

# An interview with Wilfred Widdas

Conducted by Martin Rosenberg with Graham Baker  
on 18 March 1999

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Wilfred Widdas photographed by Martin Rosenberg  
at Dilke House, March 1999.

This interview with Wilfred F. Widdas was conducted on 18 March 1999 at the offices of The Physiological Society at Dilke House (Malet Street, London). Those participating were Wilfred Widdas (WW), Graham Baker (GB) and Martin Rosenberg (MR). The transcript has been corrected by the participants.

Preliminary conversations are given after the interview itself. There is a bibliography on the life of Wilfred Widdas at the end.

WW has passed MR an account of his background.

MR: In your account, you said that you almost became a physicist or rather you decided you didn't want to be a practising medical doctor and then you almost were going to abandon that and become a physicist. I mean you don't believe in different groups, a scientist should be interested in all aspects, is this right?

WW: Well I do really believe that, certainly for doctors, I started as a doctor, you must remember that.

MR: You mentioned you were a dresser, now what is a dresser, or what was a dresser?

WW: Well a dresser – when you are a medical student, you have to do two years pre-clinical work, anatomy, physiology, and chemistry or biophysics or whatever is now the thing, and then when you go to the hospital, your first job is to act as a dresser. The consultant came round after the initial [almost nursing attention had been given to the patients].

MR: What is it, bandaging? What did a dresser do? I don't think they have that term now.

WW: Well they may not now, because my first job every morning on the ward was to do five supra-pubic washouts, that's where people have had a tube put into the bladder because they'd got prostate swelling and it obstructed the passage of urine through the urethra and they get retention of urine.

MR: So it must have been painful for you and the patient?

WW: Oh no.

MR: Was this in the Victorian Infirmary?

WW: Yes the RVI. And I would be doing this from 9 o'clock to about 10 o'clock and then the professor or the chief surgeon would come and do his ward rounds, you see. Professor Willan, who was the Senior Surgeon, he was interested in doing the operations for these bladder supra-pubic people and that was the right treatment in those days. Now they can do it through the urethra you see with their sort of scraping technique.

And then of course if we were doing the obstetrics or midwifery and gynaecology we would have to see the patients that came to the outpatient clinics and that sort of thing, the same for ophthalmology, ear nose and throat [ENT], psychological medicine, etc.

MR: So you were still a student then?

WW: Yes.

MR: And did it progress in the same way that it does now, with three years clinical and then the final examination?

WW: Well now. I think now they have to do a year of more or less hospital work after passing the final examination [Pre-registration work in a hospital to become registered as a doctor with the GMC]. No we didn't have any of that.

MR: So what level was it when you completed your medical studies?

WW: Oh well I went straight out to do a locum and before I went into the army in 1939 I had done all sorts. In fact I remember just digging out these things, I recalled I had to do a forceps delivery, and I had to give the anaesthetic as well at the same time.

MR: What was the anaesthetic in those days?

WW: Well it was ether and a little bit of chloroform. In this particular house, which was a very poor house, this woman wasn't married, but she was nearly forty, I think, and she had a female friend who was sort of looking after her, but as soon as the head appeared and things got a bit tight, this person looking after her disappeared. I was left on my own to do everything. But I managed and the woman was very grateful afterwards, and she said 'oh I have been keeping company with a young chap'.

GB: Why did you become a doctor? I know you said your uncle was a doctor; who decided you should become a doctor?

- WW: Well, I think my parents. My uncle, who was a doctor, was a bachelor and he was a bachelor all his life and so there was a chance for me to sort of follow in his practice, you see.
- MR: So it was more of what might form a good career. Were you interested in, some people say they were interested in dissection even as a child, they are interested in how animals worked and this sort of thing.
- WW: Not particularly interested, but I could tell you a story about Dennis Pattison. Dennis Pattison was the son of one of the local colliery managers and he used to come to our house. As youths, a lot of them came and played with us all. Dennis Pattison came often, and if my mother had a hen that died, he would always go and dissect it, but I was much younger and wasn't particularly interested. And when he qualified, Dennis Pattison went to work with Harvey Cushing in America and came back to Newcastle and was doing some very complicated brain operations and things. This was years ahead of such work for various neurosecretory defects like acromegaly, but unfortunately he got a subarachnoid haemorrhage and died pretty young. But when we were playing games at Christmas one time, my other uncle, who was the footballer, and was a great favourite with us all, organised a game of blow-football. We had a very big dining-room table and this was ideal for a game of blow-football, you see. My uncle was leading those at one end, including Dennis Pattison, and the others at the other end were keenly competitive. Dennis Pattison was blowing away so strongly that he must have gone into what we now know as a hyper-pnoeic coma and fell unconscious onto the floor under the table. When he recovered the game was at a very excited stage and my uncle only caught some of his mumbling: 'where been?' 'Where 'ave I been?' My uncle's reply was 'Don't worry about the beans, just blow!' It was my mother, who as an onlooker realised that something untoward had happened and stopped the game. This little episode into physiology [not realised at the time by any present] is of interest in conveying something of my happy if somewhat Victorian country environmental upbringing.
- GB: You joined the army at the beginning of the War, did you voluntarily join the Royal Army Medical Corps? Or were you called up?
- WW: Yes, you see things were not looking too promising at that time and all the doctors were circulated and the notice said that in the event of an emergency would you offer your services.
- MR: This was in '39?
- WW: Oh no this was '38 soon after I qualified, I think, and so I said yes, I thought I would, you see. And then very soon after war was declared, I was asked to go for an interview to the headquarters at York and was interviewed by the senior army medical officer in York. Afterwards, I very quickly got my joining up instructions. Then when I came back from Dunkirk, I had been looking after ...
- MR: Well, tell us about Dunkirk.

WW: I am hoping to call at the little place that we were billeted at soon – It was called Frevent in France and it's near Arras – when I go with my daughter by car to the European Red Cell Research Meeting at Ozenhausen in Germany in April.

I was going to say my Army job was to look after these engineering companies that were building airstrips in northern France for the air people. But the army had the job of doing it, making the airstrips, and in addition to the engineering companies, which were really civilian companies put into uniform, and nearly all the people in the Company I was looking after, came from Wimpeys, the builders. Oh yes, it was a building project, making the cement airstrips. And in addition to the skilled engineers like that, there were some Pioneer Corps companies who were doing rough cleaning work and so on. These pioneer corps troops were mostly older people who'd been on the Army Reserve, and of course, if you were on the Army Reserve, you were entitled to a little bit of money each week. In many cases, those that came to the medical unit had never expected to be called up.

MR: So these were people who were in the first war?

WW: Well, I don't know where they'd come from, but anyway I had one or two people of medical interest. I had one person who came to see me who had a certificate, certifying that he had silicosis. Well he shouldn't have been on the Army Reserve if he had silicosis, you see, so some problems extended beyond simple doctoring.

