

newScientist



Sir Peter Medawar: lives of a scientist

Sir Peter Medawar

Writer, philosopher, administrator, family man, opera and cricket buff—and one of the greatest of modern biologists, with a yen to find a vaccine for cancer: Sir Peter Medawar talks here to Robert Temple about his life and times, the people who influenced him, and those he has influenced in his turn

SIR PETER MEDAWAR looks and sounds every inch an Englishman. And there are plenty of inches—77, in fact, for he is 6 feet and 5 inches tall, or 1.95 m. For much of his life, however, his great height served only to call attention to the fact that he was not merely different, but “not quite English, you know”. His father was born in the village of Jounieh, north of Beirut in the Lebanon: “The name Medawar is Arabic. I think it means ‘to make round’. And an Arabic friend said to me, ‘It means “little round fat man”’. My father was a Christian Lebanese. He was a Maronite, though I’m not *completely* sure what a Maronite is”.

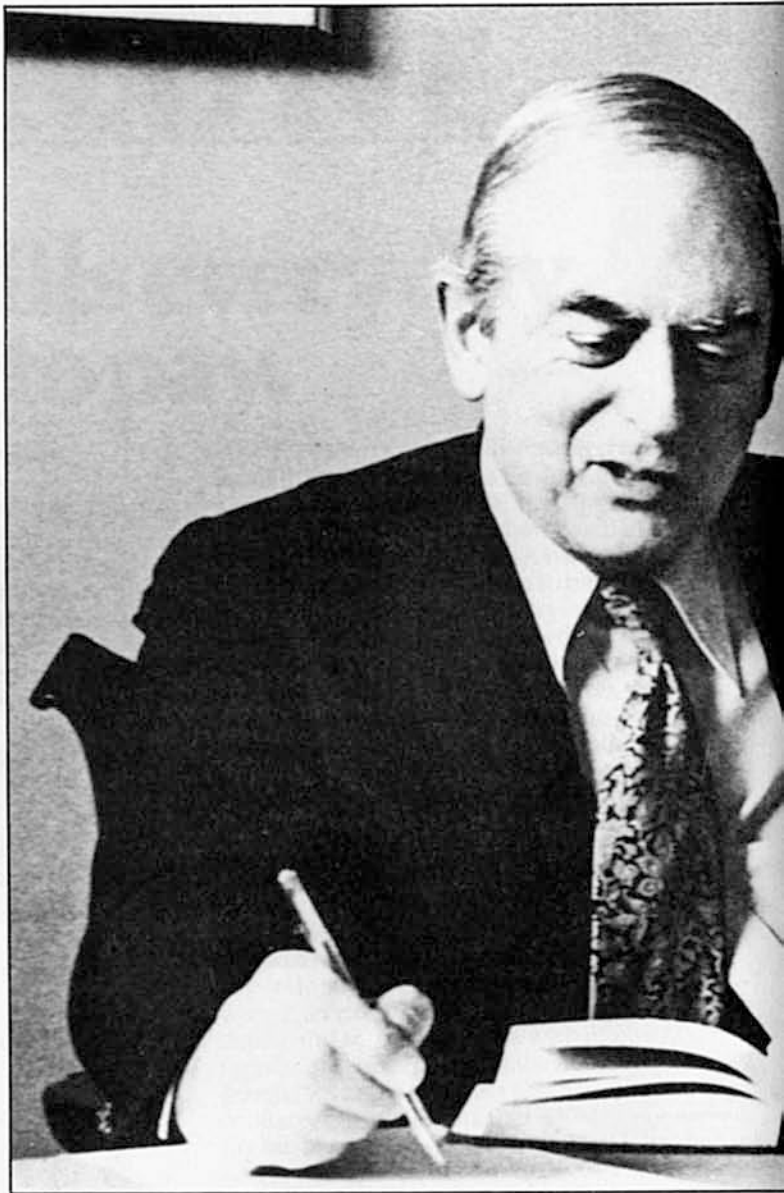
Sir Peter’s grandparents wanted their son to have an English education. While pursuing it, he took up residence as a paying guest in the household of the Dowling family in London. He fell in love with the daughter of the household, Muriel, and they were married. “My mother was a very large, very intelligent, very funny woman. She was no English Rose; in fact, she would burst into peals of raucous laughter if anybody had told her she was that. No doubt it was from her that I got my sense of humour.”

