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**Dr Elsie Widdowson, CH FRS in interview with Sir Gordon Wolstenholme  
Oxford, 7 October 1996**

GW Dr Widdowson, I believe that I first met you in January 1958 when you came to take part in a symposium at the CIBA Foundation on water and electrolyte metabolism in relation to sex and age, and your old colleague, Professor McCance, was then the chairman of that meeting. And I remember that even at that time, '58, we looked upon the two of you as already a legendary partnership in medical research, and yet it was to continue for another thirty-five years nearly, until poor Mac died in 1993. I remember also that when he died, the College of Physicians asked you to write a memoir about him and you did so, very kindly - several very fine pages of tribute to all he did, but without mentioning yourself except in the signature, and yet all of us knew your own contribution to this partnership was indeed a very brilliant one. This has been recognised of course by your election to the Royal Society, by being made a Companion of Honour, and a Commander of the Order of the British Empire. You are an honorary fellow of the Royal College of Physicians, and you've had many prestigious awards both nationally and internationally, most of them of course in nutrition research. So, it's a great pleasure now in October of 1996, just two weeks before your ninetieth birthday, to be able to interview you and to look back retrospectively over such a long and wonderful career. I'm wondering if we might start by asking you when you were a schoolgirl in Sydenham, what were your dreams and ambitions then? What did you imagine would become of your life?

EW Well, as I've mentioned in the book you've referred to, my ambition was to be a zoologist. We studied zoology at school and I got very, very interested in comparative studies, comparing the animal kingdom with the human species, putting the human species into its place, and this has continued all through my life until the present day. I'm still interested in doing that and I'm involved in writing a book on it.

GW You're involved now in writing a book?

EW Yes, as a part author of a book on nutrition and development of mammals in early life. And one important job I have to do is to bring the human infant in with animal infants, because I find that medical people on the whole know very little about the physiology of other species, and zoologists certainly know nothing about the human species. I looked at a big table of the composition of milks of different species one day and human milk wasn't even mentioned.

GW That really doesn't surprise me. I got involved in the school instruction in human reproductive biology and found that the zoologists were unable to teach any of it. They didn't know anything about it, but they loved having sandwich courses where they began at last to know something about the human. However, you didn't become a zoologist, although it's been an underground current so to speak of your whole life?

EW Yes.

GW So, how did you turn to chemistry?

EW To chemistry. Well, because I was recommended by the staff at the school. I was at a very good school in Sydenham and they said, 'Well, the only job you can get in zoology is to go abroad to Africa or somewhere,' and I knew my parents wouldn't look very kindly on that, so I turned to chemistry which I was also quite fond of. I went to Imperial College which was quite unusual for girls in those days.

GW I think you said that there were only three out of a hundred in your year?

EW Three in a class of a hundred, yes. I think it's different now.

GW It's possibly fifty fifty at least now.

EW Yes.

GW So things have changed a great deal. But, having got your BSc, I think you came under the influence of Helen Archbold, or Helen Porter as I knew her, in regard to plant physiology?

EW Very much so. Well, you see the story was briefly that I took my examination for my degree after two years, but I had to remain at the college for another year to get the degree. And so I had to go somewhere and I went into the biochemistry department and worked there for a year on the separation of amino acids, which, of course, was done in a very old-fashioned way. And then, while I was doing that, the plant physiology department was just across the quadrangle from the biochemistry department and someone came across one day and said they'd heard I was looking for a job and would I care to come over and be interviewed, which I did, by Helen Archbold, and I got the job and there I worked on the physiology of apples.

GW And your PhD was on?

EW It was on apples.

GW How wonderful, because that again seems to have been the constant backbone to your life?

EW Because I started with apples and I've finished with apples because I now grow apples. But she was a wonderful person and she taught me to love research. She taught me how to write papers and she really just set me on the right lines and that was a very, very valuable three years I spent under her supervision.

GW And then you went to the Courtauld Institute with Dodds?

EW Then I felt, well, I mustn't spend my whole life on plants and I wanted to learn

something about the animal species, but rather the human species, so I went and worked under Professor Dodds. Well, I still wanted a job and this was in the early thirties, and I didn't know what to do, so Professor Dodds actually said, 'Well, there's a course in dietetics beginning at (what was then) the King's College of Household and Social Science, a course in dietetics under Professor Mottram.' And he said, 'Well, there'll be jobs for that in the hospitals.' And he recommended me to go and take this course and so I took his advice.

