

**Dr Gordon Jackson Rees in interview with Dr Max Blythe
Oxford, 25 November 1996, Interview Two**

MB Dr Jackson Rees, at the end of our last conversation we got to an exciting point in your history, you were about to meet Isabella Forshall. How did that come about, that meeting?

GR Well, it came about because Cecil Gray had just established this new university department of anaesthesia, and there had been great advances in the field of adult anaesthesia at this time, and this lady Isabella Forshall was a paediatric surgeon. I had a great interest in paediatric surgery because there were very few people who were devoting their, their lives to paediatric surgery at that time. And the department had been opened I should think a very few weeks, and she came in to see Cecil Gray one day – a formidable lady really, and interesting. And she said to him ‘Well, now we’ve got an academic department of anaesthesia, you’re going to have to do something about children’s anaesthesia.’ And Cecil was somewhat, I think a little taken aback at this, and when she’d gone, he asked me to go and see him and ‘She says we have got to do something about paediatric anaesthesia,’ you see. And I said ‘Oh, does she?’ And he said ‘Yes,’ he said, ‘And I’m afraid you’re going to have to do it.’ And so, I was deputed to go and deal with this rather formidable lady, as I say.

MB She came as a bit of shock to you though?

GR Oh, complete shock! And it was very, very far from what I’d visualised for the pattern of my future career because things were really very exciting in the adult world in those days. People were doing the most heroic and bizarre operations, thankfully not done so much these days. But from the point of view of the young anaesthetist, this was, these were very challenging times and exciting and I felt that if I were removed from this adult field, that I’d be missing out rather a lot.

MB So this shock came...

GR So, I was very reluctant to do this.

MB This shock came towards the end of '47, beginning of '48ish?

GR Yes, I think it must have been the end of '47 actually, yes, yes. And so, I was sent along to, to go and see this lady, and she was very remarkable. Her personal history was, for a woman doctor of that era ... because she was born in 1900, her career had been really quite exceptional. And it's even more surprising that she should have achieved what she did with coming from the background which she did. She was born into a very affluent family in West Sussex. I think the family owned quite substantial tracts of land in, in West Sussex and her grandfather I think had been the founder of the stockbroking firm in the City, of Scrimgeour. This is her maternal grandfather [who] was a Scrimgeour. And her mother had been one of the very

earliest, if not a foundation student, at Girton and the mother had married an artist. I'm not quite sure what he did, I don't think he was any great success, but I think the family were really an affluent family so it perhaps didn't matter too much what he did. Her grandfather was the first commuter from Haywards Heath to, to the City. He used to ride his horse to the station accompanied by a groom who would take the horse back and he would get on the train at Haywards Heath and commute to the City. A pioneering chap obviously, and he'd be met in the evening of course when he came home. And she was brought up very much to be conscious of social responsibilities and that these were very important. She never went to school. She was educated at home by a series of tutors, governesses, and in part by her mother who in her early days at Girton had read English literature. And so, Isabella was really very well versed in the classical English literature.

MB Did you find a remarkable erudite lady...

GR Oh she was.

MB ...when you went to see her?

GR She was indeed, yes.

MB Talking of that background, Jackson, had she, had she come into medicine very early on? Had there been a thought that had crossed...

GR No, she had... She had an aunt, and they were, I think, a very socially aware family... The aunt had been the matron of one of the major London teaching hospitals – I can't remember which one it was – when they were drawn, the nursing staff of the London teaching hospitals, from the higher echelons of society very commonly. And this aunt had set up, with her own resources in a house in West Sussex on the family lands, an orphanage for the crippled children of East London. And in fact in later life Isabella lived in this very house and she was always subjected to a constant stream of very aged and largely crippled people who had been cared for by her aunt in that, in that very house. So, she did have, she was aware of what went on in spite of this rather cloistered life which she had led. And she was a, gained admission to the Royal Free Medical School, and she went off there to read her medicine. When she, when she was leaving home to go up to London to start her medical studies, she was getting an early train I think. And her father was still in bed when she was leaving and she went up to his bedroom – she often recounted this story to me – to say goodbye to him and such was the interest that the family had in her pursuing a career, he said 'Oh, you're going are you now?' And she said 'Yes, I'm off now.' He said 'I've forgotten where you said you were going or what you are going to do, but do have a nice time!' And that was the beginning of, of her career in medicine and of course she acquired the Edinburgh FRCS and was appointed to the hospitals in, in Liverpool, some adult hospitals but also the children's hospital.

MB There was no special reason for her coming to Liverpool? There was no family connection there or any reason, it was just an application she made?

GR I think it was just an application, although there were some family connections. I think there was at one time a Scrimgeour family in, in Liverpool.

MB Right. But she had a long association with Liverpool?

GR Well, yes indeed, until her retirement.

MB Her surgery was, with your help, pioneering in the field of paediatric surgery?

GR Well, she... It wasn't just the surgery that, I think, that interested her in trying to improve children's anaesthesia because in those days, dark ages almost we would describe them as I think, the care of children in hospitals was pretty inhumane. For example, it was considered that if the parents visited the children in hospital, the children were greatly disturbed and difficult at the time the parents left. And it was, with some logic you might say, concluded that it would be much better to restrict visiting to very infrequent times, then you were not troubled by these children being turbulent when the, when the parents left. And the attitude to children undergoing anaesthesia was very similar and I think this is, perhaps it was this different attitude to children which deprived them of the great advances which had taken place in the adult world of anaesthesia. Most children you see in this time were anaesthetised with an open ether mask which is a pretty unpleasant thing to happen, whereas virtually every adult anaesthetised at this time had some sort of intravenous induction or something much more comfortable than breathing this very unpleasant and irritating ether vapour.

MB What we're actually saying, Jackson, is that Isabella Forshall was one of the first people to actually see this inequality and want to, want to put it right?

GR Yes, that's right. And not only anaesthesia, but she was I think one of the early people who ... promoted unrestricted visiting and so on.

MB Because nurses weren't very happy about that, were they? Nurses weren't happy.

GR Nurses were very unhappy about that, actually. They were to some extent the villains of the piece in this, this inhumanity. The ward sister of course was something of a tyrant in those days, very different from today.

MB Jackson, take me into this, this wonderful relationship you developed with Isabella Forshall. She persuaded you that you should get involved very quickly, I know. It took off, although the early reluctance we've marked. Tell me about how that relationship got going?