Sir Peter’s parents took up residence in Rio de Janeiro, in Brazil, where their children were born. “Father was a business agent, for optical goods, and he was also a collector of semi-precious stones, which Brazil abounds in. And he made a little money by collecting these, having them cut, and selling them. Just a fairly ordinary kind of business enterprise, called *Optica Ingles*. He had a competence; he and my Ma lived in comfort, but were not rich. I mean, they had enough money to send me to an English secondary boarding school and to Oxford.”

The Medawars in fact sent their son to Marlborough. Sir Peter recalls: “When I first went to Marlborough School, Marlborough College as they called it, the little lads behaved as you’d expect—they were critical and querulous at the same time, wondering what kind of person a Lebanese was—something foreign, you can be sure. My God, they were a disagreeable, hopeless lot of people. I really can say of my public school, I think I was uniformly unhappy from beginning to end, surrounded by pedants and pederasts. Marlborough was one of those schools, founded on the principle that if you left boys alone for more than two minutes, they would infallibly bugger each other. And therefore the lavatories were not allowed to have any doors; they were open. And this is why, if you read John Betjeman’s *Summoned by Bells*, he says in fact he didn’t have a bowel movement for three years, he was so put out.”

Medawar’s scientific career took its start at Marlborough. There were two reasons. Although there had never been any other scientist in his family, his parents encouraged him for practical reasons: “It was thought I would be more likely to get a scholarship at Oxford if I did science, which I was very, very fond of and reasonably good at, than if I did anything else. I needed a scholarship.” However, he did not win the scholarship, and says, “I have never been any good at competitive exams.”

The other reason why Medawar became a scientist was



because he had the most unlikely stimulus in the form of a teacher: “I had a very, very good biology teacher—a coarse, illiterate man who would never have got a job in any school today. He’d been a merchant seaman and took a job teaching because that’s the only thing he could get a job in. He was a ScD of Cambridge, however, which he got while he was teaching. He was almost incapable of expressing himself, almost totally illiterate, and was sneered at and looked down on by all the other masters. I suspect he was appointed the way some old schools do appoint science teachers: their qualifications are to be semi-literate, coarse and vulgar, in order to bring science into discredit. But he was actually quite good. He fired me with enthusiasm. He adored his subject, and was so passionate about it that that communicated itself. He had a previous pupil who became FRS and a prof: J. Z. Young, and he made a great success.”

Zoology at Magdalen

This teacher steered his new promising pupil to form a liaison with his earlier one, who was about eight years ahead of him. Medawar was encouraged to go to Magdalen College, Oxford, “because John Young was there. He became my tutor. He was a very, very good teacher.” Medawar thrived at Oxford under the guidance of Young, doing zoology. “I did well. I got whatever a bright young undergraduate is supposed to get, a so-called first class degree. And then I became a Senior Demy (scholar) and then a fellow of Magdalen. That is, a junior fellow, which is by examination. In that exami-



Photographs courtesy of Sir Peter and Lady Medawar

nation I did all right. And so, from 1932 until 1947, I was in Oxford, man and boy, for 15 years."

Medawar qualified for, and was examined for, a DPhil degree, but he couldn't afford the £25 to pay for it. So he says: "I'm an impostor. I'm a doctor, but not a PhD. It was so expensive, I decided not to take one. Morally I'm a PhD, in the sense I could have had one if I'd been able to afford it. Anyway, it was unfashionable in my day. John Young wasn't a PhD either. A PhD was regarded then as a newfangled German importation, as bizarre and undesirable as having German bands playing on streetcorners, which they used to have in England in the early part of this century to entertain the populace."

A fellow student in the zoology department with Medawar was a young woman from Somerville College named Jean Taylor, whose tutor would later become renowned as Professor Dorothy Hodgkin, England's only female Nobel prizewinner. Jean, who is now Lady Medawar, says: "I can remember at the end of a long lecture his sitting back in the lecture theatre, pushing his books away, and saying, 'Well, boys, I'm out of my teens.' He was just 20."

Being one of the few girls then studying at Oxford, Jean Taylor was surrounded by the attentions of eager young men of all sorts and descriptions, though Medawar was not one of them at the first. However, the impression he made on her from the very beginning was so vivid and arresting that she describes it as if it were yesterday: "Nobody could forget him, because he was very tall, very untidy, obviously extremely

clever, and very dominant. And outrageous. I think the right word is *farouche*. It isn't used much now. It's French, and it means 'slightly wild, slightly untamed and not minding'. 'Thinking for yourself,' too."

