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**Professor Jonathan Stone FAA in interview with
Dr Max Blythe. Sydney, Australia 28 March 1996**

MB Professor Jonathan Stone, it is nice to be talking to you here in Sydney, at the Royal Australasia College of Physicians building, in Macquarie Street. We talked only the other day and had our first introduction, and you told me about being born in 1942, in Auckland, of an interesting family. Perhaps we could start there.

JS Yes, my parents had been in Auckland for three years. My father had gone there to take a chair of law at Auckland, as a very young man, he must have been in his early thirties. He was appointed to the Chance chair for National Jurisprudence, here at Sydney University, and moved over in 1942, and I came as a babe in arms, my mother tells me we came in, the old Catellina flying boats, landed out on Rose Bay, just out of the window there. So, yes I have a landing place in Sydney.

MB Great. And as soon as you are old enough to really appreciate family matters, you find yourself in a fairly tough moulding family environment.

JS Yes, it was. They were immigrants to Australia, obviously, but their parents had been immigrants to England from Russia, fleeing the Tsar's armies, and their claims on the Jewish population in Lithuania. So they were fighting their way up to the middle class, doing a good job of it, and My father had fought his way up, I guess, from the slums of Leeds, and went to Oxford, just at the time when it was opening up and Although it gave him his start, and he recognised that, and he still kept his college shield, Exeter I think it was, on his wall, he had a love-hate relationship with it.

MB He never wanted to go back did he?

JS No was never invited back despite all the distinctions he gained and didn't himself ever want to go back, and yet had this element of affection and love, which was all still there and spoke with great affection of his tutor there, Geoffrey Cheshire, I think it was.

MB I know Leonard Cheshire's father, yes.

JS He kept up contact with the elder for many, many years until he died. So they were tough people, come through tough times and it is is not part of my life, but within a few years, that was the timeand it was, a very strong Jewish family, a time when there was being debated the British Mandate to powers in Palestine, and he took a very strong stance against our Governor General, at that time, as a young newly arrived man, you can sense the mixture of intellect, and anger that was driving him, when I read those old papers. But I was unconscious of that time, I was just a babe, and then found myself in post-war Australia, growing up, going to school.

MB We have talked of father. He was a strong, powerful loner, and to some extent we have said that this is not unlike you in a way, because that has been part of your career, being a loner on occasions.

JS Yes, it has been, and you never know of yourself, whether you are imitating somebody, or you just are that way too, but my instinct has been that of following my mind. I never have had any problem with authority of the institutional sort, but I have always had a problem with intellectual authority.

MB You got into a few conflicts?

JS Yes, which with a bit more of a smile and shrug, and a tug of the forelock, I could have just gotten around, but my instincts weren't there then. They are well in place now, all the learnt reflexes. Yes, I did somehow or other inherit that.

MB We have talked of father, a fascinating figure I am sorry I am not going to meet at any time, but what of the rest of the family? Mother, brother and sister?

JS Yes, well it was a close marriage. My mother, Rebecca who is still alive, devoted herself to the family and provided that background, which my father drew on, in that traditional way. There were three of us, my older brother is now Professor of Religious History at the Hebrew University, and has been for many years. My sister is a psychiatrist, practising here in Sydney, and they have families, and very stable marriages, and happy families, and they are very warm sibling relationships that we have.

MB Mother, was strong, as well as father?

JS Yes, she came from that generation that had fled, and then lived, although luckily they found themselves in your country, and therefore were unaffected by the holocaust, but fiercely burnt by it psychologically and so this gave a toughness, a no nonsense attitude. I think I mentioned that I didn't do much sport at school, because it just wasn't encouraged.

MB You have got to move down a line of getting there.

JS Yes, just knowledge, learning, getting your qualifications, but I have since made up for that in various ways, but I really came through without much of other interests.

MB Jonathan we have mentioned the holocaust. That burnt a bit on you as well, because eventually you diffused some of that.