GR Well, I think... She was in this rather peculiar position. She wasn't in surgery really to make a living, to put it quite bluntly, I think. There were other resources available to her. And therefore, she was, she had a pretty altruistic attitude towards these things, and one of the great happinesses of our relationship was that she had no, no ambition to further her own interests, it was really the interests of the patients. And she regarded me as being part of, of the way in which she might further the interests of the patients by improving one of the things, these induction of anaesthesia. But there was something else going on at this very time. Paediatric anaesthesia was just about being developed; largely I have to say in the United States by a man called

Gross¹ at, at Boston in the very late thirties and early forties. Well now, in this country of course nothing went on very much in the period '39 to '45. The services which were being provided were very basic with, usually by people who were approaching or even past retiring age because everybody else had been taken off to the Forces. So, in this country, well worldwide, not much had been done in the way of advancing paediatric anaesthesia. But, for instance, the first repair of a tracheoesophageal atresia in this country was done in 1947, you see. The first ductus arteriosus was closed in Boston, '49 I think. And this was the sort of state of the surgical art in those days. She recognised what was likely to come – Isabella Forshall – and was really rather determined that she would be a part of, part of this. And at this time there was Denis Brown who was thinking along similar lines at Great Ormond Street, and she I think was a great admirer of what he was doing there at that time. And so, this is how it all came about really, that not for personal ambition but really for a desire to see something done for the children. And, and so it started.

MB What I'm getting a picture of, Jackson, at this stage, let's check... I've got an altruistic woman, on the one hand caring about children, but also a person seeing the way ahead for surgery, and beginning to see that it wouldn't happen for children without advances in anaesthesia.

GR Yes, I'm sure she saw, yes, I'm sure she recognised this very early.

MB When you started to work for her – OK, you made the relationship and decided to go along with this idea of hers and Cecil's – when you started to work with her what kind of a surgeon did you find? Was she good?

GR Oh, she was very good indeed, yes, yes. She had what I think most paediatric surgeons had, she had a very delicate touch with tissues, you know, and a very gentle dissection.

MB So, a good pair of hands?

GR Oh yes, yes. She was, she was very good. But the range of surgery being done was quite different from the range we see today. The commonest operation, certainly in Liverpool, was cutting out tuberculous glands of the neck infected by of course bovine tuberculosis which was, amongst the more deprived groups, was almost universal in those days. So that about half the cases on any operating list would, would have comprised this sort of pathology. And on the orthopaedic side of course at the same time was a great deal of bone and joint tuberculosis amongst the children, so that those two things together formed I would say the bulk of surgery. There were, the other surgical difference at this time which changed fairly rapidly when anaesthesia began to improve was that there was a belief that children wouldn't tolerate anaesthesia lasting any great length of time. I remember someone telling me if they [children] were anaesthetised for more than half an hour really this was quite likely to lead to unpleasant and serious, maybe even disastrous, consequences. Which of course is not surprising with the sort of techniques which were fairly widely used at that time. The consequence of this was that it was felt that people who were operating on children had to operate with incredible speed, almost using the sort of approach to

¹ Robert E Gross.

their operating techniques that we used in the pre-anaesthetic days. There was one old surgeon in Liverpool at this time who used to do the Ramstedt's operation – that's the operation for congenital pyloric stenosis – and he was thought to be a great exponent of this operation, largely because he was able to complete the operation in four minutes from beginning to end. So this, and really the purpose of this was to avoid any duration of anaesthesia in very small children.

MB It's an incredible situation to be in really.

GR Isn't it, isn't it really? Yes, yes. It's very...

MB I mean, whole books on paediatric anaesthesia were yet to be written. I mean, you were coming in at a terribly deprived state of play.

GR That's right, yes, yes. Well, so, it was all waiting to happen. I think Isabella had realised that it was going to happen. And so we started.

MB What kind of anaesthetics were you actually wielding at that time for child surgery?

GR Well, certainly in Liverpool, it was all open ether for the induction of anaesthesia. Endotracheal intubation had been used in children from, well I think the very earliest in the twenties in exceptional circumstances. But from about 1937 onwards in the more advanced centres, endotracheal intubation was used for cleft palate surgery and other operations around the head and neck where the, where the access of the surgeon would be restricted if the anaesthetist were occupying the mouth and nose as it were. But...

MB It was far from the rule at that stage?

GR It was far, it was far from universal, at that time. And I think, one of the things which had not been introduced until '37 was some means of hitching up a child to a, to a source of anaesthetic vapours and so on. And in '37 I believe it was, Philip Ayre in Newcastle had devised this thing called the Ayre's T-piece and, which greatly facilitated children being fed anaesthetic mixtures through an endotracheal tube at that time.

MB But, what you actually found when you came in was open ether anaesthetic. It must have been horrid, horrific for children?

GR Well, it was really, yes. ... They had to be sort of rather held down very often to be persuaded to accept this approach. And this was one of the things I think which Isabella wanted to get rid of. And so, we started... I think the first attempt I made to improve things was to start giving children intravenous inductions of anaesthesia using thiopentone, which virtually every adult was having already.

MB But, it hadn't caught on with child anaesthesia?

GR No, that's right.

MB Were you the very first in this country – I've got a feeling that you were very early in that intravenous...

GR Well, I would. You know I'm always very reluctant to say first...

MB Yes, but you were very early?

GR ... but I think I was probably the first to advocate, you know, the universal use of intravenous inductions in, in children.

MB And was that a success?

GR No, it wasn't very, it wasn't greatly successful I have to say, because the idea was to avoid the unpleasantness of inhaling ether, and to give an intravenous induction and then get them to, persuade them to inhale ether afterwards. Well, these barbiturates depressed respiration very much and...

MB Mucked up...

GR ...and they were very reluctant to breathe an irritating vapour afterwards, and so we had great problems with them being very reluctant to breathe. And this didn't, didn't make it an easy thing to do at all. And furthermore, we had at the same time introduced a morphine premedication, which still further depressed the respiration and made it really very, very difficult to induce anaesthesia subsequently with, with ether.

MB How did you respond to that, Jackson?

GR Well, it seemed that... My response was that if we were going to do this, we would have to get an endotracheal tube in so that we could help them to breathe exactly as we helped adults to breathe, and get the vapours in, in that way. So, we used, we were using relaxants of course in adults at this time and we did it in children. Not I might say the smallest children because all these things which we did we did first of all in the larger children and worked our way down the age groups as time went on, finding of course that sometimes we, when we got into the very youngest ones things were a little different from the older children. So that's, that's how it, the sort of way in which it evolved. Now, so, to summarise... Our first step – intravenous induction, followed by open ether. Next step – intubation with a relaxant drug, again followed by spontaneous breathing with, with ether and then in the very early fifties, I think it was early '52, Succinylcholine, a short-acting relaxant came in and we thought this might make this kind of approach much better. But before this, for the more major procedures, the intra-abdominal operations, abdominal emergencies and so on and indeed ... some of the extra-abdominal things... The techniques which had been evolved for adults at that time – which consisted of relaxation and continuing neuromuscular blockade and continuous artificial ventilation – for the larger children we'd adopted these adult techniques and reserved the alternative for the, for the smaller ones. And then, when we were doing these things in parallel, there appeared to be a paradox in the sense that the children who'd had the bigger operations with the continuous ventilatory assistance that we'd been doing in the adults were rather better post-operatively than the ones who'd had the other anaesthetic technique and were having rather smaller operative procedures. So,

the next step of course was to say that perhaps we should use the same technique for the lesser operations as we were using for the larger ones.