The first approach was actually made by Jean, who had come to realise how intelligent and well-read Peter was: "I was fascinated by the way he thought. And I was reading a book which was vaguely philosophical, and I came on the word 'heuristic'. And I knew that Peter had read a lot of philosophy, so I just went and asked him because I knew he would know the meaning of the word. And he told me, and I thought, 'Oh, yes.' It was in the library, and I went back to my place. And in about an hour I genuinely had forgotten and I went back and asked him again. And I remember he was very kind. And then he said, 'Would you like me to give you some lessons in philosophy?' I thought that philosophy was how to live your life well. I didn't realise what a hard discipline it was and how you had to think. So I said 'Yes, please'."

Research with Howard Florey

Romance was not slow in coming, and Peter and Jean realised that they were in love and would like to marry. But this was the beginning of many very difficult problems. Jean Taylor's family reacted with utmost horror at learning of their daughter's romantic intentions towards a man who wasn't all English. Her mother took her aside and told her in worried tones: "Eastern people age very early, you know." However: "My mother, once she saw that I was absolutely determined, then it was all right. She was sensible and made the best of a good job, she thought." But the purse strings of the family were controlled by an aunt. And she was implacable in her opposition to the marriage. She cut Jean off without a penny.

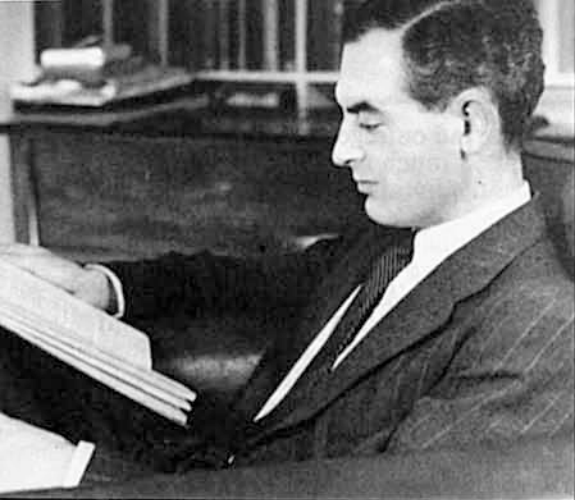
After many battles, Peter and Jean married in 1937. Jean's mother didn't cut her off, so that she had £200 from that source. And the couple lived on that together with the money Peter received from his Christopher Welch Scholarship and his Magdalen Senior Demysip. Together, he says, they "brought in a nice steady income of what in those days was a lot of money, £350 a year." They went together to work in Howard Florey's laboratory.

"It was in the days when penicillin was just burgeoning. When Jean and I first went to Florey's lab, Florey was not yet doing penicillin, but research on spit, and lysozyme. Then, when lysozyme turned out to be a flop therapeutically, he took up penicillin. I greatly admired Howard Florey. He was a most remarkable man. He had the kind of dynamism and determination to get things done one normally associates with Americans. But he also had a lot of English style about him too, so a wonderful blend he was, of the best in English scholarship and of the best in American engineering. I mean by engineering, 'converting thought into action'. That was great training."

Jean Medawar worked at Florey's lab for less than a year: "We didn't mean to have children until I'd finished my thesis. But Caroline, our first, arrived in July, 1938. By that time I'd realised that there certainly wouldn't be room in our family for two working scientists. And anyway, the war was coming. You could see it at that period, and Peter might be called up."

Shortly afterwards, the call actually came. Medawar remembers: "I was called up before a recruiting board and classified—D, I think. It doesn't sound very good, a bit low down the alphabet for one with aspirations. So that was over, and I went on teaching and researching. It was my singular good fortune that I was too large to fit either into an aeroplane or a tank; instead I was to go on teaching medical students and doing biomedical research. I also had flat feet, though I can't think why flat feet are regarded as an impediment for travelling in mechanised vehicles."

The government asked him to research two key problems, one to do with nerve regeneration, and the other to do with burns. It was the latter on which he did crucial work. It was