GW Just before we go on to that. You did do some work on nephritis whilst you were in the Courtauld, didn't you, on serum and urinary proteins?

EW Yes, that's right. Serum and urinary proteins and the identity of them in nephritis. Yes, I did. I thought that paper was quite lost! But it was right. Somebody confirmed it later.

GW Yes. Did you do that with somebody else?

EW No, I did it by myself. He suggested the subject for me, you see.

GW So you really made quite a jump at that time ?

EW I made quite a jump, yes. But then I make another jump, you see.

GW And at King's you... part of the course was at Bart's?

EW Yes. Part of the course was at Bart's, but before the course began I had to go and get some experience in a hospital kitchen to learn something about large-scale cookery. So, since King's College Hospital was near my home, I went there and that is where the momentous meeting took place of Professor - well he was Dr McCance then - and me, in the kitchen at King's College Hospital.

GW There should be a plaque. I hope there will be some day! But he was of course working in the diabetic unit with Robin Lawrence?

EW Yes, that's right. He had been working with Dr R D Lawrence in the diabetic unit and because he was a biochemist, he had been asked by Dr Lawrence to analyse food materials that contained carbohydrate for carbohydrate. You see, the food tables up until that time had no figures for carbohydrate determined directly. It was always that people analysed them for protein - well for nitrogen - fat and water and ash, and then assumed all the rest was carbohydrate. But it was Lawrence that spotted that this couldn't be necessarily all available carbohydrate for the diabetic. He was interested in diabetics. So he got this medical student - that was McCance - to analyse directly plant foods for carbohydrate, and this he had done. And that had been published but by the time I came on the scene he had been asked, having published the carbohydrate in plant foods, he had been asked by Professor Cathcart, who was the professor of physiology in Glasgow, to analyse animal foods because there were no decent figures in this country for the composition of animal foods. So this was what he was busy doing. He was studying meat and not only was he analysing it but he was studying the

losses on cooking. And so he used to come to the kitchen and put these joints in the oven and take them out again and I used to see him doing this and I couldn't make out what was going on.

GW The only doctor surely who ever came near the kitchen?

EW Yes. So I asked the cook and she said, 'Oh, that's Dr McCance, he's doing research on cooking.' Research - I pricked up my ears at once! And I ventured to speak to him and he was very nice to me and invited me up to his laboratory, which was a very small one, and told me all about the work he'd done on the fruits and vegetables. And I, I'm afraid, having done this work on apples when I was separating carbohydrates in apples, told him his results, some of them were wrong.

GW You couldn't have said anything that would attract him more!

EW Yes, because you see he had boiled the material with acid and I knew that by doing that, he had destroyed some of the fructose. Well, instead of being cross with this little upstart, he said, 'Well, I'm going to try and get a grant for you to come and put this right.' Well, of course, I had just embarked on this one-year course in dietetics and I decided that I wanted to pursue that since I had started it, and he was quite willing if I just came in my spare time and helped him, which I did for a year. And then I finished up the year by going to Bart's. I had to spend some time in a diet kitchen and during that period, which was 1933, there were only three hospitals in London with dietitians. One was Bart's, one was University College and one was the London. Miss Marjorie Abrahams was in charge at Bart's and I went and worked with her. I was supposed to work there for six months, but somehow I got away with it by just going for one month.

GW Only one month?

EW Yes, because I was so anxious to get on with my other job.

GW But you wrote a book with her, didn't you?

EW Yes, but that was mostly done after I had finished working there. We used to do that in the evenings together, that's right, 'Modern Dietary Treatment'. But anyhow, I then realised, working in this diet kitchen, that these food tables they were using were not only...they were American, 'Atwater & Bryant', they were marvellous in their day, but they were published around 1900 and really we needed better figures for everything and what we really needed were some good British tables, you see. And so this was one of the things that came out of those first years I worked with Mac at King's College Hospital.

GW I remember reading that you went out one day on the top of Box Hill and there you had something like a sort of...like Moses, you found some tablet of stone relating to the composition of all foods?