MB You moved it towards minor ops?

GR That's right. And this did seem to improve things. But when, neonatal surgery was beginning to develop now. I can't remember the precise figures, I was looking at them the other day, year by year how many of the very smallest, the neonatal ones, that's to say during the first four weeks of life by definition, the neonates, year by year... I think we started off with twelve in the first year and the numbers done increased in, very rapidly during the fifties in a sort of geometrical fashion really and, until we were doing about three hundred a year in, in 1959 I think. The result of, largely I think of... We had more cases referred to us because Isabella Forshall, with a man she'd introduced from Great Ormond Street, Peter Rickham, who had also had a very distinguished career in paediatric surgery, thought that there was a lot of under-diagnosis going on nationally. And that if paediatricians, and indeed obstetricians, over a wide area were made more conscious of the incidence of these congenital abnormalities which were amenable to surgical correction, that we'd gather in a much, a much larger population. So, they had a kind of missionary drive-round in mid-Wales, Shrewsbury, up into Lancashire, North Lancashire and Cumberland, drawing the attention of paediatricians over a very wide geographical area to what was possible, what was going on and indeed how to make an early, what the diagnostic features of these congenital abnormalities were. And this led to a tremendous increase, and there was a time when we were drawing cases from a very wide geographical area. Of course, there are far more centres doing this sort of work now, so that the...

MB This was pioneering crusading of the fifties?

GR Yes, that's right.

MB Yes. Just keeping you to those early fifties, you started working with Isabella Forshall end of '47/beginning of 1948?

GR Yes.

MB There was a slow start finding your way into a number, your way through a number of problems. But once you'd found out how to advance paediatric anaesthesia, you were working with her on a regular basis and that skill that you applied opened up a range of gateways and the department of paediatric surgery began to grow, I suspect?

GR Well, yes it did. It grew first of all when she brought...

MB Rickham?

GR ...Rickham in, who was young, enthusiastic, very bright indeed, and another man who, an Ulster man, Herbert Johnston, who also was brought in, and he was brought in to specialise in the urological aspects of paediatric surgery. And he acquired an international reputation for himself and I think was generally regarded as

perhaps the world authority on, a world authority on paediatric urology.

MB I mean what we're actually saying, Jackson, is not only had we started to get paediatric surgery as a speciality, you'd now started to get sub-divisions?

GR That's right, that's right. Yes.

MB In the early fifties, it started to have branches?

GR Yes, that's right, yes, yes. And then in '59 I think Rickham and Johnston... Isabella Forshall retired in '65... No, I think it must have been a bit later than that, anyway they produced the first textbook of neonatal anaesthesia, no not neonatal anaesthesia, neonatal surgery ... which I think again stimulated a great deal of interest in the, in the field.²

MB Let me just take you through the fifties though, Jackson, if I can, with just a number of questions. Once you've started to actually work with Isabella Forshall on a regular basis, what kind of a partner did she prove? I mean, was she very supportive of your side of it? I mean, she brought you in to actually facilitate what she was doing, but how much did she assist your development?

GR She was extraordinarily supportive. She always used to try to make me think that what we were doing was really rather more important than what she was doing. And she really did genuinely try to promulgate this. And it's almost embarrassing to say this to you, but in the very early days one of the nurses said to me 'You know what she has just said to the students, don't you?' I said 'No,' and she said 'She's telling them that they ought to watch you giving this anaesthetic because then they're able to tell their grandchildren that they saw you doing this in this time.' And that's the sort of, that was the sort of very genuine feeling, I think, she had about it all.

MB She was sponsoring your work in a, in a big way?

GR Absolutely, yes.

MB Which is a great stimulus?

GR Yes. And in that era I have to say that this promotion of the anaesthetist was pretty rare amongst surgeons.

MB They were a second division team?

GR Absolutely, yes. But it never was regarded as such by her.

MB By her, yes. So she changed things?

GR Quite the reverse, in fact.

MB Yes. Also in the early fifties, keeping you to that, you were still a member of

² PP Rickham, J Herbert Johnston, *Neonatal Surgery*, London: Butterworths, 1970.

Cecil Gray's department, although on this specialised trail of paediatric anaesthesia. How much work did you continue to do with Cecil in the fifties?

GR Not a great deal except to help with the clinical commitment of the department, and with the, with the teaching. But we did do a lot of theorising together as it were and produced a few papers, you know, on the philosophy of various things.

MB Do you want to flesh that out a bit for me? I mean, quite early on I know you talked about where the department had to go to and I just wondered whether that had profound results?

GR Well, you see, in these very early days of the relaxants, I think everybody appreciated, including ourselves, that we had a pretty potent tool here. But nobody was quite certain as to what we ought to be doing with this potent tool. And certainly the early Canadian pioneers for instance had felt that, that the relaxants shouldn't necessarily be used... You should try not to use them in order to abolish respiration, but you should use them merely to make the muscles less tense than they might otherwise be, putting it not very seriously, as a means of making a bad anaesthetic slightly better really and not integrating it into the whole philosophy. And Cecil and I at this time were thinking that really the, we should reduce this state of anaesthesia into various components. And we postulated something which we called the triad, you see, saying that this state which we would like to have people in who were undergoing surgery would comprise of a number of components. The first was they should be narcotised, they shouldn't know what was going on. The second was that they were, should be relaxed so that the surgery was facilitated. And the third was that their response to the onslaught of the surgery, their physiological response to the onslaught of surgery should be mitigated by something and we, which we called analgesia, perhaps wrongly, semantically wrongly in those days. Anyway, we said that we had this triad of narcosis, relaxation and analgesia being the third component. We postulated this and this, thinking on these lines was really what governed our approach, making the relaxation an integral part of producing a state which you could sub-divide into different components. And you could increase the level of one of these components in relation to the others and sort of tailor-make something which previously had been regarded as a uniform thing which you took or left as it were.

MB So this triad view really was to have a profound effect. I mean, it showed a versatility in the arms of care that you could vary?

GR Well, it did, yes.

MB Did you publish on this?

GR Yes, I think... Yes, we did.

MB Because you didn't publish always. I'm just coming to a point that, Jackson; you tended to be reluctant to publish sometimes. You just got on with the job, you weren't...

GR Oh I was, I was always a terribly reluctant writer!

MB I know a lot of people wrote up what you did and sometimes you missed out altogether.

GR Yes, that's right. Well, it did happen sometimes. But ... I think Cecil, he was a great writer of course. Loves writing and still does, not technical things now but various historical things. And he, I think he wrote this somewhere. It was, it used to be quoted.

MB When was this – towards the end of the forties/beginning of the fifties?

GR It would be about '52.