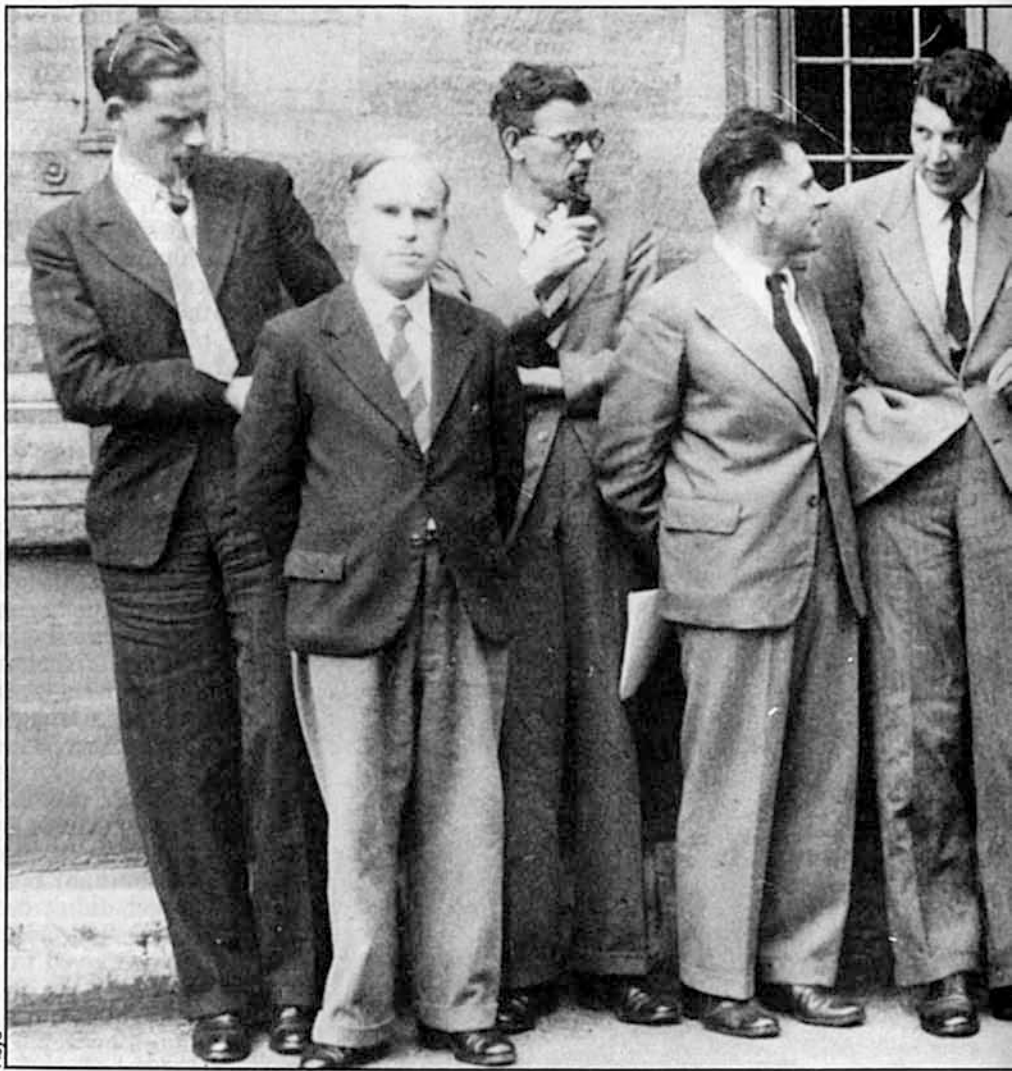
At Magdalen College, Oxford, Medawar (above and right, second from right) was guided initially by his tutor J. Z. Young (third from right). And in 1946, when the group photograph was taken at Magdalen, he had the good fortune to meet Karl Popper (fourth from right), his friend for many years

to lead directly to his work, after he left Oxford, that would win him the Nobel prize. "The burns research led to an interest in grafting. That's how it all started. The Medical Research Council asked me to do the study. It gave me great faith in the incentive power of applied science. You know, to try and solve practical problems in the fundamental way is one's best lead into fundamental science. For all practical purposes, the lead into this was solely due to the need to solve the practical problem of why you can't graft skin from one person to another, desirable though it would be. To treat burns was the great incentive. And the rest followed from that pretty logically."

After the war ended, the philosopher Karl Popper published his first book in English: *The Open Society and Its Enemies*, in 1945. It made something of a sensation, and one of the readers who was seized with admiration and enthusiasm was Peter Medawar. It led to their meeting in 1946, and to a long friendship. Medawar is probably Popper's best-known philosophical disciple within the field of active science, and has lectured and written about Popper's ideas with the conviction of a man who, as he says, knows from his own experience of scientific research that Popper is right.

Medawar's impact on modern science began in earnest after he left Oxford in 1947 to take up his first chair, as professor of zoology at the University of Birmingham. He was recruited for Birmingham by Solly (now Lord) Zuckerman, who had become Birmingham's professor of anatomy in 1943. Medawar says of Zuckerman: "He was at Oxford while I was there. We became quite close friends. He is the most delightful drinking companion in the Western world, you know. He's a very, very funny man. His first thought on getting to Birmingham was to make the place more agreeable to live in, and this meant attracting his old pals and populating Birmingham with his own drinking companions, so far as he could."