EW Well, yes. I suppose I had been thinking about this quite a lot you see and I

suddenly thought, well, we've now analysed fruit and vegetables and he's done meat and fish and that covers a lot of the foods. We've just got to go on with the analysis a bit longer and study cereals and jams and marmalades and so on, and we should have all the wherewithall for making some British food tables. So this was one weekend we went on this family picnic, so I came back on Monday morning and I put the idea to him. He thought it was not a bad idea - let's do it!

GW A huge amount of work.

EW Well, it was all a tremendous amount of work because of course you have to think what equipment we had. We had burettes and pipettes, visual colorimeters, you see, and the inorganic constituents which we analysed the foods for were all done chemically. We had no clever machines to do that in those days, but we did it, and we had slide-rules. Of course, we had no calculators or anything like that, everything was calculated by a slide-rule. And we did it and we produced the first edition of 'The Chemical Composition of Foods' which was published in 1940 and is now in its fifth edition, but I don't have anything to do with it now. I looked after the first three editions.

GW But that was a stupendous task. I would like to ask you, in the course of doing all this it must have been self-evident that you couldn't plan anything in relation to human or animal nutrition without knowing the composition of what they were eating? But hospital patients, generally...you say that only three hospitals had even a dietician on the staff. Hospital meals really had a pretty bad reputation, didn't they?

EW Yes, they did.

GW They weren't adjusted, shall we say, to the needs of particular patients, with the possible exception of the diabetics?

EW Yes, that's right, you see. And then they had low protein diets for patients with renal problems. That was another thing they did, you see. But of course the three dieticians at the London hospitals had nothing whatever to do with the general feeding of the hospital, they were only concerned with the patients...

GW With very special patients?

EW With special patients, yes.

GW They didn't influence the overall diet?

EW No, not at all.

GW And the problem of feeding people up after surgical operations and everything was simply not thought about?

EW No, that hadn't been thought of at that time, as far as I know.

GW When did the interest in infant feeding begin with you?

EW That was much later. That was after we'd moved to Cambridge.

GW Which was in 1938, wasn't it?

EW We moved to Cambridge in 1938, that's right, but the actual interest was sparked off while we were still at King's because Mac had a house physician who had been testing urines for chloride because he was making his studies on experimental salt deficiency at the time, while I was busy with food analysis. And she then went to work with Sir Leonard Parsons at Birmingham ...

GW This is Winifred Young, isn't it?

EW Winifred Young, yes. And she had to test the urines for albumen and sugar and by force of habit she tested them for chloride and found they contained almost none. She couldn't make this out. So she came back and told Mac about it and he at once was interested in this and this really was what started the whole interest in infant physiology. It just started while we were at King's and then, of course, during the wartime we were busy with other things, but then after the war we took it up again and I got interested in it. But he was interested in the renal function of the infants and he followed that up. That was his great interest. Now, I couldn't get very interested when he was confining himself to the kidneys, and it was, in fact, a study of mine on rabbits that really gave the solution to the whole problem. You see, the infants had this poor renal function and yet the composition of their body fluids remained normal and he could not understand this. This was a complete puzzle. But I was making some studies both on babies, human babies and on various animal species, but I think it was the rabbits really.... We measured the retention of various nutrients, but particularly nitrogen, from their mother's milk, you see, and we discovered that the rabbits retained about nearly ninety per cent of the nitrogen from the protein in the milk for purposes of growth, so they'd only got a very small amount of nitrogen to excrete as urea.

GW It didn't matter that their kidneys were not...

EW It didn't matter a bit, you see. But this had never been thought of before. And then we made studies on human infants and we found that human infants, a week old or so, retain about fifty per cent of the nitrogen in the protein in their milk for purposes of growth. And it's only when you start feeding babies on unaltered cows' milk or milk containing more protein that they get into trouble.

GW We'll come back, I think, to the infant feeding, if we may, a little later. Can we go back to the early days of the war, because there you were challenged with the problems of nutrition for the whole population including, of course, children in the war, and particularly, of course, the bread problem and what was a suitable diet within the capacity of the country to provide something during the war?

EW Yes. Well, we made two studies really during the war, two major studies.