MB Right. So, that'll still be within the period we're looking at?

GR Still within that period.

MB That's a seminal point?

GR Yes. So that, following this philosophy, if you can use that name for this way of thinking, we evolved an approach to this in which the... We produced apnoea, complete cessation of respiration, sleep and analgesia with various things. And this of course meant that you would regard the cessation of respiration not as a nuisance as these earlier people with relaxants had regarded it and something which you tried to avoid if you could, as to something which you should positively aim at and, for all abdominal surgery at least and indeed for all surgery. I did it in children eventually. And there was a paper that we published jointly called 'The Role of Apnoea in Abdominal Surgery' which set out this sort of thinking.³ Very difficult looking back to say what's truly original in what you've done and what has been the result of other people's thinking. For instance, this, we talked about this analgesia component of general anaesthesia. But way back in the pre-world war days, there was an American anaesthetist who clearly had thoughts on the same lines and produced what he called a noxio-association(?) – which meant disassociating the brain from noxious stimuli I presume – which he achieved by blocking the nerves supplying the areas which were being operated on with local anaesthetic techniques.

MB Jackson, it's difficult to ascribe kind of pioneering.

GR Well, it's such a hotchpotch, yes, one, that one is very reluctant to say, you know, 'This is mine.' I don't think you can.

MB But I've got a feeling, in Liverpool, from the time you met Cecil and started to work in that department, that you moved out into a range of specialised interests, a lot of research and some teaching, all of it constituting rather an interesting nuclear point for anaesthetics in Liverpool...

GR That's right, yes.

MB ...that I think drew attention from a range of centres in Britain, and also

³ T Cecil Gray, G J Rees, 'The Role of Apnoea in Abdominal Surgery,' *British Medical Journal*, October 1954.

internationally?

GR It did indeed, because we were certainly doing things which, which I think other people were not doing with quite the degree of enthusiasm and single-mindedness, and pursuing a theoretical basis as it were for the things which we were trying to do.

MB I mean, you were highly motivated in Liverpool. What was the, I'm trying to look for the basis of that. I mean, Cecil and you really were a strong nucleus. You've got Isabella Forshall also providing great stimulus. It became a great centre.

GR Yes, I think I have to say that it was Cecil's enthusiasm which...

MB Was it really powerful, and forcing you down line?

GR Oh, he was a great enthusiast, yes, yes. Of course, you see his enthusiasm today. He's enthusiastic for whatever he does. He's the only man I know who'll come out of a meeting and say, you know, a medical or a political meeting or something like that, saying what a splendid meeting that was. Most people come out of a meeting with their hand in their, head in their hands, you know! He will say how splendid it was!

MB I haven't asked you about that teaching you were doing in those early years. I understand you taught physics?

GR Yes, I did. Odd, isn't it?

MB To medical students?

GR To the postgraduate students. Well, you see, in ... the very early days, before the department of anaesthesia had been established, Charles Wells – who was the professor of surgery – had established a postgraduate teaching course for overseas surgeons largely, but for surgeons from this country as well, which was meant to prepare them for the FRCS and indeed to teach them the practical aspects of their craft as well, and which lasted for a year. Well, Cecil thought that this was a splendid idea and he thought he'd emulate it in anaesthesia. And [he] went really rather further ahead than Charles Wells had done because he was able to persuade the hospital authorities then, and this is the very early fifties, that the appointment of the senior house officers in anaesthesia should be delegated to the department, and that the department could advertise and select these people in a position that the hospitals would be guaranteeing them a post. And furthermore, he had managed to negotiate a sort of day release scheme in that they were able every morning, these people who were appointed in this way, to attend a lecture course, return to their hospitals afterwards and in the latter part of the day would be trained in the practical aspects of anaesthesia. This was very popular of course and I think was about the first course of this kind, in, certainly in anaesthesia, but I think in any postgraduate training. Of course everybody gets day release now for their postgraduate training work, but I think it really, this was the pioneer course. And it attracted a great number of people, more people in fact than we could take in, to fill the limited number of posts which the hospital authorities had given to us as it were, given to the department. And we

also took a lot of people from overseas who were funded by their home governments. And we made them supernumerary senior house officers so that we had these foreign bods coming in funded from usually their own governments, British Council or some source like that, and they got the same training as the home product. And they went, and I'm sure you'd get an account of the, from Cecil, of the number of places that these people went to and it gave the department a tremendous influence world-wide really, particularly in the old Commonwealth countries.

MB I mean, this was really advancing the speciality in a special way that hadn't been done quite like that ever before?

GR No, I think that is true.

MB And you taught the physics?

GR I taught the physics.

MB You talked about gases, gas laws, or about vaporisation? I mean...

GR Oh yes, classical Newtonian physics, nothing particle about me! But anyway, there wasn't much particle physics in those days perhaps.

MB But you provided them with the right physics to go back with a research understanding, a research kind of background to carry their discipline forward?

GR Absolutely, yes, yes.

MB And you also saw them in theatre because they came to see you; they came to see you work providing anaesthesia?

GR Absolutely, yes. Well, so... Some of them, some of them were actually working in my hospital, you see, because they would have been posted there and they used to rotate at about three monthly intervals, some of them, and some of them at six monthly intervals. So, I had most of these chaps at some stage or another.

MB We haven't taken your hospital in and where Isabella Forshall was stationed in this new development of paediatric surgery. Where was it actually?

GR Well, in those pre-NHS days – I know we're talking about post-NHS but we're talking about turnover time really – there were two breeds of hospital. The voluntary hospitals, the old teaching hospitals, and there were municipal hospitals. And Liverpool had a voluntary hospital, the Royal Liverpool Children's Hospital and it also had a municipal children's hospital, which was much bigger, but in the early days didn't really provide the quality of service that the teaching hospital provided and, which was Alder Hey. And Isabella Forshall was on the staff of, of both of these, as a woman not entirely accepted. She was, in the pre-NHS days, when people were called honorary surgeons rather than consultant surgeons as they are now, she was never a full honorary. She was a clinical assistant or something like that and was not permitted onto the medical board for a, until she'd been in the hospital for a great number of years doing a vast amount of work there. But by the time the NHS came of

course in '48, then she had...

MB Which was about the time that you came together in your partnership?

GR Yes, that's right, yes, yes.

MB Where did you actually stabilise and station? Was it between those two hospitals or did you have one particular centre?

GR Well, it was between those two until the end of my working life really, but they were, they complimented each other. They were, the staffs were largely common to both and some things were in one, the cardiac surgery for instance ultimately came into the old teaching hospital and the neonatal surgery into the old municipal hospital. But they are now unified on one site and with one name – now called the Royal Liverpool Children's Hospital.

MB Right. So, they eventually came together, but not in your time?

GR Not in my time, no.