Medawar took "one of his brightest Oxford pupils" with him, and got him a lectureship. This was Rupert "Bill" Billingham, who was to be Medawar's closest long-term collaborator. Billingham, an FRS, is now chairman of the Department of Cell Biology at the University of Texas. Medawar's other main collaborator was to be Leslie Brent, who had come out of the Army and was doing a preliminary year as a student at Birmingham when Medawar arrived there in 1947. Brent is now professor of immunology at St Mary's



Hospital Medical School in London.

Brent then entered the 1948 class, along with another student who was to make a name for himself, Desmond Morris, "whose very obvious talents were easily recognised", says Medawar. Morris says of his tutor then: "His brain was at its zenith and there was no escaping its influence. He carried with him minute by minute that contradictory, relaxed intensity of a man whose superiority requires no feedback, no enforcement and no contrived display. His lectures were a revelation, not so much in content as in style." Morris has given much thought to analysing just what it was about Medawar that made him so unforgettable: "He inspired a student simply through the elegance of his thought processes, the style of the man. He had a curious amateur sophistication about him which appealed to me. I loved the way he chose his words, and if my own books later were successful, I owe to him the lessons on the need to find the elegant phrase or succinct juxtaposition of words."

About a year after moving to Birmingham, Medawar became Dean of Science. The most powerful figure in the university's scientific establishment then was Professor Walter Haworth, who had won the Nobel Prize for Chemistry in 1937 and achieved in his university the status of an Olympian. Medawar speaks of the "enormous power" Haworth then had, "which he exercised beneficently in the main". Haworth's approval had been successfully sought by Zuckerman for Medawar's appointments. Medawar recounts the amusing tale of how he won Haworth round to his first big project: "Haworth also supported my first academic enterprise in Birmingham—which was to found a Department of Genetics. I thought that this was the outstanding need of Birmingham at the time. Haworth supported me because I



showed an intelligent interest in carbohydrates, I think. He showed me some white crystals in a very small test tube, clearly very precious ones. To begin with, I didn't drop it as I could have done, being rather nervous. And he said these were pneumococcal polysaccharides. They have extreme specificity. And we went on from that to genetics and we worked our way around to the idea of how important it was to have on the campus some real card-carrying geneticists, and how useful it would be. He agreed with that—to support the interests of carbohydrates.”

In the latter part of 1949, Medawar went to America “to sit at the feet of the great Peyton Rous at the Rockefeller Institute in New York, for three months”. Rous had discovered the Rous virus which induces tumours in chickens. For this work he won the Nobel prize 60 years after the event, in 1966 at the age of 87—probably the most notorious of all delayed Nobel Prizes. Concurrent with his Rockefeller Professorial Fellowship, Medawar had been asked to give the Prather Lectures in Biology at Harvard University, and so combined the two. “I was fascinated and dazzled by America,” he says, “as who wouldn't be?” In America, however, he had “one or two unfortunate incidents”. He loves to recount the comical debacle of his introduction to New York City's august Century Club, where he was taken by Peyton Rous: “Peyton took me to the Century Club one night for Thanksgiving Dinner. It was very hot in New York, and I arrived in my sensible English woollen suit and Peyton asked me if I would have a cocktail

before dinner. Like a mug, I said, ‘Yes, I would love a cocktail. I said I had heard the Manhattan very well spoken of.’ At this club they not only brought you about half a pint of cocktail, but there was a pitcher put beside your glass containing at least as much again. I had two full glasses of cocktails and like a fool I drank the whole lot. At Thanksgiving Dinner we had turkey and pumpkin pie and lots of robust Californian wine, and shortly after that I passed out. And Peyton recollected that at one time he had been an MD, and he had me sit down and put my head between my legs, and very slowly I revived. But this put him in a terribly difficult position, because being through and through a gent, knowing what I must be feeling, he was wondering how to put me at my ease. He flailed about a bit and he said this wasn't the first time one of his guests had passed out, and a few things like that. But he saw this wasn't cutting any ice with me, and then he had a wonderful idea. He said that idiosyncrasies were one of the rarest and most puzzling phenomena of medical science, and their explanation was still far to seek. He said that I was *obviously allergic to pumpkin pie!* Peyton was so pleased and relieved at having found this face-saving formula, which I seized upon . . . Good old Peyton, he was a wonderful man, full of energy, sharp as a gnat. He was so abashed for me, never thought of himself.”