They were both Mac's ideas. The first was an experimental study of rationing because obviously rationing was going to come in, and he thought we would devise some rations that would really be good and physiologically sound although they would include.... The only food that would be imported would be wheat, because this country at that time couldn't produce enough wheat. But we would only eat enough meat and fish and so on and eggs and milk that this country could provide. And he took a lot of trouble going round to various experts in these fields. Of course, we had the Agricultural Department and the Biology Department near us in Cambridge and there were people to ask about this, and our rations were based on this and we lived on these diets for some months.

GW Both of you always experimented on each other?

EW Well, on ourselves really.

GW On yourselves, and sometimes very roughly indeed.

EW But this wasn't rough at all.

GW But when Mac put himself on the strict war ration, he proved, and you too, that you could undertake physical labour; if anything, I mean, very fully, I mean if anything, you were fitter?

EW After our period on this, we all went off to the Lake District, you see, to test our prowess.

GW With Andrew Huxley?

EW With Andrew Huxley, later president of the Royal Society, as one of our guinea pigs, and he came on our trip to the Lake District. And he and Mac were the best walkers and climbers of us all, but we were all very physically fit and I've never done such walking and climbing as I did that January.

GW January, it was?

EW January, yes. Marvellous time.

GW You had this...you were regarded as the authorities on bread, but you were also asked to come over to Ireland at one stage, weren't you, even during the war?

EW Well, this was the second study we made. There was a suspicion from this first experiment when we were living on, had wholemeal bread for our rations that there was something in it that interfered with the absorption of calcium, and this is what Mellanby had been saying for years. Sir Edward Mellanby was at that time secretary of the Medical Research Council and he had said that there was some anti-calcifying substance in whole cereals and this idea he had had from his studies on puppies. Well, now we knew the country was going on to a higher extraction flour - the national loaf - and we all felt that it would be good to test this, so we did test it.

And we measured our intakes and excretions of calcium and of other substances on various breads and we found that there was something in wholemeal bread that did interfere with the absorption of calcium. And since our calcium intakes were low during the war because milk and cheese were severely rationed, this was an important thing. But then we found that it was phytate, a substance called phytate, which is in the outer layers of the wheat and in the germ, which was the substance that was causing this. It formed an insoluble salt with calcium in the intestine and so interfered with its absorption. Mellanby had already discovered that phytate was the substance we should look for, but we were showing that what was true of puppies was also true of humans. And we found that this could be overcome by adding either calcium carbonate or calcium phosphate to the flour used for bread making and we recommended that this should be done, and it was done in the amounts we recommended. It was by law, it had to be put into the flour and there was a great to-do about this to start with - but still - people were all going to get gout and I don't know what. There was a man called Isaac Harris who was particularly vociferous.

GW There was a natural supposition that wholemeal bread was better for you in every way, isn't that right?

EW Yes. It's got more vitamins in, that's the difference you see. Well that was that, and as far as I know the amount of calcium in flour is still controlled up to this day.

GW Ireland wanted this information as well? They already had some rickets, I think, hadn't they?

EW They had some rickets in Dublin, that's right, and of course rickets is not caused directly by deficiency of calcium, but it may be linked with it in some way, but they must be deficient in Vitamin D to cause rickets. Professor Jessop in Dublin read about our papers and he came over to see us and asked if we would go and give a talk in Dublin about this. This we did in wartime and this was quite exciting because of course Dublin was lit up and we were in darkness in England, and De Valera came to the lecture. The scientific result of it was they did put calcium carbonate into their flour as we did in England, but the personal interest was that we were photographed shaking hands with De Valera and this photograph got into the Northern Irish papers.

GW Where of course Mac was born.

EW Where he was born, where his brother lived, and this caused a lot of trouble! Of course, it didn't matter that I was photographed because I had no Northern Irish connections.

GW So this kept you busy, rationing altogether, through the war. And it was because of this experience that after the war you went to look at what had happened to the people with very deficient feeding, in Germany, at the end of the war. Isn't that right?

EW That is correct. This again was Mac's idea. All these ideas for big



experiments were his ideas. Yes, he said, 'Well, now we've looked at English rationing, let's see...' He knew that each food was very short in Germany, so he and I made a preliminary expedition in March and April 1946, just six months after the war ended, to look for somewhere where we could set up a unit and we found by far the best place was in Wuppertal, not far from Düsseldorf, and so we did. The MRC sponsored this and there we worked for almost three years with a team of people with different expertise.