MB Not in your time. Jackson, I just want to just do a bit of distilling out of what we've said, so that we've got the bulk of the pattern on the record and anything we've missed, we can then put in. I've got you joining Isabella Forshall at the end of '47. A reluctant pioneer in a way, finding her a remarkable lady, a remarkable spinster with an enormous drive that caught fire with you. And you started to run with the ball of paediatric anaesthetics, probably before anybody else in Britain.

GR I think sort of devoting my total energies to it, yes, which is what I did although I did continue to do...

MB The odd adult?

GR The odd adult.

MB But this captured you?

GR Yes, that's right.

MB You started to move into new lines of anaesthesia for children. First of all intravenous provision, finding out the breathing problems, the suppression of breathing by that caused you to move into another range of routes. So you pioneered widely a number of techniques to cope with that and eventually found out that you could use relaxants in a much wider way even for minor operations in children.

GR That's right, yes.

MB And by the time we get to 1952 you are really closely geared with a lot of new developments, the neonates featuring in the reckoning who'd been kept out because of people fearing those early weeks of life. And by the time Isabella Forshall's dream was about to be first realised – larger major surgery in Liverpool for children – you

were equipped to facilitate that?

GR That's right, yes, we were. I think we should say a word perhaps now about the relaxants in the neonate...

MB Please.

GR ...because that was, that was a curious story which went on for ... oh, some forty years I would think the, until it finally gelled. When we gave curare to the very smallest babies, we had great trouble in a number of cases in re-establishing respiration after the surgery. And this ... caused us to think that perhaps we shouldn't be giving it to these very youngest children. And for a time we used, we used to intubate them and then ventilate them artificially with, with ether and ventilate them so much that they stopped breathing. The stimulus to breathe was so attenuated that they remained apnoeic and for the duration of surgery. We did this for a long time until in fact Succinylcholine came along in '52, and then we thought that we could use Succinylcholine. Well, Succinylcholine is a very short acting thing and some of these operations went on for rather a long time, so we established continuous infusions and had, well I had built some infusion pumps which of course, which are common everyday appliances, you see them everywhere now. They had been used in physiological laboratories I think for various things previously, but I don't think people had used them in anaesthesia before we used, and we used them for Succinylcholine which, which we were using at that time for neonates. Anyway, a little later on, two of my colleagues felt that perhaps we ought to have a go at curare again on these smallest ones and used very attenuated doses. And this seemed to work extremely well, and that was what we adopted thereafter. But following our observation that these very youngest infants seemed to be peculiarly sensitive to the effects of d-tubocurarine chloride, we thought that this ought to be investigated. And at this time one of these SHOs [Senior House Officers] who had been through the course decided that he would like to pursue a life in paediatric anaesthesia. He was a bright chap and we got on well together, and when his period as an SHO finished we managed to get a research fellowship for him.

MB Who was this?

GR This was Alan Stead.

MB Right, who you worked with for the rest of your...

GR The rest of my life, yes. And he, he had this research fellowship and what clearly needed looking into was the relationship between the age and sensitivity to this particular drug. And such were the, was the nature of research in those days that the only way in which we were able to look at the response to the relaxant drug in any way objectively was to record the respiratory effort and see how much this was obliterated by, or attenuated by the dose of curare. The only way we had of recording this in the absence of amplifiers and cathode ray tubes and all the other bits that people use these days was on a smoked drum. That was to say you had a piece of black paper, and you put it in a smoky flame...

MB A kymograph? Round it went.

GR Yes, that's right, yes, yes. And so we had such a thing in the operating theatre and old Alan was recording the child's respiration on the smoke drum. And there's a slide I was showing last week actually of one of these tracings, and it's a beautiful tracing of the depression of respiration, right in the middle of it is a great thumbprint which is Alan Stead's...

MB Autograph!

GR ...or mine, so there must have been a lot of black fingers I think!

MB What came out of that investigation of respiration? Did you find a better way?

GR Oh well, what was being looked at was the sensitivity, comparing the sort of response we knew we would get from an adult and, which was well established of course, the dosage and responses by that time. And there was no doubt that there was, our findings were at least that there was a great sensitivity. And curiously this led to a tremendous spate of investigation over the next forty years around the world. People accepted what we said as, as gospel originally, a very happy state to find yourself in I have to say, but then people began querying this, whether in fact there was this particular sensitivity amongst the neonates. And our American colleagues – I'm moving ahead in time but this is all part of the continuum – using more sophisticated electronic recordings of electromyograms seemed to believe that this was not true. But using clinical studies our group had confirmed what these primitive earlier investigations had shown – that there was a sensitivity. And a controversy raged for a very, very long time. And it wasn't until about the mid-eighties that a resolution to this difference in findings and beliefs began to arise ... and there was a rather comprehensive study, a pharmacodynamic and pharmacokinetic study in the neonates carried out in San Francisco by a man called Fisher.⁴ And what Fisher demonstrated was that the neuromuscular junction of the neonate was undoubtedly more sensitive to the same, to a particular plasma concentration at steady state of this drug, but that the drug in the neonate was distributed in a much larger volume of fluid than it is in the adult, so that to produce this concentration required a larger dose than you would need in the adult to produce the same concentration. So to some extent the fluid volumes compensated for the differences in the, in the sensitivity. And then he showed further that although the kidneys cleared the drug from the system at about the same rate in terms of clearing ... the millilitres of plasma of the drug as occurs in the adult, but because the drug is distributed in a much larger volume in the child there is more of it to excrete through the kidneys, which means of course that the duration of the drug in the infant, having obtained a given concentration, is greatly longer than it is in the adult. Well, since we were dealing with very practical things, what we were concerned with was how much you needed for, per hour or per minute...

MB To do the job.

GR ...to do the job we wanted to do. Well this work said that we were certainly right in that respect. We might have been wrong in the instantaneous effect of the drug. But I still don't think we were quite as wrong as that, because what these

⁴ DM Fisher.

fellows were doing was infusing at a very slow rate until they got the depression of neuromuscular function, which they were wishing to co-relate with the plasma levels. Whereas ours, we were injecting little boluses so we were producing a first pass effect when the, when the drug circulated in its first initial concentration before. So we were all, we were all right. But, we were arguing about it vehemently for years and years and years until we all realised that it was perhaps a more complicated situation than any of us had appreciated at the time.

MB But, in that early research of yours in the 1950s, what you were doing was to try to bring the dosage down of curare so that respiration wasn't going to be adversely affected. I mean, you were safeguarding that position?

GR So that we could reverse it at the end. Yes, with the...

MB Because there might have been difficulties of reversing it?

GR Yes. Well we'd, well there were, certainly in some of our cases, yes.

MB So early on there were, there were difficulties.

GR Well I think our observations were right, our interpretations perhaps were wrong and I think some of our American colleagues in the early stages hadn't quite appreciated that we were looking at slightly different things.

MB Jackson, at this point I am going to take a break with you for a couple of minutes...

GR Oh how lovely.