JS Well obviously I didn't experience it. I didn't become aware of it until, in the most peripheral way, as kids you learnt about it. You do realise, one thing, firstly, that within Europe, within central Europe, something of the most awful nature happened. I drew out of that scepticism about the role of culture, *Kultur*, in the German sense. I realised in a sense the amorality of culture, and so I came to appreciate something that my father appreciated the value of the British tradition, which was a powerful set of mechanisms, quaint, and odd, and full of idiosyncrasy, which nevertheless had provided England, and could provide Australia with a form of government that, for all its imperfections, got rid of that terrible instability that afflicted middle Europe and I tried to understand that at its fundamental levels, coming at it and thinking with my training in science.

MB I'll get you to school now. I have kept you back, but I wanted to see that family because that was the cradle of it all. You go to Primary school, I think we said didn't have that great an influence.

JS No. I went to the local public school, Gordon Public, which I remember with affection, but Gordon now is a suburb which has matured, there aren't many kids now, and I think they have closed the school down. I went to one of these selective primary schools, they called it opportunity schools, and had a happy time there, and then passed into a selective high school, which was North Sydney Boys.

MB And that was a tough, no nonsense school.

JS It was I recall that it was not really a caring environmental, although it wasn't a care-less environment, but I have since learnt through my children's experience, how much more caring and attentive schools can be. It was a tough environment, but a fair one, and I appreciated that. I threw myself at the academic windmills. I did well enough.

MB So you stacked up well.

JS Yes, I did OK.

MB What kind of subjects did you do, was it right across the board, or did you have a particular area?

JS The area that I wanted to have a go at everything, but the area that I really found myself standing out in, was English. For some reason the words came and I found myself able to just be a star at that particular subject.

MB And you wrote, you liked writing.

JS Yes.

MB And I have got a feeling from what we have talked about, there was some philosopher in there, rooted in there, that reached out at quite a bit of philosophical material. Perhaps that was father's link?

JS Yes, that is right. One way or another I got from him through genes, environment, or absorption, but a need to understand at some fundamental level what was going on, without getting into what, either two things, the scholasticism of a lot of modern philosophy, which I read and just couldn't handle, and then came to understand, for what I think it was, or else the gloom that you remember Boswell referred to with Johnson. He has this comment about. 'I have tried to be a philosopher, but cheerfulness kept breaking in'. And at some point you walk away from it, because it just drags you into the deep and difficult debates, but you realise that the philosophers have tackled very difficult issues that afflict us, generation after generation, and I found that I could make my way better in science, to my satisfaction, if I understood those issues.

MB There is an analytical, strong analytical person in there, that science actually moulded better at that stage.

JS Yes. Well science gave a lot of materials for understanding. For example, I found it fascinating to read, not the debate over evolution, which was a confrontation which became persistent with knowledge, but within the scientific system, the drive that some people had to have a clear cut classification that everybody could understand, and others who said wait a minute, what we need is a classification that can deal with errors, that can be creative, be heuristic, is the word that was constantly used. I came to understand that. I could see then what was drawing my colleagues in certain directions. I became, I felt, more of a fuller scientist for doing that.

MB Jonathan, are those flowers in your way I could them back a bit.

JS I seem to be hitting them.

MB No, no. I thought I might just move them because you are nicely expressively involved, and you can't really go for it. I wanted to get you into a medical course now at Sydney. It was a bit of parental pressure, I suspect, that pushed you there?

JS Yes. I came out of high school, young. Hell, I thought I was a ready for anything, but I was sixteen and I didn't have a clear idea of what I wanted to do, and I am sure if I had said, I wanted to do any one of a number of professions, I think they would have wanted me to do a profession, but any of a number they would have supported me, but I wasn't sure, and they suggested medicine, and in I went.

MB But sixteen. It couldn't happen now, could it?

JS No, no.

MB I mean you would be guarded against.