About 1949, Medawar had become convinced of the importance of studying animal behaviour, and he set about trying to establish what has now come to be called the discipline of ethology. He befriended Niko Tinbergen, who had just come to England to be a reader at Oxford. “He and I naturally became friends, and we liked each other and had many common interests.” Unknown to Tinbergen (who only learnt of it many years later), Medawar, in his role as adviser to the Oxford University Press, persuaded the press to publish Tinbergen's first major book, *The Study of Instinct*, which finally came out in 1951. Medawar says: “I think my main role was in making sure the Oxford University Press was prepared to publish it. And it was a great pleasure to be able to say, ‘This is important.’ Niko had worked on it for a long time. I read the whole thing through for the press, and was very happy to launch it on its way. In terms of the English, I did a great deal, but the substance was all there. Improving the English was a pretty minor contribution.” But Lady Medawar speaks of her husband sitting up with the manuscript “night after night”, and Tinbergen today says he never knew a thing about it, so modest was Medawar, whose editing was also assisted by David Lack. This book became the great classic that established ethology in England.



1959: at Royanmont

But Medawar did far more than launch the book for Tinbergen, who was eventually to win the Nobel Prize for Medicine and Physiology in 1973. He raised the funds to enable Tinbergen to pursue his work: “When Niko won the Nobel prize, the Nuffield Foundation very generously looked out a report I had made for it on him and his work. At that time a lot of people had criticised his work. I don't want to betray a committee secret, but one person dismissed Niko's work by saying: ‘Oh well, that's all some kind of bird-watching, isn't it?’ Because his great work was on herring gulls at the time. But I wrote to the Nuffield Foundation and explained what Niko Tinbergen was going to do. I also said in that letter that if all available funds were at my disposition, I would support Tinbergen's work as an overriding priority. And they therefore supported Niko in a big way.”

In 1948, Medawar had attended the International Congress of Genetics at Stockholm, where he met Hugh Donald, who was researching into animal breeding. Donald had embarked upon a project of comparing cattle twins and told Medawar that he was unable to tell monozygotic cattle twins ("identical", which come from one egg) from dizygotic twins (which come from two eggs and just happen to be born together). Could Medawar help? Was there some foolproof test he could devise to tell which kind of cattle twins one had at a given time? Medawar, with his experience in skin-grafting research, was certain that he could easily perfect a technique based on the fact that a skin graft between a monozygotic set of twins would be accepted and one between dizygotic twins would be rejected, along the classic lines of immunology at that time. Medawar told Donald not to worry, that he would solve this for him quickly enough.

Medawar and his colleague Rupert Billingham then set about the necessary experiments but were astounded at their results. "I was absolutely dumbfounded when twins which were clearly dizygotic, because they were of a different sex, and therefore must be dizygotic, accepted each other's grafts." They repeated the whole set of experiments because they simply could not accept their findings. It all came out the same again. What could possibly be the answer to this unbelievable state of affairs? Traditional immunology could not encompass or explain the findings in any way.

About the same time, two other scientists had been doing work that related to these results, unknown to Medawar and Billingham. One was Ray Owen, an American agricultural geneticist who also studied cattle twins. The other was Macfarlane Burnet in Australia, with whom Medawar was eventually to share his Nobel prize.

"In the course of our work, I got sent for review a copy of Burnet and Ferrer's book called *The Production of Antibodies*. And then I read in it all his examples of the blocking out of the particular immune responses by presenting antigens early in life, such as happens naturally in the cattle twins, because they have a common blood circulation. We had already discovered the phenomenon that cattle twins accept grafts from each other, and we couldn't make it out. But when I read Burnet's book and, above all, read Ray Owen's paper, it seemed obvious. And the way we were to find out why it does this, was to reproduce this experimentally." The cattle experiments were completed and further experiments were planned to induce tolerance by experimental means with other animals, but then the time came for Medawar to leave Birmingham.

Medawar says University College, London, "was looking for a professor, and I was going through the kind of phase where you get offered every job that's going. And they came to me, and that could not be resisted. After all, this was the first and oldest chair of zoology in England. It was founded in 1828." So off he went to London. He says: "I took Billingham with me. Brent assumed he was coming—he was my nicest pupil, and he was determined to work with me. And so we took him on. His PhD task was to discover immunological tolerance and win me the Nobel Prize for Medicine. And he did, too! He was very, very scrupulously careful, accurate, a good hard-working man. Bill [Billingham], Leslie Brent, and I made a very, very good team. We worked together in complete harmony and covered ground at a huge rate. We all got on well and we were strongly synergistic: the three of us as a team did much better than the sum of the three of us working singly."