MB ...but just when we come back I want to go to the more impressive major surgery that Isabella had believed would arise, and go to the, to the later fifties. For the moment though we'll take a break.

GR Good, good. That's great. How long have we been going?

MB Jackson, I'm trying to get a full picture of that Liverpool period from 1947 to 1960 going through the fifties when all was happening. It's quite difficult because, well it's difficult for you because you're not going to tell me of all the triumphs because of personal modesty, but when did you begin to feel nationally and internationally you were really on the map, Liverpool was really being looked at? By what kind of time was that? After two years, three years?

GR ... I think nationally after about three years, and we began to get people visiting us from other centres. They used to come and see what we were, what we were up to because I think it was thought possibly to be a bit eccentric, the sorts of things we were doing at that time. And we had a great number of visitors; I remember Macintosh came a couple of times. And Macintosh, whenever he visited anywhere, he was one of the earliest people I ever saw to carry with him a portable tape-recorder. And I would have loved to have heard what was on the tapes because it was his practice to sort of watch something for a bit, and then to disappear into the far distant corner and whisper into this tape-recorder. And I would have loved to have known what he thought.

MB So you were never privy to his crits, you were never privy to those criticisms?

GR Never, never. I don't know what he said. And then, oh another... But we would often have ten or twelve visitors in and I never turned any, any away. I always let everybody come who wanted to come. I thought it was rather nice to have them, being a sort of fairly social animal, and some of my colleagues got a bit fed up with the number of people we had around.

MB You got stick, you got criticised for having too many visitors at times?

GR Yes, that's right, yes.

MB I'm just thinking whether there was any bad feeling from other centres that were making progress in anaesthetics, whether you, whether you ran in danger of, of being the precocious child unit?

GR No, I don't think so.

MB No?

GR Well I hope not.

MB So, relationships with other, other centres like Cardiff and Bristol were cordial all the time?

GR Oh, yes indeed. And the other centres too used to send us their senior registrars and registrars to get a bit of exposure too and sort of... This went on for a very long time. No I, I don't think that there was any serious...

MB I just got an impression that places like Bristol where you, where you took some of their staff for training already felt fairly proud of their anaesthetics and might have felt that you Shanghai'd some of their, some of their students.

GR I don't think so, no, no.

MB No, that didn't arise?

GR No, I don't think so. No, but this of course was the, the period you are mentioning is the period in which the surgical operations which were being undertaken were being extended. And in fact we were doing operations for instance on hiatus hernias in children in great numbers, not I don't think a very successful operation and one which I think you very rarely see or hear, see done or hear of now. There were many things which were, which were done in the euphoria of the time. It was a euphoric time, you see, because in all forms of surgery, because the sky suddenly appeared to be the limit to what people could do in surgery and they sort of sought, sought the outer limit of what they were, what could be done. And much of it was I think disastrous, and operations, massive ones were done then which you would never see done today. Though of course, as a consequence perhaps of advances in other directions, one of the adult operations done in those days in great numbers in Liverpool for instance was total extirpation of the thoracoabdominal sympathetic system for treating hypertension, if you please. Well, now you'd never dream of...

MB Unbelievable, isn't it?

GR Absolutely unbelievable, yes.

MB But it was done regularly?

GR But that was the sort of thing that was done and the same thing to a degree was going on in the paediatric world at the time. And, of course, the oncology was in its infancy so we used to see a lot, at this time of massive tumours, which you don't see now anymore, I don't think. That sort of surgery is certainly less common than it was now with the great advances that there are in...

MB It was a different world, wasn't it?

GR A different world, yes.

MB Everything was opening up and everybody was trying everything...

GR Everyone tries this, everyone tries everything. Yes, that's right.

MB And for you that started probably with, with thoracic surgery, the main, the first really big adventures?

GR Well yes, that's right. In '52 I think in our hospital we started doing, doing ... ductus arteriosus, closure of ductus arteriosus. And I was having a look at the operating books the other day to see just how much we were doing at various times, and I noticed that the very first one was anaesthetised in our hospital. He'd been brought in by the thoracic surgeon who'd worked with him a lot, was John Halton who was an associate of [Cecil] Gray's of course, but that was, he only did one case ever, and then ... we took it over. And this was a great growth area in those days, a

very limited range of surgery because it was comprised largely of the closing ductus arterioses and, and the Blalock-Taussig anastomosis for the Fallot's tetralogy. But there was of course a tremendous backlog of cases running up into adolescence at that time which you don't see now, a different sort of world. And we, this grew, not just with us, but with all, all centres I think.

MB Jackson, you were saying to me at one time that that first rash of, of heart surgery that came your way was not impressive in its results and...

GR Ah, well, the ductuses and the Blalock anastomoses, they were eminently successful, but of course of, the Blalock anastomoses [were] of limited value but the immediate results were, were very good. But of course, largely in the United States, we saw the beginnings at that time of open-heart surgery as we know it today, using heart-lung machines, cardiopulmonary bypass machines. And, I went over to the United States in 1956, I think, to look at what people were doing on the other side of Atlantic. An old colleague of mine had been appointed to the children's hospital in Montreal which was just starting up then and he had asked me to go over and, and give him a hand at setting the department up there - Tony Davenport(?) this is. And I went over and spent a month with him, six weeks or something, and during that time I made one or two little trips across the border down to, to see what was going on. I went to the Mayo Clinic to see Kirklin⁵ and then also went to Toronto where they had, were becoming involved with the cooling of patients for, for cardiac surgery and came back fired with imagination. And we sort of set up a... Together with my surgical colleague then in cardiac surgery - this was Ronald Edwards - we sort of decided we would set about on doing these intracardiac procedures.

MB This was for septal defects and things like that?

GR Yes. And, we had a, we built for ourselves really a rather primitive arrangement based on a design by Lillehei⁶ of ... St Louis, I think it was St Louis where he worked. The twin towns, what are they? In the United States.

MB ...You've got me!

GR Ah, never mind.

MB You get a point up for that!

GR Yes. Anyway, Lillehei had designed a pump consisting largely of plastic tubing of varying diameters strung together and, to serve as a, as a heart-lung pump. And we set such a thing up and boldly embarked on this open-heart surgery, which I regret to say was an abysmal failure. In retrospect, I think I know why we, it was an abysmal failure because whenever you start something off that is potentially hazardous, the cases that you are presented with are in the main hopeless cases. People don't want to send you the, they're almost all in a sort of pre-terminal state. And I think that a lot of the things that we were trying to correct, some of the anomalies were and still would be regarded now as being virtually on the uncorrectable border, you know, although the cardiac surgeons can do most things

⁵ JW Kirklin.