MR: So where were you?

WW: In France. I was the medical officer for these groups of Army troops, some in Engineering units some in Pioneer Corps companies.

MR: You were billeted in France? How was your French? Are you a French speaker?

WW: Oh you would laugh at my French speaking. I was billeted in a sort of funny little place that had pigs down below and I had to go up a staircase to a number of bedrooms up above. And I went up there to sleep. On the ground floor, I got talking to this person who was running this billeting place, she kept rabbits too, you see, and so I started to talking to her and I said 'I see you have a lapin'. 'Non, no lapin'. So I said 'lapang' instead [a non-English idea of lapin], and she said 'ah, oui oui'. Eventually, she understood exactly what I was talking about, but I was no good at French.

MR: Did you speak any languages. I mean is languages something that you do?

WW: I speak English. I can speak Geordie if you like.

MR: Can you do any Geordie?

WW: Oh yes I can tell you. But anyway when I came home on leave it was a very cold spring, with snow on the ground, so I came in a lorry to the station. In those days the transport lorries just had a tarpaulin over the back of the lorry. So instead of sitting in the back I got into the front beside the driver, so I was

talking to him a bit and he said I think you must come from the North of England. I said 'yes I do,' and he said, 'I would say round about West Hartlepool'. I said 'about 12 miles away from West Hartlepool'. He must have been very good at detecting different dialects.

MR: It's like the man in Pygmalion isn't it? So military service was partly then, as it was, in the field and then you went to the War Office.

WW: Well I was trying to explain to you that these Engineering and Pioneer companies were not like a battalion. You see if you were medical officer to a battalion, when you came back from Dunkirk you went to the battalion's headquarters, but when I came back from Dunkirk, they sent me to the RAMC depot in Leeds. We had a Depot in Aldershot and one in Leeds. Mostly Canadians and people who had come from overseas to work with us were using the one in Aldershot, and so they had a second one in Leeds, and I was sent to Leeds. When I got to Leeds, there had been so many people coming back that the DDMS, who was in charge of the whole of the Northern Command, Major-General R. W. D. Leslie [late RAMC], had written to the Commandant at Leeds and said, 'I am snowed under, can you send me someone to do administration in the office,' and so I was sent to York. That is how I got into medical administration. I had some medical administration to do, but one of my jobs was to take the general to visit all the medical arrangements under Army rule, which he had to visit.

MR: So you weren't actually doing medicine, you weren't treating patients at this time?

WW: No, but I had to check medical boards and things like that.

MR: Were you thinking at all about what has happened subsequently. I mean were you thinking about these physiological ideas.

WW: No nothing of the sort at that time. I just found about two days ago, some notes I'd typed when the revised health service was first proposed (oh here they are). I think I must have written this about 1944. I shouldn't like you to read it, because it shows a little bit of my non-conformist views even then.

MR: This is a speech you made?

WW: Well, no I never made it, but it was a speech I prepared in case I had to go to a meeting to discuss it.

MR: Well do you want to read it?

WW: No I wouldn't be able to now. Well Graham might be able to read it. The typewriting has not stood the years of storage to make it easily readable. Well I will read you just a little bit just to illustrate my rather odd views. You see the idea was that they should form a salaried state medical service similar to the way in which medical officers in the army were employed on a salaried basis and the Beveridge Report, which was very far-reaching, suggested this, you see. Well I say here the idea that medicine should be available to all is as it should be, as every member of the community is directly concerned.

'No one covers the span from cradle to the grave without at some times consulting or being seen, perhaps for the first time after death, by a doctor. The care and advice given by him may well be the most important thing that a man or a woman ever receives. It may literally mean the difference between life and death and at any rate several years more of life as even doctors do not claim to be able to conquer and banish death, who marching through the world, often in the company of that old enemy time, claims his victim as one and all sooner or later'.

You see I was a little bit verbose.

MR: The grim reaper you mean. You clearly enjoy writing. When you write you usually write it once and that's it?

WW: Oh no. Those have been worked through many times.

MR: But you enjoy that? You enjoy writing?

WW: Well I don't, but I like to say exactly what I think. I haven't normally had to retract very much of what I have written.

MR: You feel that you like to get things down to have a document?

WW: Well that's right. If I am writing a document, well Graham will tell you, my writing is not perhaps as good as his sometimes, but I try to get the facts right. But the way I express it may not be good.

GB: You like to cover every detail don't you? You go through things systematically point by point. I can remember your lectures as well, starting at first principles and working your way through.

WW: Yes. Yes.

MR: Let's talk about teaching because in what I have read so far, you don't talk about your attitude to teaching or your enjoyment of teaching. Perhaps we could talk about it. When did you give your first lecture? Did you do much in the army? Did you do much talking in the army?

WW: Well if you want to go back to the first lecture, it was pre-army OK. Because when I was doing a locum for Dr Harrison at Sherburn Hill near Durham City, I was asked to do some First Aid lectures to the miners at Bowburn Colliery. So I did some talks there on First Aid and this was all without any extra funding.

MR: Did you do it off the cuff? Did you write it down?

WW: I must have done some preparation, but never kept my notes; this was unpaid, you see. But when I finished they insisted on giving me a little fountain pen, which I have since lost, but I greatly appreciated their kindness.

MR: Did you enjoy the experience of giving those talks?

WW: Well yes, I suppose so. I had another quite successful medical case in the locum work. At my first locum job, I had to go and see a girl who had sprained her ankle, you see. Whilst I was bandaging up her ankle she said, 'I wonder if

you will see my mother who's not been well?' And so I examined her mother, and came to the conclusion that she had an exophthalmic goitre. So I arranged for her to see Professor Natrass, in Newcastle, and he agreed with my diagnosis. He asked Mr Hodgson to do a partial thyroidectomy. I saw the patient about three months later and she had made a very good recovery and the family sort of wanted to give me a monetary reward, as the doctor I was doing the locum for had never got the right diagnosis. However, I said, 'oh no, doctors are not allowed to do that,' but I was very pleased because I said that I was acting on behalf their own doctor. Their doctor was a Scottish doctor who made maximal use of sodium bicarbonate when prescribing medicines for his patients.

MR: Sodium bicarbonate?

WW: He used to give them medicines, with mostly sodium bicarbonate in. It wasn't too bad. A lot of people just recovered without any treatment or had some acid based indigestion.

MR: What was your view of the placebo effect. The homeopathic type of attitude to treatment?

WW: Oh sorry I got sidetracked. But when in the Army, I was taking the general round to visit all these medical establishments, because in those days they had removed all the signposts. There were no signposts anywhere and so you had to go by reading the map and the ATS drivers could not do it – well they had to drive, they couldn't do both.

MR: There were no street lights either?

WW: Oh no, well we were never brought up with street lighting on country roads in those days. Anyway I could read the map. We had very good maps and I knew exactly where to turn and where we had got to go. In fact it had been reading the map, that as the medical officer in my little car, I had been able to get the convoy of all my companies back to the beaches at Brae Dunes.