GW And comparing the nutrition of different groups?

EW Well, no, no. At first we were studying the adults, the undernourished adults, and the hunger oedema was Mac's great interest - what causes hunger oedema? Well, of course, we got to the bottom of that. A person who is undernourished has a big excess of extracellular fluids in his body and the oedema is just posture oedema, you see, and it disappears at night. But the big problem is this excess of extracellular fluids, of which the oedema is only a very small part - I mean, we got that sorted out without any difficulty and a lot of studies were made and two Medical Research Council special reports were published describing all our results.

GW And there were the resources to provide food for these people you were studying? You get adequate nutrition?

EW Well, if people had a hunger oedema, they qualified for extra rations if the doctor signed them up. They were sidetracked to our hunger oedema clinic, you see, before they were signed up for rations. That's how we got hold of the patients. But yes they did, that's right. But then we made another study on bread in Germany after this was finished. This was all due to Mellanby again. I came home for Christmas and there was a meeting about what bread this country should go on and he looked at me and he said, 'There are a lot of hungry children in Germany, there must be. You go back and find out which is the bread for us to eat.' Obediently I went back and we found some orphanages where we worked. And the children lived largely on bread with only their German rations beside that, which was very little animal food. But they had as much bread as they wanted, of several different sorts, and what we discovered to our surprise was that they did just as well on white bread, with no additions, as they did on brown bread, on wholemeal bread. Well, this surprised everybody. Of course, the answer was that they got all the other food nutrients they needed in the small amount of other foods they got. Everything was turned into soup and they got plenty of vitamins. They had vegetables, you see, vegetables and very small amounts of soup. Well, they had quite a lot of green vegetables and they got enough of the vitamins from the other foods and they didn't need the wholemeal bread necessarily. Well, of course, nobody would believe us, but it was true!

GW Nobody wanted to believe you. But you did have if I remember rightly, one very interesting psychological experience in one of these trials?

EW Yes. That was another story. It was one of the orphanages where we were making this bread experiment, but we were doing something else. I think we had finished the bread experiment and we made another study. I know what we were

going to do. We were going to measure the children's heights – we measured their heights and weights and they were examined physically. They were going to live just on their German rations for six months and then for the other six months we would give them extra bread. They would have the sort of food they'd had in the other orphanages. But we had two homes so that one had the extra bread first, in the first six months. And what we found was that those in the home that were not having the extra bread gained weight and height faster than those in the other. Well, then we switched them round and gave them the extra food in the other home: those children immediately stopped gaining weight so fast and the ones where they had not got the extra bread started gaining weight more rapidly. Well, this was very extraordinary because we couldn't believe that extra food would stop them growing. So we looked into this a little bit more deeply. Well, you see, we'd been working in these homes and we had a nurse working closely in them and a dietician, and what we realised was that the house mother at the home where they'd gained weight badly in the first six months had been moved to the other home at the point when we changed the diets over. That was just chance. And she was a very unpleasant woman, always scolding the children at mealtimes. A very nice woman was in charge in the other homes when the children were gaining weight well. And we know the children ate the food because we had a dietician watching them all the time, but it was the psychological trauma that did this.

GW It's a fascinating story, isn't it?

EW It was a very interesting story. And it's been confirmed. It's regarded as a...it's an experiment you could never design. It was just chance observation.

GW Yes, but there was a solution?

EW There was a solution. I'm sure it was right. But everybody agrees now that this was right and animals have shown the same thing.

GW Yes, if we might come to the animals because you have worked with so many different species, haven't you?

EW Yes.

GW And you've done under-nutrition, delayed maturation and all kinds of studies on these.

EW Yes, I have done all sorts of things.

GW Including if I remember rightly, pigs that were extremely malnourished. Do tell me something about that?

EW Yes. You see, when we came back from Germany we had never worked with experimental animals up to that point. I had never touched an experimental animal. We started with pigs because Mac had kept pigs in wartime

GW Yes, as so many people did.