⁶ C Watson Lillehei.

these days. However, we, we abandoned this after seven or eight cases, something like that, and thought we'd better have another think. And things had been developing in the adult world in this country in the Hammersmith. A fellow called Melrose, Denis Melrose at the Hammersmith had designed a pump and we decided we would get one of his which was a rather more sophisticated arrangement than the botched-up thing we had previously had. Then we started up again about 1959 with the open-heart surgery and, and this went pretty well really, and went from strength to strength. But, there were problems with the surgery in – moving on a bit now into the sixties – with the smaller children. And it seemed that a new approach was necessary. And way back of course in the fifties people in various places, Bigler⁷ and McQuiston(?) in the United States, had been cooling patients by exposing them, their surfaces to ice and cold water and so on, and... To lower the metabolism so that you could perhaps arrest the circulation for a period of time without doing too much damage. And we had dabbled a little bit in this without any great enthusiasm, again in the, in the fifties. But then there came a time in the sixties when we thought we could combine this surface cooling with the cardiopulmonary bypass. Now, people had, there was a group in Japan that had been using the surface cooling very successfully, taking patients' temperatures down quite low, and...

MB We're talking about 12 degrees or something like that, aren't we Jackson?

GR Yes, 18 to 12, that sort of, that sort of area, at which of course you can arrest the circulation for an hour and ... without much ill-effect, without any ill-effect apparently. And, but we thought we might have a different, a slightly different approach and we set up the cardiopulmonary bypass and cooled the blood going through the cardiopulmonary bypass – this was for the smaller infants undergoing cardiac surgery... And we cooled, using the pump ... by cooling the blood going through the pump to that sort of temperature range you are talking about, and then stopping the circulation altogether, draining the blood out of the patient and letting him lie in this state of no circulation, cold enough for his tissues to survive with the metabolic requirements at that temperature, and then re-warming them by warming the blood in the pump at the end. Again, one hesitates to say whether you're the first or the second or what is it, but I think we did rather more than anyone else using this technique in the country in these early parts of the sixties. And there was [at] one stage an operation devised by a man, in the transposition of the great vessels, a man in Toronto called Mustard.⁸ Well, we had done I think sixty of these Mustard operations, consecutive ones, without any fatalities amongst them, which for that period was, was pretty good.

MB Jackson, what you are saying is that you were actually suspending circulation for a period of time?

GR Oh, yes, yes.

MB I'm just wondering how that affects anaesthesia?

GR Well, you don't need any anaesthesia if your temperature is at that level.

⁷ ME Bigler.

⁸ Dr William Thornton Mustard.

MB Right, that's low enough to actually...

GR Yes, I mean that, that is below the coma level.

MB Right, so you're totally, totally out of a need for it? So you could switch off for a time in those, in those operations?

GR Yes, yes, absolutely. Because there was nothing, virtually nothing that one could do except keep an eye on the stop-clock to tell the guys when they ought to be thinking of coming out.

MB What were the other major advances in surgery? We've got now into the sixties, I mean we're well into the sixties, you're looking at hypothermia in an impressive way, and using it a lot. What advances kind of followed that?

GR Oh, well one of the big problems of cardiac surgery is, using the, particularly using this kind of approach, is getting bits of air into the circulation, because of course the, the vessels are not pressurised. And I think that people have tended not to shut off the circulation completely, to use the lower temperatures but to keep a, keep a trickle of blood so that you've got a positive pressure in the, in circulation all the time, which reduces the hazard of getting air in. But, getting air in of course is a question of technique and expertise I think on the part of the people doing the surgery, so... And I, and we had some extremely competent people; a guy called David Hamilton who was working with us at this time, this was after Ronald Edwards, my first colleague, had retired, sadly died at 73. But I think that we, if we want to talk about paediatric anaesthesia and things going on, I think we've got to slip back again a little bit to the sixties because in the late fifties and early sixties we were all becoming interested in intensive care. And at that time if you wanted to ventilate patients in the long term, the received wisdom was that you could not do this through an endotracheal tube, leaving the endotracheal tube inside you for a long period of time because this would produce damage to the larynx and trachea and so on, and that it was necessary to do a tracheostomy for this purpose. And whenever we wanted to ventilate a child or a baby for any length of time, a number of days, this is what we considered we had to do, and indeed what, this is what people were doing in adults too in those days. Now, if you do a tracheostomy in an adult or an older child, when you've finished with it and the patient is recovering, you can just take the tube out and it will seal itself off and all will be well. Now the situation is rather different in small babies because... Well, I think there are various reasons. One is the rigidity of the rings in the trachea and so on. But if you make a hole in the trachea and put a tube in, that's great, when you take the tube out, you have great problems with respiratory obstruction and so on. So, we all did these tracheostomies and we had terrible trouble with getting rid of the tracheostomy at the end, a tremendous complication rate.

MB A sealing problem?

GR Yes, and I think there were in those days a number of, of children who'd had tracheostomies in, there were a number of people who'd had tracheostomies in infancy who were in fact condemned to a lifetime of tracheostomy. But in 1965 I went to Australia, and we were in the children's hospital at Melbourne chatting away one night as one does, and the fellows there were saying 'There's a very extraordinary

fellow in Adelaide,' which is sort of just up the road from Melbourne if you know what I mean. And they said this chap had an awful lot of croup there, that's that 'bark-bark' you know, that babies get that obstructs their respiration when they get an infection of their larynx or trachea. They had this extraordinary incidence of croup there, and they'd do tracheostomies, which was the sort of thing to do there. Or they had been doing tracheostomies on these infants with croup. But this fellow they were telling me about, they said has been putting endotracheal tubes in through these infected and diseased larynges and leaving it in until the disease recovers and then taking it out. Well, this seemed to me to be a most exciting thing because although... His name was Allen, by the way, Thomas Allen(?), the Adelaide fellow. Thomas Allen had been using this endotracheal tube, leaving it in for 48 hours or so in these larynges, purely to relieve the obstruction of this disease. And when I heard about this it struck me – I think it was me it struck but we were in a group together – that here was the answer to our long-term ventilation of babies because if we could do this without a tracheostomy, this would be an enormous advance. And so, I went along and we, had a long chat with Allen, and I told him how excited I was personally about it, what a splendid thing it was and that he really ought to write this up immediately so that we could all know about it and... And his results were remarkable, I might say. From, in the previous ten years, they'd had a total of 200 deaths from croup in this hospital and for the first time ever, they'd had a year without a death from croup following his introduction of, of this thing. So from 20 a year to zero from this particular disease in, in the space of a year. And I left Australia and went, went home. And I did a circumnavigation, I went home across America, and called on my colleagues there, because we were, we were still quite a sort of smallish group, around the world even, the people who were really influential...

MB There was a sense of a worldwide collaborating community?