MR: Where was this in the South of England?

WW: No this was before Dunkirk. We were placed near Arras, and we had to go across land near Belgium to this beach North of Dunkirk, which is called Brae Dunes. It was quite a complicated road and of course, in the army you don't have to travel bumper to bumper, but to keep a distance of 25 yards or 50 yards in a proper convoy. So I had to see that the others behind were following and so on.

MR: Did you enjoy the military experience? Did you enjoy the army life?

WW: I wouldn't say I enjoyed it. You see I think my family very quickly adapt to difficult circumstances in one way or another. We manage to have, say, one day where we'd feel a bit thin but in a couple of days we had adapted.

MR: You mean after a family sad event and that kind of thing?

WW: Well that sort of thing; yes.

- MR: We were talking about teaching.
- WW: I had to do these lectures before the army for First Aid and then when I got this job at St Mary's to do research I was working in the Physics Department mostly and then Professor Huggett suggested I might investigate iron in new-born rats, you see.
- MR: What are your memories of Huggett? Professor Huggett?
- WW: Oh, he and I got on very well together. He was quite a nice person.
- MR: Who else was around at that time?
- WW: Oh, well, his wife was Professor Killick you remember, and McDowell was at King's. I've forgotten the name of the Professor at Charing Cross. Charing Cross is now near Hammersmith or Fulham, but when I first went there it was at Charing Cross, I can't remember exactly which building it was in.
- MR: Oh I remember, it's a hotel now or something.
- WW: Is it a hotel?
- MR: Well, it's something quite different from a hospital. Da Silva you mentioned.
- WW: Yes, well he was Professor at the London Hospital.
- MR: Did he go to King's eventually?
- WW: Well, you see, Professor McDowell came to St Mary's where I had been working. He must have heard that I was quite a useful chap, or something, I don't know. Anyway he asked me to go there as a Reader, you see, and I didn't like to walk out on Professor Huggett because he'd given me my chance, in a way. But I went to see him and he said, 'Well I think you might be wise to do it, because McDowell is due to retire in two years.' So I decided to do so, and so I went. I had a little room on the top floor and Dr Bowyer who had been working with me on the inhibition of glucose exits by DNFB [the reagent used by Sanger when discovering the structure of insulin] decided to rejoin the Biology Department at King's. She had come from Danielli's department in the first place so was going back. We still carried on the research and our joint 1958 *J Physiol* paper was published from King's.
- GB: When did you actually start the glucose red cell work?
- WW: Well, the first work I did was not really on glucose, but I used a photoelectric apparatus, which I'd made, to measure the osmotic fragility of fetal sheep red cells and compared them with the osmotic fragility of adult sheep red cells.
- GB: You made that yourself?
- WW: Probably. I think I did yes. Anyway I published a paper on that and you'll see that fetal sheep red cells withstood much more osmotic shock than did adult sheep red cells; the latter haemolysed very rapidly. And then, at the same time, I had been working out mathematically the results, which Huggett had

got with Dr Warren, the biochemist, who I think, went to the London Hospital Medical School as Prof. Warren didn't he? As their Professor of Biochemistry.

MR: I don't know the name. He's not the one who went to the Home Office is he?

WW: No, this one was Willy Warren.

MR: Did it all begin with Huggett; the interest in glucose transport? Where did the whole story start?

WW: Oh no, no. Huggett's interest was the fact that in sheep, in the fetal sheep, you have fructose in the blood. Now there's no fructose in my blood, and there's no fructose in your blood, and so they wanted to know why it occurred in the blood of a fetal sheep. And so Willy Warren and Huggett decided to investigate this and he [Huggett] got some pregnant sheep from Wales. Also, Hancock, who was a very expert technician who came with Huggett from Leeds, made a bath, which would take a fully anaesthetised sheep. The fully anaesthetised sheep sort of sat up at one end as it lay in this bath and then they opened the abdomen and the uterus. They delivered the fetus into the saline bath and took samples of the umbilical artery and vein blood.

MR: So the original question was 'why is there fructose in the fetal sheep?'

WW: That's right, and how does it get there? And so what they thought they would do was produce hyperglycaemia in the sheep and they raised the blood sugar in the sheep blood up to about 500 mg per cent. It was all in milligrams/per cent in those days, not millimoles per litre. And then over about four to six hours the maternal blood sugar came down to about something just over 100 mg per cent. The fetal blood sugar went up very quickly initially but became absolutely flat for more than two hours and then it came down.

MR: This is after parturition?

GB: In the fetus when it is still connected to the mother?

WW: Oh yes. Oh yes. We were taking samples from the umbilical vein or artery, you see.

MR: Did you have any connection with Amoroso in those days?

WW: Oh yes, very much so. I will switch on to that in a second. The blood fructose in the fetus went up sort of slowly like that but when you worked it out from the knowledge of the value in the isolated fetus. Well Willy Warren had also detached the fetus and followed the rate of fall of the sugars in the detached fetus, when it was no longer perfused. Putting that data into the other data, it became obvious that the rate of transfer of sugar couldn't be proportional to the difference in concentration, which it should be if it was diffusion. And so I started working out the possible kinetics and prepared a document setting out the reasons why there could not be diffusion. A pre-circulated communication on this was given at Oxford. I don't remember whether I was alone when I gave the paper or whether Huggett was there too. I can't remember, but I think that was in 1950 that I gave that paper or possibly 1951. Anyway, at that

meeting R. B. Fisher and Parsons, who were the biochemists at Oxford, had been doing some uptake of sugar from the intestine and they said they'd got exactly the same result, that it could not be due to diffusion. Anyway I tried to write up a longer paper about it and Huggett, of course, was no mathematician at all, you see, in fact when I was trying to explain to him about differential calculus and I said you have to say  $dy/dx$ , he asked, 'well why can't you just cancel the d's'. But apart from that mathematical lack, he was very good and understanding, you see. Anyway, because he felt he wasn't up to the mathematics, he sent my draft paper to A. V. Hill at University College London.

MR: How did you keep up with your mathematics, because you hadn't really used it in your medical work. Was it all that you had learned at school, or did you have to do a lot of mathematical study to get it up to standard?

WW: You haven't read my degrees. I am a MB,BS which is a medical degree, and then BSc. Well that's usually thought to be an intercalated BSc in physiology, but it wasn't. When I was in the War Office, the war in Europe had nearly ended about 1945, I was in charge of all the schemes for release of medical officers from the army and I knew that, at my age, release would be at least two years or more, the way things were still developing in Japan and in the Far East. So I started going to night classes at the polytechnic in Regent Street, which is now the University of Westminster, and there I was studying physics, chemistry and mathematics for an external London degree. Well I took the London BSc three months after I was released and got through. I didn't get through very well, but I got through.

