxford where the strong refugee team collected by Lord Cherwell led to a renaissance of physics in that university. But the effect in Bristol was very great too. All through the period up to the war Walter Heitler, the originator (with F. London) of the quantum theory of the chemical bond, was with us. For a while so was Hans Bethe, who later went to America and was awarded the Nobel Prize for his contribution to the theory of the source of the sun's heat. Bethe is now one of the most respected of the older generation of the US physics fraternity, a man whose evidence in the notorious security trial of Robert Oppenheimer was a model of moderation and good sense; in Bristol I remember his equanimity and friendliness, his enormous appetite and his equally enormous productivity in theoretical physics. When something was clear in his mind and ripe for publication he would withdraw into his little room at the end of the passage on the second floor of the laboratory and hardly emerge till his paper was ready, written in his clear handwriting, for Alice Masters to type. Then Herbert Fröhlich, who went from Germany to the USSR and was later expelled from that country, came to us, lucky to have survived two tyrannies; after the war Chadwick appointed him to a chair of theoretical physics in Liverpool. How we found stipends for all these talented people, even at the figure of £300 a year, I cannot remember, but some must have come from the Academic Assistance Council and some from the Wills Endowments. One of them achieved a particular notoriety, Klaus Fuchs, who was employed in 1943—44 at Los Alamos in the US on the atomic bomb project and communicated what he knew to the Russians; he was arrested in Harwell after the war and suffered a long term in prison; he is now in Dresden in the German Democratic Republic. I remember how he was brought to my office by Ronald Gunn, a director of Imperial Tobacco and a Quaker, with whom he lodged during the war and who to the best of my belief supported him. He was not Jewish, but a political refugee. He was a very shy young man, who did, under my direction, some excellent research. His views, as we all knew, were left wing, and at the time of the Spanish Civil War, the rise of Hitler and Mussolini's invasion of Abyssinia, so were those of many of the young physicists. At that time in the USSR Stalin was liquidating the men who had made the revolution, and verbatim scripts of the 'treason trials' were published in translation. A Society for Cultural Relations with the Soviet Union used to meet in Miss Brownlee's studio, half way down Park Street and destroyed in the blitz of November 1940, and we read these trials there, each of us taking a part, and wondering innocently if these men really were guilty of the treachery imputed to them. Klaus Fuchs took the part of the prosecutor, Vishinsky, for which he threw away his shyness and attacked the accused with a venom which showed clearly enough where his sympathies lay.

Apart from the refugees, other physicists who came to Bristol during this period included Ronald Gurney, who died in the US after the war, and Frank Nabarro who came from Oxford and is now professor at Witwatersrand. In addition to the achievements of the school on fundamental particles which later achieved such distinction under Cecil Powell, I think it would be fair to say that many of the foundations of what we now call solid state physics were laid in Bristol in this time by some of these men, working with Skinner and Jones and myself. We used to organise international conferences at a time before such meetings became the rage, some of the early ones being published by the Physical Society. R. W. Pohl of Göttingen came to one; Pohl, who recently celebrated his ninetieth birthday, is in my view the real father of solid state physics. He recently wrote to me from Germany of his gratitude to Bristol as the first international centre which took his work seriously, at a time when

atomic science, quantum mechanics and the nucleus were at the centre of everyone's attention. Pohl's work was on 'colour-centres' in crystals of rock-salt (sodium chloride). The chemical formula of sodium chloride is NaCl, meaning that there is just as much sodium as chlorine in the crystal, but Pohl found that traces of sodium in excess gave the material a deep colour and enabled it to conduct electricity. Pohl felt that most of his colleagues in Germany felt this to be 'dirty' physics, and did not appreciate as we did that he had made it 'clean' and a precise branch of science. In fact the ideas of that time led through war-time developments and some brilliant work in America's Bell Telephone Laboratories to the transistor and with it to a whole new industry, solid state electronics. Another memory that I have of Pohl at one of these conferences is his asking me in 1938 or 1939 why the young English physicists no longer came to Göttingen as they used to in the early 1930s, the great days of the Göttingen school of quantum theory, and indeed as I had myself. I said they were afraid of war breaking out and being trapped, as Chadwick was in 1914 in Berlin. He could not believe it. 'Ach, nein', he said, 'it is impossible, not again ...'.

Bristol in the 1930s must include the outbreak of war. Many, perhaps most, of us were soon involved in military work, on radar, operational research or later the atomic bomb. On the bomb, I must say that in the Department in 1939 and 1940 it was common tea-table talk that it could be made, but how easily or with what industrial resources we had not the information to guess. In 1940, with the fall of France our refugee scientists, as enemy aliens, were interned; Fuchs had left us to work with Max Born in Edinburgh, but he was interned too and shipped to Canada and brought back to work on the bomb, ultimately in the US. We had six, among them Heitler, Fröhlich, H. London, and Kurt Hosieltz, now director of research at Mullards. I remember filling in forms, certifying to the anti-Nazi sentiments of all of them and their probable loyalty to this country, which they could well serve in military research or other ways. They were in fact soon released, but the official at the Home Office must have turned the pile of forms upside down, as the most junior came out first, and the others one after another at intervals of a few weeks, and finally — understandably rather cross, the senior and most distinguished of them.

At the beginning of the war King's College London was evacuated to Bristol and for a time, before most of us dispersed to our war-time jobs, in the H. H. Wills Physics Laboratory there was no longer a separate room for everyone. It was sad that they came to Bristol only to lose their library in November 1940, when the roof of the Great Hall of the University was burned - to provide the setting under a corrugated iron replacement for a magnificent oration by the Chancellor, Winston Churchill, who conferred honorary degrees on the American Ambassador and Ernest Bevin.

If this article is concerned mainly with the Physics Department it is because this is where I was most involved. I have the impression that the Physics Department tended to be rather a world of its own, and apart from some useful co-operation with Professor Garner's chemists there was small interaction with the rest of the University. This was a pity, and a contrast to the post-war period when Philip Morris was Vice-Chancellor. Then I remember an expanding university for which everyone was ambitious and anxious to be involved. In Physics we felt 'let's do it better than Cambridge', and wondered regretfully why potential students still put Cambridge first; was it just the punts on the river? Before the war the size of the Physics Department was out of balance with the rest of the University; but the University was a friendly community, and if there was any jealousy because the Physics Department received so large a share of our resources, I for one never heard of it, at any rate in the pre-war period.

If this group of talented men did not often ask themselves where Bristol University was going and what we should do about it, there are two things to be said. From 1936 onwards we lived under the shadow of what seemed an inevitable war, of a character which we could not foretell, and still less could we imagine the future of a university. At the same time those of us in that small world of physicists knew they were part of an adventure that would change human thought and the human condition. It was a very absorbing world to live in.

Coming to Bristol from Cambridge, a great difference that struck my wife and myself was that the University was part of a city which had created it and - as it seemed to us - was proud of it. I felt then, as I have felt ever since, the enormous advantage of having men and women from the city involved in university affairs through their service on Council. If for instance it was proposed to create a chair *of* business studies, any don who said that this was not an academic subject could be quietly asked 'why not?'. The feeling of involvement of the business community and of the staff of many of the great schools was strong. The University Settlement under Miss Lucas was another link with the outside community. The University as a whole, with its contacts with city life, was a very friendly place and a very good place to work in.