EW And so he still had the accommodation. So we started working with pigs and under-nutrition was what we were interested in at that point. So we tried to undernourish pigs from ten days of age. You can wean pigs quite early and we took them away from the mothers and fed them, but very little food, so that by the end of the year their weight was only five or six kilogrammes compared with several hundred, two hundred kilogrammes for their litter-mates. It's the greatest under-nutrition or difference in weight that has ever been produced. Of course, you can only do it in the pig because the pig adult is so much bigger than the newborn pig. That's why you can get this difference in a pig.

GW But these very tiny pigs, they were otherwise active?

EW Well, we had to keep them warm. That was the mistake we made at the beginning because you see they had no subcutaneous fat at all and they just died. We had to keep them in a warm atmosphere. That was the secret of keeping them alive.

GW But given that, they would survive well?

EW They survived. But, to me, the most interesting thing of all was the way they recovered. After a year on this diet when they weighed three per cent of as much as they ought to, they were then given plentiful food and they ate it and they grew. They didn't grow quite as big as their litter-mates, but their curves went right up and then it turned over as they grew to maturity and they developed sexually. Well, now after Mac had retired, I had still got the pigs and I thought I would go on a little bit longer. So I undernourished them for two years and three years. We had to let them gain a little bit of weight all the time.

GW But still far below normal?

EW Far below. And even after three years of this deprivation, at an age when the normal pig has stopped growing, they started growing, but the longer they'd been undernourished, the smaller they were as adults. They didn't develop sexually at all when they were undernourished, but it was the one immediate response to rehabilitation or quick response. And we mated the previously undernourished males with previously undernourished females and got marvellous litters, perfect litters, the mothers suckled them and that to me was in a way the most amazing thing of the whole experiment, the way they could recover and produce...

GW And the next generation didn't suffer?

EW And the next generation bore absolutely no stigma of the deprivation their parents had undergone.

GW It is remarkable. You weren't able to study the longevity of these pigs?

EW No, not pigs, no.

GW Because in other cases, I think with rats, anyway...

EW We did study it in rats, you see.

GW And there the longevity is greater if the maturation is delayed with under-nutrition? I think so.

EW Yes. You see, what happened was we found if the animals were undernourished early in life and then rehabilitated, during the first year the ones that were small and had been undernourished got more infections and more died. But if you took all those that were alive at the end of a year, then the ones that were undernourished appeared to live longer. But of course, a lot of work has been done in America on this subject.

GW Cornell, I think.

EW Yes, that's right, and a lot is going on.

GW And one hopes it will not be applied to us for a long time.

EW No.

EW All of this work has a special interest or repercussions for our Third World, as we call it nowadays, all the poorer countries where malnutrition is still rife, and I know you did get involved to some extent quite early, didn't you? Dagmar Wilson was a friend of yours, and in India she was studying I think mainly rickets and osteomalacia, which was a really serious problem in India.

EW You see, the main part I played in her work was to help her sort out her results and write it out. I did get involved in it, but I wasn't actually involved in the work itself.

GW And you didn't go to India at all?

EW No, I didn't go to India.

GW Subsequently, you did go to Uganda.

EW Yes, I went to Uganda because you see, Rex Dean, who was one of our team in Germany, and he had done a study on feeding children on soya protein there and when he came back there was all the problem about kwashiorkor in Uganda. And Harold Himsworth, who was now secretary of the Medical Research Council, asked him to go to Uganda and make a study of plant proteins for infant feeding and that was why he ever went. But, of course, he found this kwashiorkor and they did quite a lot of work on the biochemistry of this and then that developed later into a unit. There was a tremendous lot of kwashiorkor there.

GW The protein intake, I think was mainly...it was very low, but I mean millet and did they have wheat?

EW No, it was matoke. It was a cooking banana was the adult staple and the children who had got kwashiorkor were the newly weaned children. You see, they had the feeling that when the mother became pregnant again, the new foetus would poison the milk.

GW So they didn't go on with breast-feeding?

EW So they weaned the child, but they had no idea of weaning food so they weaned them straight on to this matoke, which is a cooking banana, very low in protein, and that is how they got the kwashiorkor, you see. And then they tried force-feeding them because they lose their appetites and this really did more harm than good because they tried to push more matoke down their throats.

GW Was this solved with soya proteins?