MR: But you obviously enjoy mathematics?

WW: Oh yes and physics, you see, because as you probably know at that time radioactivity was the kingpin. My first job when I got to St Mary's was to help Dr Rowland, who was the Reader in physics, I think, and there, of course, they taught physics and chemistry as the sort of first-year course for all medical students. My first job was to help him keep a big amplifier working, which was used for counting radioactive samples using planchets and placing them under a Geiger counter. This amplifier had about, I should think, 30 or 40 valves. It was not a transistor and the circuit was always going wrong, usually because of dry solder joints, so my job was to go round and try and get these dry solder joints identified and repaired or renewed. And at that time I made a special little apparatus, of which I used to have some photographs. The apparatus held the planchet under the Geiger counter by raising it on a platform to a fixed position locked by a hinge device I designed from a Colliery invention, which my father had done in about 1912. Well, I didn't start doing any teaching until I had nearly finished this work, this research work, this three-year research appointment. I can't remember just what teaching I had to do during this time.

MR: But did you teach across the board?

WW: Oh yes.

MR: The tradition was in those days people didn't teach the field that they knew most about, you taught everything.

WW: Well, anyway, A. V. Hill advised Huggett that it was all wrong, my ideas why transfer of sugar could not be by diffusion. But he, very cleverly, said that it wasn't in his field, so he had given it to his biochemical friend, and that was Dr E. J. Harris, but you won't know him. Well, anyway, he said that diffusion could explain the findings and in further correspondence wouldn't accept my argument that diffusion couldn't explain it.

MR: And Amoroso? Where did he come in?

WW: Ah, well then in addition to doing this work, on the fetal sheep, I found that the weight of the fetal sheep, because Huggett had been very careful with his friend in Wales who was sending these sheep, he had been very careful in getting the dates of tugging, so he knew exactly what the gestation age was, and I found that the cube root of the weight of the fetus went up linearly with the gestation age, provided you deducted a bit for the establishment of the fertilised ovum in the uterus. So as this worked for the fetal sheep, I went to Huggett and I got some data from two very big textbooks, which he had by, my memory of names is pretty troublesome, anyway a biochemist at Cambridge, Professor Needham. Needham had written two very huge textbooks, on fetal physiology, and he had a lot of data in that. So, I went through the tables of fetal weights and found that some of them would fit in this formula of the cube root of weight and gestation age. There was also a whole lot of data on the weight of developing chickens in eggs of different incubation time.

MR: So nobody had done a mathematical analysis of this before?

WW: Oh yes, the French had done it on chicken in eggs, but they thought the line went straight through the origin, they didn't allow for this bit time needed in mammals [only about 0.5 to 1 day for chicks]. You have to get the embedding in the uterus and a placenta working before you can get the establishment of cube root of weight increasing linearly with time. This deduction from gestation age, was the only new bit, because this cube root idea goes back to about 1900, a very long way. Anyway, this is how I got in touch with Amoroso, because he had a lot of data on the pregnant cats. He was at the Vet. College. He had data on pregnant cats and sent me his data and it fitted very well with this scheme too.

MR: He was a very colourful character wasn't he?

WW: Oh yes, yes. At one of the meetings of The Physiological Society, Amoroso was demonstrating the blood pressure of the lion. He got this lion anaesthetised, I was a bit scared myself, but he seemed to be quite happy.

MR: What he had the lion at the Physiological Society, where was the lion?

WW: Oh, it was in the Vet. College on a sort of operating slab, perhaps large enough for a horse.

MR: It seems ironic that you became diabetic. Is that a life-long thing or has that happened fairly recently? Or was that a result of your study? They say we all suffer from the thing that we study.

WW: This is one of the reasons why I keep working, if you like. I told you about my uncle who was the good footballer. Well, my father was the better tennis player, but the two of them played tennis, and won the county championship I think two years running. In 1910 Durham County got into the final of the Inter-County tennis championships and they had to play Middlesex in the final in London. Of course people up North don't have nearly as much chance of playing in tournaments as those that play down South, as you probably realise. Anyway Middlesex won all nine matches. You see there were six on each team, that's three pairs, and it was doubles. So each pair played each of the three opposite pairs. And so they won all nine matches Middlesex did. But on the Middlesex team there were the two Lowes, Gordon Lowe and his brother and on the Durham team, there were three Widdases. My father was one, this uncle was another, and my Uncle Henry was the third. The elder one, who was the good footballer, got diabetes in 1929, and he got a nasty septic carbuncle at the back of his neck.

MR: That was very serious in those days.

WW: Really serious and he died at the age of 59. Well I have had diabetes for 50 years, but I am alive and well. And why am I still alive? Simply because of the work done by Banting and Best in their experiments with dogs. So when I get people writing very plausible pamphlets saying, 'We must accept that vivisection has failed,' I am afraid I usually reply and using a North country idiom, 'I usually tell them what for!' I once had a letter from some people, antivivisection people, and it was signed by two ladies, and so I wrote back to them and I said, 'I see that you are both ladies, I wonder if you have had any children.' And then I related that my grandmother had looked after four, had three of her own, and another one, a niece both of whose parents had died of typhoid fever. All four children under seven years of age had died in one week in April 1874, of diphtheria and I asked how they would have felt if four of their children had died in one week. In my case, these were my aunt and two uncles, but I never was old 'enough to know that they existed. But I have a picture of their gravestone if you would like to see it. The fact that I am just relating historical truths can be supported by evidence available in the graveyard, if anybody doubts it.

MR: You talk about football and tennis, you don't mention cricket. Cricket is a North Country sport.

WW: Oh yes, you probably know that Sutcliffe was on the team for Yorkshire and that Hobbs and Sutcliffe were the opening batsmen in the Test matches in my youth.

MR: On the tennis side, were you interested in Wimbledon? Your family? Was Wimbledon a big thing in those days as it is now? I mean they were the days of Fred Perry and co.

WW: Well as soon as the war finished, in 1945, my doctor uncle – born in 1875, so he would be 70 wouldn't he – wrote to me and he said, 'I am coming down for Wimbledon.' And he said, 'your father will be down for the second week, but I am coming for the whole fortnight.' He always got tickets and I used to take him to the ground by car.

WW: ... I have got this photograph. It's a very historical thing.

MR: [Bishop Auckland Football team 1891, F. Widdas.] Well they have got a good Edwardian look about them.

GB: You still play tennis regularly. Have you ever won any competitions? Or have you played competitively? Or is it just a hobby?

WW: I didn't think you'd be asking me that question. I could have brought you an extract from a Newcastle paper in which it says, 'North Country player gives tennis star a fright.' A 21-year-old Davis cup player, Tony Roberts, I think it was, who'd played in the Davis Cup with Mottram was taken to three sets by somebody who they said was a North Country player, but I had been playing at Queen's.

MR: Which is your best stroke?