GR Of course yes, and we knew each other on a personal basis, you see. And I told the chaps on the way, particularly the one in Philadelphia, a chap called Jack Downs who's just retired, and he was interested in this and he had started ventilating. And I told him 'Well we must wait till Tom has, has written this up before we put anything in the journals about this, you see, but there's no reason why we shouldn't start doing it.' Then I went up to Toronto, not Toronto, to Montreal where my old friend, Davenport(?), was. And in the wards there he had had, he had two of these babies that had had tracheostomies and try as they may they could not get them to breathe without this tracheostomy tube in their throat, you see. So he said 'Well, why don't we put an endotracheal tube in here and let this settle down, let this hole in the neck close down, and we'll take the tube out and then it will be all right.' So we did – well I was only there for a couple of days, you see – we did this. I think he passed the tubes, I'm not sure whether I did it or he did, and I left to come home with these things, you see, and I rang him up a few days later and said 'How, how did you get on with those babies?' And he said 'Oh, we've taken the tubes out of both of them, they're both fine,' you see. So that was, that was another very valuable thing. But also it meant that we could leave these endotracheal tubes in for some length of time and, and use them for ventilating in intensive care.

MB Why had it been thought impossible to do that earlier actually, Jackson?

GR Well, yes, there were good reasons for this. Endotracheal tubes up to 1951

were made of vulcanised rubber. Now, vulcanised rubber is a very, very unpleasant thing to be in contact with tissues for a very long time. It ulcerates the tissue and produces an inflammatory reaction and then as the inflammatory reaction resolves you get contraction and, and a lot of tissue damage. It wasn't until 1951 I think it was that we had this Portex plastic tubing – it wasn't called Portex, it was called Portland Plastics Ltd, ivory tubing they called it, which it was, produced much, much less tissue toxicity than the vulcanised rubber. And I don't know if it was, whether Tom Allen was consciously aware that we'd got these new materials or that he was just desperate to do something for this appalling situation.

MB His role was just bringing intubation back into focus?

GR Yes, that's right. Indeed he did, and of course now...

MB With incredible consequences?

GR Absolutely, because not only do children enjoy the advantages... We were always very reluctant to put a child on a ventilator long-term because of the necessity to do this tracheostomy. Now of course you can do it at the drop of a hat and if you find you've done it unnecessarily, you can stop it, and there it is. But, but it wasn't always so. And of course this has spread into adult intensive care as well – prolonged endotracheal intubation is, is very commonly used now.

MB Jackson, we've got you well and truly launched into the sixties. We've even touched on the seventies. We're moving towards the end of this particular session we have together, I just wonder whether you could, and it's not an easy job because so much was happening, whether you'd like to crystallise any of the other major developments that were part of the story of your career?

GR Yes. Well... One of the things that I am known for, and I really deplore the fact that this seems to be the thing that I am known for because there are a lot of other things which I'd much prefer to be known for having done, was this business of ventilating children during anaesthesia. The, as soon as we paralysed the children and had to ventilate them, we needed some comfortable and easy way of ventilating the lungs. And we had this Ayre's T-piece which I've spoken of earlier, and you could ventilate the lungs by feeding gas into this thing and putting your thumb over the opening to the air so that the pressure built up. But this was a bit uncontrolled and I think pretty hazardous too really because you had no means of determining precisely what pressure you were exerting on the respiratory tract. And so it seemed to me to be a very simple thing to put a rubber bag on the end of this tube which had a secondary opening, an opening at both ends as it were, one connected to the tube where the pressure was rising, and another one to the atmosphere, by squeezing the end you could feel how the pressure was rising, and...

MB So, you were monitoring it at that level?

GR Yes. And so, we were able to ventilate, very comfortably, in a piece of equipment which was really rather well adapted to the size of patient we were dealing with. And so, it became very widely used for resuscitation, and for, still is I think, and for ventilating small children temporarily.

MB And I'm told that you had a, a very rapid method of ventilating, your own technique, that had profound repercussions?

GR Well, yes, for the small babies, yes. You see we were very, we had, our methods of measuring were terribly crude – we couldn't measure pH, we couldn't measure gas tensions in the blood as, which is absolutely routine now. So we didn't know really whether we were ventilating enough or, or not when we artificially ventilating.

MB You've transported me back to those fifties now when you were getting that relaxation procedure going.

GR That's right, in these very early days of IPPB [intermittent positive pressure breathing] and anaesthesia of children. And, so what we did was to make jolly sure that we were ventilating enough and to make jolly sure that you're ventilating enough, you usually...

MB Did it a bit over the top?

GR ...go a bit over the top, go rather fast and so on. And people used to comment on the rate at which we were ventilating, but it always seemed to me that the children looked better, perfused pinker and so on if I did this than if I did, ventilated rather less. As I say, we were, we were navigating completely blind of course, there was no, no easy way of measuring whether you were doing the right thing or not. And so we, that's what we continued to do. And there was very little known of course about the physiology of infancy in these early days. This didn't begin to crystallise until Geoffrey Dawes...

MB In the late fifties?

GR Yes, that's right.

MB At Oxford?

GR That's it, yes. He died recently of course, sadly. And he and his co-workers really elucidated all the vast amount of the physiological difference that exists between the infant and the adult and the older child. But one of the things he didn't actually elucidate ... this was left to a group in Toronto. Bryant(?), Levinson(?) and Reeve(?) I think were the three authors of the classic paper, I think that's the right order I've got them in. But, I was in Toronto I think before the paper was published, and Charlie Bryant(?) was lecturing. And what Charlie told us about their findings in studying the respiration of infants was that the, the older child and the adult when he expires still has a long way to go before his lung and its airways become so small that the airways obstruct, you see. But in infancy there's very little difference between the end of a normal expiration, and the thing, and as I was sitting in this lecture theatre...

MB This was the late fifties as well?

GR Oh no, no. This was, this was '72.

MB Oh, way on?

GR Way on, yes, way on. And ... I said 'Well that's what we've been doing, we ventilate so fast we don't allow time for full expiration, so, so we're maintaining airway patency under all circumstances in anaesthetised children.' And then of course we were able to, which is done I think pretty universally now in children... Having appreciated what this rapid ventilation did in the sense that it was what we call elevating the FRC – increasing the functional residual capacity of the lung – that we could do this in another way altogether by putting a definitive positive pressure at the end of expiration, again something which is very widely used in intensive care and in children and in adults. So the exchange between paediatrics and the adult world was a two-way affair. We took, we brought the endotracheal tube to them for their intensive care, we also brought this thing which is called PEEP now, positive end expired pressure.

MB But in those early fifties, you pumping the bag at the...

GR Oh, it was empirical and...

MB You just saw there were improvements, and that, that because you published it had its effects but long before the research in '72 had actually vindicated the method?

GR Well, when we were writing about the neonates, we said that ventilation should be rapid. It's a very non-specific thing to have said, but there it is!

MB Jackson, with that in our minds we are winding down now. We're coming towards lunchtime and the end of this particular interview, but for that view of twenty years of research contributions and contributions to surgery and paediatrics, thanks for giving me that, that view of what was happening.

GR Well, thank you very much indeed.