EW Well, they hadn't got soya at that point, but they tried local foods, you see. And they made biscuits out of wheat and so on. They did quite a bit of work on this. But the one thing, when they got the children into hospital, was to get them to regain their appetites. But then they gave them milk foods and so on. I don't know what the position is now in Uganda.

GW Well, they've been through so much trouble that it's just beginning to pick up again, I think.

EW But then of course they got a parallel group of children with marasmus, that is starvation, semi-starvation, and this usually occurred when the mother had died or the mother had deserted it or something had happened to the mother. Often the grandmother tried to feed the child. That worked a little bit, but not very satisfactorily. So the unit had its beds and patients there and they had some with kwashiorkor and some with marasmus and they were so different.

GW They had previously been hopelessly confused, I think?

EW Well, I don't know that those particularly had been confused, but there is a big difference between protein deficiency, kwashiorkor, and marasmus, energy deficiency. There is no doubt about that. They may be at the extreme ends of a spectrum, but they are the extreme ends and that is what we were seeing in Uganda.

GW Another country that you had some connection with was what was then Northern Rhodesia?

EW That goes back to the time we were at King's, Audrey Richards.

GW Now, you said...I have read that you have said that this was probably the first time that an anthropologist worked with a nutritionist?

EW Well, I've only said this because I've been told it, you see, by anthropologists. I've met anthropologists, both in this country and in America, and they know of me because of this pioneer paper with Audrey Richards, when she came back with a lot of weights of food that people had been eating and didn't know what to do with the figures, and I sorted them all out for her.

GW This was a study of the diet that the Northern Rhodesians were getting in relation to their development and mental development?

EW Well, yes. She was studying their development in all sorts of ways, you see, yes. I can't really give you every detail. It was a long time ago!

GW Indeed. But it's fascinating that you should ....

EW That I should have become famous in anthropology!

GW Well, that isn't surprising! There's an aspect of infant feeding I would like to come back to, and this was the amount of fat in the human infant at birth and what the nature of that fat is according to what they have been allowed to consume. You had a wonderful interest in the maize oil given to Dutch children. Could you tell me something about that?

EW Yes, I can tell you something about this. This was in association with our great friend, Professor Jan Jonxis. He was professor of paediatrics in Groningen and he was the adviser in nutrition to the firm of Nutricia who produced most of the artificial baby foods there. They were by far the biggest firm. Then for some purpose, I was interested in the types of milks fed to babies in different countries and I think I had to give a paper on this. And we collected samples of the infant foods, well I mean the milk foods, fed to babies in Germany and several different European countries and compared them chemically, and we found that the Dutch one, the long chain, the unsaturated fatty acid, the linoleic acid, made up such an enormous proportion of the total fat. Then we found out from Professor Jonxis it was because they take all the cows' milk fat out and put corn oil in instead. Well of course, we weren't doing that in this country at all. So then we did this joint experiment, getting samples of subcutaneous fat and analysing them for fatty acids and of course the Dutch babies had a very different fatty acid composition in their body fat compared to British babies. I mean, it reflected the type of fat they were eating. Well, none of us could really say that the fat in either milk did harm. It was very difficult to say what this did.

GW But it did have a permanent effect on myelination?

EW Well, it lasted as long as they were fed on this milk, you see, but again of course they then went on to milk mixed diets, you see, and it gradually disappeared. We did follow them up later, but whether this had any permanent effect, I've never discovered. I've tried to get people interested in doing something about this, but I think that time has passed now.

GW There was never any suggestion that the demyelinating diseases were different in the Dutch children?

EW Well, no. We made studies on animals after this. I made studies on guinea pigs because fat crosses the placenta of guinea pigs, and we fed pregnant animals on different types of fat in their diet. And the newborn at birth, they reproduced the Dutch and British children, you see. If the mothers had been fed a high linoleic acid diet, they had high linoleic acid in their body fat, and the others corresponded to the British children and had low linoleic acid.. Well then, of course, we were able to follow them and also to look at the other parts of the body and all lipids of the body were affected, including the brain.

GW But there is still a turnover when they go back to normal feeding?

EW Yes, there's a turnover when they go back to the normal feeding. Well, I don't think we continued the guinea pigs long enough. We did continue the Dutch children and the British children.

GW I know that this is an enormously complex field and especially when you are dealing with humans, but it does seem surprising that most of the agricultural development is done – for food – is done irrespective of the requirements of the human being. I mean, the green revolution is a good example of it?