WW: Backhand I think. My father had perfected the backhand. They were all four brothers interested in football to start with. My Grandfather had been and seen some of the experts at Newcastle and the Dougherty's used to come to Newcastle and they were the absolute kingpins. He told his four sons to take tennis up instead of football.

MR: He became the manager didn't he? One of the Dougherty's?

WW: I think they were children of a vicar. I think they had private funds, but one of them won Wimbledon six years running I think, or something, and only when he was beaten, the other took over. Previously the younger one, H. L. Dougherty, had always scratched if he was drawn against his elder brother, but later it was *vice versa* and he went on to win about five times. The gates at Wimbledon where they go through to the Centre Court are called the Dougherty gates. Anyway my father was once leading the elder Dougherty by 5–2 in the first set, when he [Dougherty] said that he would have to go and change his shoes, but I think that was putting my father off, and so when he came back, he knew just how to beat my father.

MR: They played in long trousers in those days.

WW: Oh yes, long trousers.

MR: Apart from the money side, do you think the game has changed very much?

WW: Well you see Fred Perry played in long trousers.

MR: Did you ever meet him?

- WW: I don't know, but I saw Borotra play and also Cochet play, they both came to play in the Covered Court Tournament formerly held at Queen's Club. Borotra was unbeatable in that Tournament, which was played on a wooden court.
- MR: Let's get back to professional things then. You went to King's as a Reader in 1955 was it? That's quite quick moving isn't it? When were you appointed as a lecturer?
- WW: Well I did three years from '47 to '50 in a research post and about two years as a lecturer and then I might have been made a senior lecturer about a year before I moved. I don't know, I can't remember. You see there were quite a number of highpowered people there [at St Mary's], if I may use the term. David Greenfield was there. Do you know David Greenfield.
- MR: Will I didn't know him no ...
- WW: Well I know him very well. He went to Nottingham. Well he first of all followed Barcroft as Professor in Belfast and then he was appointed to the Chair at Nottingham and became one of the UGC medical representatives too and is now a CBE. I saw him only about a year ago in Nottingham, because my grandson is doing biochemistry in Nottingham. Well he was there [St Mary's]. And Kenneth Cross, he was at St Mary's at that time, and David Kerslake, also Keith Cooper [now Professor at Calgary]; I don't know what Kerslake is doing now, I will have to look him up in the *Grey Book*.
- MR: Were you very involved with The Physiological Society in those days?
- WW: I became a member, I don't know quite which year [1950]. And I was on the editorial board for seven years.
- MR: When you came to Bedford, when you became Head of Department at Bedford, what sort of changes did you feel you'd want to make?
- WW: Well when I went to be the Head of Department, the Principal was Nora Penstone and there was another lady who was on the Senate called Dame Lilian Pensori. One mustn't get those two mixed up. Anyway, Nora Penstone was pretty progressive and she said there was a chance of getting an extension to Physiology over the new library building and so I had the job of designing the new physiology department, and with the help of Jerry Gough, who was my Chief Technician and who'd done some work with me at St Mary's, we managed to get it organised pretty well, and by doing that it was possible to sort of separate off the people who were teaching biochemistry from the physiology teaching. What was the old physiology lab became the biochemistry lab and I think it would be about 1963 or '64 that I was able to initiate the setting up of an independent department of biochemistry. And Cheesman, who was the Reader in Biochemistry, soon became the Professor by title, and so he was in charge of the Biochemistry Department and I was in charge of Physiology.
- MR: What did you feel needed to be done in the teaching side of things? Was the course structure, did you have any views about the course structure, or

changes that needed to be made? Because Bedford is not for a medical student is it?

GB: It must have been very small as well? Did you feel that you had further ambitions, was it a stepping stone? Because Bedford must have been very small compared with places at the medical schools?

WW: Well the people at St Mary's wanted me to go there, but I thought through it carefully and I thought, 'Well Bedford have done well by me, so I had better stick to them,' and so I said I wouldn't go. But I was asked by the Dean of St Mary's if I would consider. Also, I was already going to them regularly for my diabetes, so I was both a bit of a medical liability as well as not wishing to leave Bedford.

MR: George Darlow was there when you went or did George Darlow come along later?

WW: Oh no he was already there in 1960 when I was appointed, he was already there and so was Mrs Hilton.

MR: Now the Hiltons are confusing to me. This is Sidney Hilton's wife?

WW: Well, he has had several. But it was his first wife, I think, Elizabeth; she was known as Beth Hilton. I think she had two daughters from Sidney. Anyway she was now more or less separated because I think, is it somebody like [Gerta] Vrbová who had married him, and I think that has broken up now as far as I know. But I know very little about social contacts so don't ask me in detail.

MR: What would you think was the most exciting thing in your scientific career, when you felt the most pleasure scientifically?

WW: Without any doubt working with Graham has been the most rewarding although perhaps exciting is not the right word. After I gave a symposium lecture, we carried on working on joint research projects. You see, when I retired in 1981, I think that it was, my wife had Parkinson's disease, and so I had to spend all the time looking after her. I had a home computer and my little workshop up in the loft, and I was working through the results, which we'd got for the years that I had been at Bedford. You see being brought up in radioactive things, we did some radioactive experiments at Bedford, and one of them was to follow this uphill transfer by counterflow which I predicted in 1952, but which I didn't give it that high-faluting name. I just said it could occur and it was proved to occur by the Nashville group in 1956. Rosenberg and Wilbrandt (1957) showed it occurred in human red cells by the use of radioactive sugars. They didn't mention that they'd got the idea from my quoted paper, but they called it 'Uphill transfer by counterflow'. Rosenberg was a physical chemist and I think Willbrandt's brother-in-law. As it was sound experimenting, all credit to them. As it was a suitable radioactive experiment a similar practical was devised using other sugars for the final year students' projects. The results for over 20 projects had been kept. Although students' work may not reach the accuracy of pure research, it was hoped the means

would be useful. This was the data I worked on, on my computer. There were 22 sets of experiments to analyse.

MR: So you had a computer from the beginning really. In '81 they weren't so common place.

WW: No mine was a little Acorn, which has gone out of fashion. Now, I have got a better one. Anyway I worked out all these results and then I think there was something I thought ought to be topped up. So after my wife had died in 1983, and I found that I had a bit of time, I came in to Royal Holloway and Bedford New College and Olof Lippold, acting Head, kindly allowed me to work alongside Graham to help in joint research. Thus we did some extra work and wrote it all up. And then having done all that, I thought I would give a sort of seminar, partly because I felt a bit hurt that when I retired the College had not tried to fill the Chair in Physiology. I think that they were in financial trouble, too, but they replaced professors in two classics departments, which ... – well perhaps I am biased – I thought science was more important than classics.

MR: Are you a reader? I mean outside of science?

WW: No I don't do very much reading.

MR: Do you like music or theatre?

WW: Oh I listen to some music, but I am pretty old-fashioned even in that.