The work done at London was very successful. The first breakthrough, says Medawar came with mice: "Getting hold of pregnant mice and injecting their fetuses with cells from other mice. We thought about it all at Birmingham, but we did it when we went to London. This was what we got on with right away. We had a brown mouse of strain CBA, upon which a skin graft from a white mouse of strain A had survived four standard deviations longer than the average of



Rupert Billingham



Frank Macfarlane Burnet



untreated mice, a chance of thousands to one that it could be mere luck. So that convinced us; and the person who does the work is the first person who has to be convinced. And it's very important not to convince too easily." The acquired tolerance induced in the mice was the result of the unborn mice having the tissue fragments of fetuses of the other strains put into their bloodstreams. The technical part was "one of the great contributions Leslie Brent made—he was a beautiful laboratory worker—he injected newborn mice intravenously. That's a tremendous feat. We all realised that this was what we needed to do."

The other experiments were with chickens' eggs: "We did them concurrently. When the mice were being difficult and were not producing tolerance, we turned to chickens, which are in some ways easier to work with." Medawar and Brent formulated the chicken experiments from work done by the Czech scientist, Milan Hasek, whom they met at a conference in Amsterdam. Hasek told them of his work and gave them his paper about it. Medawar points to the irony that "He had done his experiments to prove Lysenkoism. In the first paragraph of his paper he refers to 'Our master and teacher, Stalin, under whose guidance and inspiration these experiments have been done.'"

But despite the fact that Hasek's work had been done to fortify the indefensible nonsense of Lysenkoism, the Soviet creed that denied genetics, his experiments on chicken eggs provided a model for Medawar and Brent. They adopted his techniques of "parabiolysing" the yolks of two separate chicken eggs, so that their blood circulations fused. They were able to create "chimeras" by this means, as well as with their mice. A "chimera" is a creature containing another creature's cells in a mixed condition with its own from the fetal state, so that in adult life it can tolerate grafts or transplants from the other creature without rejecting them as "non-self". This is experimentally produced *acquired tolerance*.

Medawar says: "We had pulled it off, produced acquired tolerance, and announced it at a meeting of the CIBA Foundation. And then we published our first paper in *Nature* in 1953, the three of us. It created quite a sensation, because it



1960: Medawar (centre) with Howard Florey (right) and Sir Henry Dale at the CIBA Foundation's Nobel dinner

showed that the grafting problem could be solved. Not that our method was of any possible practical application, but it showed to the people who were working on it there was a goal that could be reached. And the moral effect was absolutely amazing, perked everybody up no end. And opened the coffers of the foundations, who soon recognised it. Until that point, many people said, 'It can't be solved—genetically programmed antigens, a rejection process known to be at least 200 million years old because it's fully developed already in fish.' But acquired tolerance showed it *could* be solved. But whether we'd existed or not, that would have been discovered, you know."

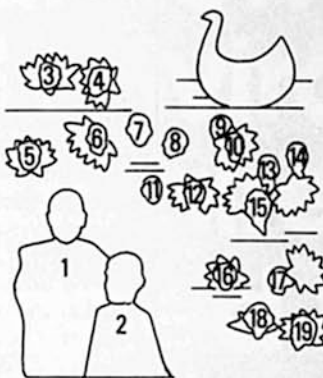
This was the great work that led to Medawar and Macfarlane Burnet (who had actually predicted the discoveries that Medawar and his colleagues made) sharing the 1960 Nobel Prize for Physiology and Medicine, "for discovery of acquired immunological tolerance", in the words of the Nobel committee. All the transplants of kidneys, hearts, lungs and bone marrow, which we now take for granted, owe their inspiration to Medawar's pioneering work. Until then, orthodox science said sternly: "It can't be done."

Medawar felt the stirrings of literary aspirations now, and gathered together his first book, *The Uniqueness of the Individual*, published in 1957. He says: "That was a sort of pastiche, you know, a collection of articles I'd already published somewhere or other. It was received with total silence. Literary intellectuals aren't interested in books by



1969: Medawar (right) before his stroke at the British Association's meeting at Exeter University

Key to cover illustration



- 1 Sir Peter Medawar
- 2 Lady Medawar
- 3 R. E. Billingham
- 4 Prof Leslie Brent
- 5 Prof J. Z. Young
- 6 Prof Niko Tinbergen
- 7 A. G. Lowndes
- 8 Sir Karl Popper
- 9 Sir F. MacFarlane Burnet
- 10 Sir James Gowen
- 11 Lord Solly Zuckerman
- 12 Lord Howard Florey
- 13 Ruth Hunt
- 14 Jürgen Merten
- 15 Lesley Palmer
- 16 Charles Medawar
- 17 Caroline Medawar
- 18 Louise Medawar
- 19 Alexander Medawar

scientists or about science." Despite the absence of reviews, this book helped Medawar receive the invitation to do the 1959 Reith Lectures for BBC Radio, which were then published in 1960 as his second book, *The Future of Man*. This was very favourably received, being the first general acknowledgement he had of his writing ability.