EW Well, I suppose you can't expect the farmer to think about why ....

GW Well, one would expect governments. ...

EW Yes, you would expect somebody higher to do something about it. I don't know. Let's not get into that topic!

GW In a way, it's parallel to the situation with the hospital, which certainly must have improved enormously since the days you were at Bart's and King's?

EW Of course they have.

GW Enormously. But nevertheless, the idea that it [diet] had to be matched to the requirements of the patient was an awfully long time in coming, wasn't it?

EW Yes.

GW And I suppose even more when we are talking about the infant and the weaning, in particular. I think weaning...there is so much talk about the importance of breast-feeding, which I think of course is enormously important, but I always feel that without the package of weaning and what happens to them at that point in life, that you are really aren't talking about something of primary importance to the human child. What looking back...well, firstly what would you say has given you the most pleasure, apart from working with Mac?

EW What has given me the most pleasure? I don't know. You see, in my old age I have got very interested in comparative studies and I've got very, very interested in comparing one species and how each species is so perfectly adapted. The newborn, I am particularly interested in, is adapted to its surroundings and the mode of life of its mother. It's a marvellous process of evolution that this should have happened, and of course it was essential for their survival. But this is what interests me at the moment. But looking back, I don't know, it has all interested me. It's very difficult to say. I've often said the food tables are what will last longer than anything else. Perhaps they were the duller, but they were quite exciting when we were doing them.

GW Well, in some ways it must have been a very big chore, yes. But it's fairly interesting that you do look upon it all as exciting?

EW I think of it all as exciting.

GW That's wonderful.

EW And this is I think, one advantage of the way we had to calculate our results. We didn't put them in a computer or calculator or something else and lose them for months. We calculated our results every day and we all gathered round and we looked at our results and saw what we'd got and we were so happy when we got something rather interesting.

GW You made one visit at least to the United States, didn't you, when you were preparing those tables?

EW Yes, I did.

GW And you saw what the rest of the world at that time was relying upon. So it must have been quite a big stimulus to you to get on with it and complete the chore?

EW Yes it was, and, you see, at that time they had no organisation to analyse foods for food tables, they were all getting their results, still from the Atwater figures and any other figures they could find.

GW From early this century.

EW I had this great discussion with them as to whether it was better for the person who produced the tables to be an analyst and analyse the foods or whether it was better - which they thought - that they should search the literature because they got a wider view.

GW Well, still if the literature was not adequate then they went on repeating their mistakes.

EW No, but they didn't understand that, you see. No, we were ahead of them over this. But then I got to know the people who were, later, who were preparing food



tables in America, and by then they had got people. They were still sitting in an office, the people that made the tables, but they had got some people in labs analysing food.

GW Some of the awards you have received have been from America, haven't they?

EW Yes.

GW They have fully recognised the value of what you have managed to achieve?

EW Yes, I got one from the American Dietetic Association a few years ago.

GW Now, I think this has been a wonderful life ....

EW It's been a wonderful life. You see, my life is different from most people's life of research because I've dabbled in so many different things.

GW Well, if that's dabbling, we need a lot more of it. I think I'm going to end this talk now.

EW Some people work on one ....

GW Absolutely. All their lives are repetitive and so on.

EW All their lives on one tissue or one little thing. Well, Mac did that too of course. I mean, I was so much under his influence, especially in the early years.

GW As you said, he was brimming with ideas and always dying to do experiments.

EW Any big idea. He would have the idea, and then I would ...

GW And when you think he began his life as a fleet air pilot whose life must have been in imminent danger of finishing at any moment.

EW Yes.

GW And then to achieve so much, and he lived to be ninety four or ninety five. It's wonderful, and I hope you will continue and do the same.

EW He always hated flying.

GW After that?

EW I think it was something to do with his experiences during the First World War.

GW Well, Dr. Widdowson, thank you very much indeed for submitting to my questions this afternoon. It's been a delight for me and it's lovely to hear all that you

have managed to do.

EW I've thoroughly enjoyed it.

GW Well, we can never do justice in a short interview like this, but it has been a very great pleasure. Thank you very much.

EW Thank you for honouring me by inviting me.