MR: Well how old-fashioned?

WW: Well you probably don't know that Alan Keith does a programme on Radio Two every weekend on a Sunday night from nine o'clock onwards, and I always listen to that while I am in bed.

MR: What kind of music is that?

WW: Well he calls it 'your hundred best tunes. That's what he calls it, but it's mostly classical or semi-classical.

MR: Would you go to concerts, do you go to concerts?

WW: Well, my wife and I went to one or two and I took my mother to see La Traviata in Newcastle, but that was long ago. But, you see, if you wear two hearing aids, you don't get the best out of concerts.

MR: Yes but you enjoy it? What I am getting at is that you derive pleasure from good music.

WW: Yes, I have got a fairly tolerant ear for music.

MR: Did you ever play an instrument?

WW: Oh no, no, I was never any good at playing the piano.

MR: Did you ever try?

- WW: Well, yes. It's not in our family I'm afraid. Although my mother was very good, she played very nicely, but my father had no aptitude. I used to get my children to play. We had a music teacher just along the road and we used to get her to give lessons to the children. One day, we heard Richard my boy playing away at his scales, and we thought he may take to music, so went quietly to look and he had the Eagle in front of him, not a sheet of piano music. He is more typical of the family I think.
- MR: But sciences, amongst your children there are scientists? You said your grandson is a mathematician.
- WW: Well my boy went to Manchester University and took a BSc in physics, but then he got side-tracked into the computing work and he has spent most of his time on computing work. My two daughters didn't have the necessary A levels to go to university. The family tradition is to get all children educated so that they can earn their own living, so I got both daughters trained as teachers, and the one I am staying with at the moment is a headteacher of a school in Milton Keynes, and the other gave up teaching to run a computing business. So none of them are on the medical side, but the younger one has a son who is at Nottingham doing biochemistry, and it's possible that he will change over from biochemistry to do medicine, so he is the only sort of hope if you are looking for a family of doctors. But whether he will go into ordinary medical practice, or specialise in one of the subjects, like ophthalmology, or ear nose and throat, or be a surgeon, or a neurologist, or whether he will do research, I don't know.
- MR: [To GB] Do you have any final questions? I think we have tired Professor Widdas enough.
- GB: It's probably worth telling Martin about your ideas and how they come to you and if you have a problem how you'd tackle it.
- WW: Well I think the essential thing is that I like to consider it from a simple point of view and I am much more interested in putting it in such a simple way as you can imagine a little mechanism would work. You could even perhaps make a model of and try it out. I showed you examples of those water molecules in that picture, well the point about that is, you see, that I made that framework as a rectangle. You don't see it as a rectangle there, but if you read what I say you'll see that I've hinged each of those sides, only one side is actually fixed. The other sides are hinged, so that if you stand it up at a right angle, it's a rectangle, and by doing so, you could get the 35 balls,  $5 \times 7$ , in it quite easily. But there are a lot of spaces and I gave Graham the problem of putting an extra ball in and he managed to do it, you won't see how it's possible there. If you can move it over to be a parallelogram, you can move it over until it comes to the angle of  $60^\circ$ , anywhere between  $90^\circ$  and  $60^\circ$  you could have all those 35 balls in without any trouble. But, as soon as you get it to  $60^\circ$ , it becomes tight and you can't go any further. All this is already fairly well known by physicists and engineers, namely, that a layer of spheres can only be closely packed as a close-packed hexagonal arrangement, and if you look there you'll see the hexagonal arrays with a centre one. Can you see them all?

GB: It's just like a honeycomb isn't it?

WW: Perhaps you know that a water molecule isn't a true sphere. It's got two hydrogen atoms sticking out as little bulges. So these might prevent it packing in the minimum area of a true sphere or layer of true spheres, but I made this frame with a view to seeing how they could be packed. And that's the way I found an answer, then I had to go to my mathematics and work out what the forces would be. With that arrangement and the mathematics you'll find in the appendix to that paper, which Graham and I have written ...

Returning to the conformational changes in the glucose transporter, you see, it's really very simple to simulate the conformational changes by the palm and closed fingers of your two hands. It is easy to open the fingertips to indicate a cleft open on one side. Then to close the fingertips and open the two palms to indicate an opening at the opposite side of the membrane. This sort of mechanism, is that generally proposed, not only by us, but also by many others, see Science (1992) for instance. Well, if the protein has to move like that to get the sugar through, someone or something has got to do the work of moving the protein backwards and forwards in this way.

MR: The upshot is that you are challenging all the time what people take for granted.

WW: Well that's a fair summary of the apparent reason why they reject our papers. The mechanism is described as 'passive' in the literature so it is assumed that no further explanation is required. Therefore, all-important from our point of view is to publish our ideas and results of experiments, and to leave them for posterity. Scientists of the future can look at our interpretations and use them if they are found to be of any value.

MR: This is a good note to end on.



Wilfred Widdas and Graham Baker photographed by Martin Rosenberg at Dilke House, 18 March 1999.

The interview was preceded by some other conversations.

## Some recent work presented at a meeting of The Physiological Society in Manchester (29–31 March 1999)

WW has brought the result chart, which he and Graham Baker demonstrated at Manchester on the evaporation of hydrogen ions. See Baker GF, Baker P & Widdas WF (1999). A possible whole-body acid/base effect due to the respiratory elimination of carbon dioxide. *J Physiol* 517 (Suppl) 64P.

WW: [Showing a diagram] Here Graham has made a marvellous diagram of the tap manifold that we used, but we will forget about that for the moment. We have two flasks, you see; one flask contains 250 ml and the other flask contains only 40 ml, which is about six times less (of water, just water). Graham started just bubbling air and air containing CO<sub>2</sub> through the water, but this new system had a pH-measuring electrode in each flask. These outputs were recorded on a three-channel recorder and the third channel is used for the CO<sub>2</sub> meter, which gives you the percentage CO<sub>2</sub>. When we started with just air, with no CO<sub>2</sub> in it,

this was the CO<sub>2</sub> reading down here; you see, it gives a flat [near zero] reading. Then as we bubble pure air, which maybe has a little bit of CO<sub>2</sub> from the atmosphere in it, the pH [record] in the 250 ml flask just rises; well, its not the pH it's the hydrogen ion concentration that is going up. The pH is getting less [more acidic], but the pen record rises. [This is the way the chart is connected.] The second record, that of the 'small 40 ml volume flask' is flat all along there, but if I show you the previous bit of the chart [folded back], you see that the 40 ml volume also comes up to this level, very quickly, whereas the 250 ml volume comes up more slowly.

MR: So this is like a buffer solution this one?

WW: No buffer at all.

MR: No, but I mean it's acting like a buffer solution.