Meanwhile, Medawar's work at London continued: "We had an enormous amount to work on. Our ambition was to produce tolerance in adult animals without injecting embryos—which is a pretty absurd thing to do. And we started working on the nature of the antigenic substance—what is it about *your* skin that differentiates it from mine? What makes *your* skin antigenic to me, or vice versa? Nothing personal in this! We went on working on the nature of the antigens (antigens are substances that evoke immune responses).

"In 1961 I was asked if I'd accept the directorship of the National Institute for Medical Research at Mill Hill (outside London), because Charles Harrington, the then director, was due for retirement. I became director on 1 August 1962. As a matter of principle I felt that the director of a large research institute (with a staff of hundreds, in this case) like that *must* be seen to think that research is a very important thing, and I carried right on with my research there. At this stage it was still general immunology and grafting.

"I opened up again my friendship with Karl Popper. We'd drifted apart a bit. I went on with writing book reviews and

giving lectures, of general interest as I thought. I published another collection, *The Art of the Soluble* (1967). And then another, *Induction and Intuition in Scientific Thought* (1969). That was based on the lectures I was asked to give at the American Philosophical Society in Philadelphia. I liked those lectures—I thought they were good. I thought they were well-written, and they explained Popperism as simply as I knew how—part of my feeling of indebtedness to Karl.”

Then in 1969, while reading the lesson from the pulpit of Exeter Cathedral at the annual meeting of the British Association for the Advancement of Science, of which he was president, Medawar's words became more and more slurred. His wife instantly realised he was having a stroke. He was helped down the aisle to his seat, but was rushed to hospital, and then transported by train in a special carriage to a London specialist. A lasting partial paralysis resulted from this, and the harrowing stories of his survival and slow, painful rehabilitation are a lesson in heroic fortitude. All agree that Sir Peter survived only through sheer force of will added to superlative medical care. He even returned to his job as director at Mill Hill, and only retired from it in 1971. Since then he has had a small research unit of his own at the Clinical Research Centre at Harrow, where he dutifully reports for work every day, and has three important research projects under way. “I can't myself do bench-work anymore, much to my very great regret. I loved laboratory work and the bench, and thought I did it rather well. My research is made possible by my very good fortune in having two quite exceptionally accomplished research assistants, Ruth Hunt and Lesley Palmer.”

Vaccines for cancer

One of their projects, Medawar says, “is very close to my heart. It is a fact that many tumour cells re-express embryonic antigens which appeared in embryonic or later fetal life, coded for by genes which are normally switched off as development proceeds. It's just an empirical fact about cancers, that these sometimes reappear in malignant cells. This makes it possible in mice and rats to vaccinate against cancer by inoculating mice, for example, with fetal cells. And also by inoculating mice with adult cells which happen also to display these fetal antigens—testicular cells, for example, and—for some reason which is not yet fully understood—also thymus cells. The upshot of this is, I believe, that vaccination is possible against a wide range of cancers, in principle. This is now our principal line of research.”

Since his stroke, Sir Peter has written *Advice to a Young Scientist* (1979) and co-edited *Structure in Science and Art* (1980, the proceedings of a symposium he chaired, with contributions by Karl Popper and other distinguished figures). And he and his wife have co-authored two witty and informative books: *The Life Science* (1977) and *Aristotle to Zoos: A Philosophical Dictionary of Biology*, published in Britain in January, 1984. Most recently, Sir Peter has finished a major book entitled *The Limits to Science*, which should be published before the end of 1984. “It explains why science cannot answer any of the questions we most want to have answered, such as: ‘How did everything begin? How will everything end? What are we all here for? What's the purpose of life?’ Science is logically incapable of answering these questions. They are simply outside the domain of its competence”—for reasons he hopes to make clear.

Does he ever, will he ever want to stop? He insists not: “I do nothing but work—*ever*. I'm still young enough to be interested in anything interesting in biology. I'm not going to retire. There's not going to be any time when I hang up my hat and say: ‘I won't need to use that . . .’” Indeed, with the prospects of a cancer vaccine eventually stemming from his work, Peter Medawar's hat is one that millions of people can only hope remains on his brilliant head, and if there are hats that come off, they will be other people's—to him. □