WW: It's water, pure water. More or less distilled water, you see. And then as soon as we get to this point which is 40 minutes, these are minutes, you see, we turn off the tap to this small flask. But we connect the CO<sub>2</sub> air to the large flask, which then goes to the pump, which is sucking it through, and you can see the CO<sub>2</sub> percentage goes up to nearly 5%. The large flask which is being bubbled with CO<sub>2</sub> becomes acid fairly quickly, whereas the flask that's just turned off has initially become alkaline and then it stays alkaline, you see; along here it is constant while the acidity in the large flask climbs [pH falling] up to its steady level on the chart.

Using this technique, with pure air bubbling, you see, the CO<sub>2</sub> percentage comes down very rapidly, that's as fast as it rises, but it doesn't go right down to the bottom. There is a slower phase when it goes down to the bottom in another quarter of an hour, you see, and after this time the chart level for the CO<sub>2</sub> is back to the normal. Now the point is that we've given this big flask time to recover from this loss of CO<sub>2</sub>, but the acid part takes a very long time to recover and so we think there must be some acid evaporating from the water.

MR: It's kind of controversial isn't it?

WW: Yes. My grandson, who has a PhD from Cambridge for mathematics, raised his eyebrows very much when I said this is acid evaporating. He later followed the logic of our deductions and concurred with our view.

MR: What do you mean by evaporation?

WW: The rain that comes down is proof of evaporation isn't it?

MR: We have water vapour. You think there is a gas there which forms the acid?

WW: Well. You say you have water vapour, but in water you also have OH<sup>-</sup> ions, and you have got H<sub>3</sub>O<sup>+</sup> ions too. If you know your chemistry.

MR: Well vaguely.

WW: Well the OH<sup>-</sup> ion is 17 daltons. Water is 18 daltons and the H<sub>3</sub>O<sup>+</sup> ion is 19 daltons.

MR: Partial pressure?

WW: No I am talking about weights. If they all evaporate, it's only reasonable to assume that the lighter one will evaporate faster than the heavier one and if the lighter one evaporates that will make it go a little bit acid, which it did.

MR: By contraction.

WW: Well, if you take the alkaline component out, you get left behind some acid components, but if you go back to electricity, the one that goes out is negatively charged, the one that's staying back is positively charged; it will quickly come to the surface and start sucking back the negative charged ones. So it will hold back some of the  $\text{CO}_2/\text{OH}^-$  complex to come to an equilibrium when both will evaporate. So in view of that possibility, at this point we turned off the air to the big volume flask; turned it off altogether. Then we started to bubble just some ordinary air through the little one, and you see that where this pH record went alkaline on cessation of bubbling, it immediately went back to where it had started, you see, as soon as bubbling was restarted. We kept it isolated for two minutes, and then we connected the two flasks by the manifold taps, so that we are now collecting the vapour that's coming off the big flask into the air forming bubbles in the little flask. And, you see, we now get an additional acidity in the small volume flask. During this time the pH change for the large volume flask has been going progressively more alkaline and if you were to use a ruler, you would see that the slope has been linear for all 30 minutes. Now the pH, you probably remember, is the negative logarithm of the hydrogen ion concentration, so that [the linear rise in pH] means the hydrogen ion concentration is reducing exponentially. This occurs in reactions of the first order; this is what you would expect for evaporation. Thus, the more hydrogen ions there are, the more will evaporate. So this little bit of experiment that we've done is just to show that hydrogen ions do evaporate. The medical significance is not the hydrogen ions that evaporate, but the fact that during the  $\text{CO}_2$  evaporating, it's taking out some hydroxyl ions with it, and electrically the two must evaporate and have the same rate.

MR: So what is the consequence in the physiological context?

WW: Well, the consequence of what Graham and we have shown is that the more acid your blood is, the more hydroxyl ions you'll lose when the  $\text{CO}_2$  comes off in the lungs. Even if the  $\text{CO}_2$  is only coming off at 5 per cent, as it is normally, you don't have to have an accumulation of the  $\text{CO}_2$ , because if you have an acidosis, you're going to increase the hydroxyl ion loss and get more of an acid load left behind even for ordinary respiration [as in a resting subject].

MR: The respiratory acidosis.

WW: Well you probably know that the final balance has to be done by the kidney and by the gut, but the point that we are making is that if you start with an acidosis you are sort of giving yourself a bigger load to deal with than if you can get rid of the acidosis.

- MR: So it's worse than you think in other words. You are making it worse than you think.
- WW: Precisely. That's precisely the message.
- MR: So much for homeostasis.
- WW: Oh yes homeostasis.
- MR: I am a neuroscientist so I have to think hard when you tell me these things.
- WW: You are a neuroscientist. Well, you see I brought you some recent reprints, but I'll send you a Collatum when I get the proper cover for all three reprints. So I will send you one. They are all published in one volume of the journal in which we publish our work, which is *Cytobios* [66, 179–204; 68, 131–152; 68, 71–76].

## On the working of the glucose transporter and the idea that the energy source must be that of the surface energy of water, with an interlude on religion

See Widdas WF & Baker GF (1991). The role of the surface energy of water in the conformational changes of the human erythrocyte glucose transporter. *Cytobios* 66, 179–204.

WW passes a document to MR

- WW: Now this one is more a note on our paper of the working of the red cell glucose transporter and is of possible interest. It chiefly shows the way in which our original efforts were rejected by (a) *The Journal of Physiology* and (b) *The Journal of Theoretical Biology*. Now *The Journal of Physiology* people [Editors and Referees] said that it was over speculative and too much theoretical and I know *The Journal of Physiology* doesn't like too much theory, because I was on the editorial board as you know.
- MR: How do you react to this sort of criticism? Do you become angry?
- WW: Oh no, no. I just laugh at them, because what I aimed to do, you see, was to leave the ideas in print; let the readers either throw them out, or take notice of them, whatever they like ...
- MR: [...] Reading your family history [a document presented by WW] ... you don't mention anything about religion, for example. Was it [WW's] a religious observant family.
- WW: Well, yes, I believe, although I shouldn't use the word *believe*, but I have the idea that Moses perhaps had consulted the doctors in Assyria who were very much in advance of most other medical opinion in those early days, because it was they, the Assyrians who knew all about the production of canals and irrigation to get the agriculture going, and all that sort of thing. They knew, and I think that if you read the bit about Moses, it's very typical of what might happen today. Because he sort of had the job of taking perhaps 3000 people

from Egypt to this land, which he thought he knew of, and as soon as they ran into a bit of trouble, just like a group of boy scouts, some of them said 'oh I wish I hadn't come.' If you read you will see that some of them say that they were better off in Egypt, you see. And then somewhere, I don't know where, he met his father-in-law and his father-in-law said, 'well how do you deal with all these problems?' And Moses says, 'well I go and visit each one and discuss it with them,' and his father-in-law said, 'oh that's no good, I will have to show you how to do it. You go up a mountain and you see all the thunder and lightning which none of these people understand.' Well as they didn't understand it, they thought that it was the Almighty talking from above, you see, and he said, 'then you lay down a set of rules for all to follow, and say they were given to you by the voice from above [thunder and lightning]. Well, if you neglect the first part about there being only one God, and all that business, the remaining rules are extremely good. I told the vicar when I left Kew after 50 years, I wrote to him, and I said that if the sort of masses, if you can call the general populace that, followed those rules, at the end of Moses' 10 commandments, I said there would be nothing to report on the media at the moment.

MR: I gather from that you are not a believer?

WW: Well, not completely, you see, I had the Jehovah Witnesses coming to me and I used to give them a good old talk and I used to say, do you really think that the flood occurred like that? And I told them the flood might have occurred in a very local area, but it certainly didn't occur throughout the world. I think it is T. H. Huxley you want to look at. He defined what an agnostic was. Now an agnostic is not one who doesn't believe, but is one who doesn't think there is evidence one way or the other, which is a slightly different position. I think that a lot of very good work has been done by the Church, but at the same time you can get the sort of fanaticism and intolerant prejudices, which we are now witnessing in Northern Ireland, and which has been evident all through the centuries of the past.

MR: This is not belief or non-belief, this is groups of people.

WW: Well it is, but I, for my sins or otherwise, get a lot of junk mail nowadays, and one of the junk mails that I was quite interested in was a whole sheet about this bag full of little postage stamps or items that looked like postage stamps, but they are really advertisements of different journals I could buy for a cheap rate if I went through this publishing firm. There must have been about 200 different adverts on this form, going from model railways to ladies' clothes, all sorts, *Nature* was one of them, I could get *Nature* for 20 per cent off, or 10 per cent off, and along at the other end there would be little things about collecting birds, overall a huge collection of magazines. Now it seemed to me that if there are 200 magazines that I could subscribe to, there must be 200 bits of the population who are prepared to buy that magazine, otherwise they wouldn't be advertising it. Now that means there must be at least 200 different points of view. All different from my own. Well, for instance, I have a nephew who has always been keen on little model railways, Hornby model

railways, and in his garden he has a sort of run for these little model railways, which in the north of England you can only do in the summer time.

MR: You put religion into that sort of context as a hobby?

WW: No I don't put religion as a hobby, although you could perhaps, there may be magazines that you can buy of a religious nature. No I was just trying to explain the wide variety of opinions. Now you can get those same variety of opinions on religious things you see, perhaps not so wide, but I think it was Confucius in China who had a philosophical system about 500 years BC. Well that couldn't have been the same god could it? And a lot of Islam people believe in Mohammedan and that sort of thing, and even the Jews, you see, don't really believe in Christianity do they?

MR: Well, it's not on the agenda. Because it came later.

WW: Well I am a bit worried whether there is any prejudice in science of that type, because, you see, in our paper of 1991, we did all the work in 1989, two years previously, we spent a whole year 1990, being rejected. You have got all the documents there, but the *Journal of Theoretical Biology* turned it down, saying that it was wildly speculative. We'd pointed out that the standard idea that the energy for doing the conformational changes could not come from substrate binding was wrong. We had pointed out such changes occurred in the total absence of any substrate. [Shown by the Americans Appleton and Lienhard (*Biochemistry* 28, 8221–8227); they had actually measured the rates without any substrate there at all.] Now, you see, one of the reports from *The Journal of Physiology* said that this might be due to a disequilibrium of previous reaction or something. Well, how could a previous reaction, 10 minutes previously or more, affect it at that time? It's just not logical, and I am afraid I like to see things logical.

MR: [...] You are obviously excellent at both the theoretical side and the practical side. You speak at length about Faraday. Now Faraday is often regarded as an experimenter par excellence. You know more about Faraday than probably I do.

WW: Now what did I do with this little book I brought. This little book was given to me, if you can read very carefully on the bottom of it, it was given to me when I was probably at school.

MR: It's called *Pioneers of Progress*, it's a series Men of Science, its about Michael Faraday and it's written by J. A. Crowther, and it has written on it Wilfred Faraday Widdas from his Godfather.

WW: [...] What you want to consider is the relevance of what is written here. It says a good deal of misunderstanding seems still to exist as to the exact nature of the scientific method. Then it goes on, but discussing a scientist, says his first step is to collect all the known facts which seem to bear upon the point. Having this accumulated available evidence, he proceeds to let his imagination play upon it. The author continues: 'It is just in this power of imagination that the great scientist excels his lesser brethren.' Now, I have left that bit out, because

I don't regard myself as a great scientist. Then it says: 'This process may suggest some theory or generalisation which seems to embrace the whole of the facts, and it must first be carefully tested to see that it is not at any rate contradicted by anyone of them.'

Well, now I had the ideas and I said what I thought might be happening to explain how the conformational changes occurred. [At a coffee break with several physiologists at RHBNC] It was Graham who said, 'Well if surface energy is the source of power, we should be able to get an inhibition of glucose transport by lowering the surface energy.' He went on to say that he thought we could do that with the alcohols. But the paper had been turned down because we used the alcohols to do the testing. But the *Journal of Theoretical Biology* also said we were wildly speculative and not sufficiently based on experimental tests. Well what can we do? Anyway the adverse report goes on to say one bit of evidence that the authors advance is that the conformational change wouldn't have occurred spontaneously and therefore you can rule out the question of substrate binding as the source of energy. The Referee wrote that if you read the Monod–Wyman–Changeux model, then in brackets he wrote, 'see any biochemistry textbook', it postulates that conformational changes do occur rapidly in proteins without substrate. In my extract I have drawn attention to the words 'it postulates'. How does that differ from 'speculation', which we are denied?

So I thought, well I better read up what Monod, Wyman and Changeux had written. What they wrote was that spontaneous conformational changes may occur in polymeric proteins. Now, the glucose transporter is a monomeric protein and Monod *et al.* excluded them, so I wrote back to the Chief Editor [a FRS] and gave him a whole lot of reasons why he should reconsider. You see, the idea of one part of a protein causing a conformational change in another, was due to Perutz and that was very good, because they were doing haemoglobin and when the oxygen goes on to one haem-group it affects the others.

MR: Did they start with myoglobin?

WW: Well it doesn't happen with myoglobin [a monomer], that's it you see, that's a monomer. It only happens with the tetra-haem groups of haemoglobin and there was no evidence that the glucose transporter is a tetramer, although Carruthers and others have suggested that it might be, but I don't think they have any very good evidence for that either. Their postulates are not wide speculations.

## Bibliography

### [Wilfred F. Widdas](#)

Boyd R (2009) and Naftalin R (2009)  
*Physiol News* 74, 59

### [Wilfred F. Widdas – Model scientist](#)

Naftalin R (1996)  
*Phys Soc Mag* 24, 18–19

### [W. F. Widdas – Living History: The surface energy of water from 1908](#)

Widdas W (2006)  
*Physiol News* 65, 7–10





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