JS School has been extended by a year for a start. Now increasingly they are trying to bring them into medicine at an older age. I was a case in point, I threw myself at the medical course, it was then and even as it is now a flood of knowledge that people package for you as best they can. They were extraordinary years, and I think, that didn't help, but after the war the Australian universities were asked to cope, not just with the normal flow of kids coming out of high school, but they had been asked to deal with the returned service men. They were not allowed to put academic restraints on. We had seven hundred in that year. Seven hundred of us and of that three hundred failed, and we passed on and picked up three hundred and it went on for a few years later. So we were dealt within, in mass. I wasn't enjoying it, but the opportunity came to do a research degree, which is still there, its called a Bachelor of Medical Science, I didn't and I said, 'I don't want to go back'.

MB So you quit.

JS I quit the medical course and went into research.

MB It is fascinating because Peter Bishop who you joined in that experience of Bachelor of Medical Science degree was here this morning talking from that very chair. Perhaps you would put me in tune with that environment that he had created for that Bachelor of Medical Science degree.

JS Well, Peter had the passion in him to establish the study of the brain in Australia, and there was another group, that was Eccles' group in Canberra, but outside of that very specialised environment of the Institute of Advanced Studies in Canberra there was almost nothing, and Peter went to University College in the late forties, he came back, and he set up the labs, he started to bring in people, and I was one of those lucky enough to go into his lab, extraordinary people who have gone on to make their mark, right throughout Australian neuroscience, and some of them overseas and in Canberra of course he attracted a lot from overseas, who went back, and made their mark in their own countries. Looking back it is quite extraordinary, and I feel privileged to have been one of those people. I remember he was interested then in the cortex. He had moved on from the study which he did so well, of individual neurones to saying we have to study the system as a whole, we have to go to the high levels. His first project he gave me was to explore the visual cortex and I couldn't do it. He was so busy administering that I found myself on my own. I remember gritting my teeth and saying I am just going to work until I find my way out of this and the way out came out partly through a collaboration with an American chap called Bob Rodack, who had just about retired, but he had a very distinguished career and I was lucky to meet him at that stage. Bright, full of ideas, full of self confidence, he was there. I remember Bill Levick who has just retired, I think, from chair, a personal chair at the ANU. Jack Pettigrew, who is up at Queensland now, heading a research centre. He came just a year after me, quite an extraordinary group. The other thing was, I think I created it for myself, I got really interested in the structure of the retina. Peter gave me a project. I did it. It was an experimental project. It worked. I presented it at the Society, and then I had a vision of, it was a retinal project on the beginning of the visual system. I had a vision of how differently to look at the retina and I figured it out, doing an old exercise. I brought one of them along actually. There was a way of taking the retina, and simply, instead of cutting it up into pieces, to take a whole retina, rather like this, and I am going to lay it flat and it gave you a way of surveying it which had enormous power. I had a vision of it. I can remember after that meeting coming back on the train, it was a long train ride from Melbourne in those days, thinking through, how could I do this better, how could I see the, what I was looking for was variations across the retina, and I had this sort of insight, and somehow or other I brought it off, and...

MB Is it easy to peel off. Does it dislodge easily?

JS Once you get confidence, yes and now it is used in hundreds of papers, in many, many labs every year. Although its origins are forgotten. I have some pride in having contributed to it at that point. But then it gave me insight, what is the word, data, ways at looking at things, and I was ready to go, and we gave up with a series of studies then, which led to understanding of aspects of the retina, which then could be the foundation on which Peter could build and draw, and then strengthen his cortical work, and so once he understood what I was getting at, and I have always been so grateful to him. He gave me freedom.

MB Just summarising it. I mean you started off with the cortex, which is almost a mosaic of cell areas interpreting the retina, messages from the retina. Peter had already looked at the cortex a bit, was looking at the optic nerve, and the kind of nucleus and the way through. You were actually providing a look at the mosaic that was at the front end.

JS Yes. I went out to the periphery.

MB I suppose no one was doing that in the lab at that time, was there? You took the lab as a youngster.

JS I was quite young when I went out. In fact I ..

MB ...in your early twenties.

JS I must have been about nineteen, twenty when I got it. Yes. When I made those first hormones, and I am still looking over them. I spent time on the microscope on one this morning. So it has made a powerful technique, of course we have brought in the more molecular techniques in the new microscopes, but it has been, yes that was a cool thing for me.

MB And how had this gone. You were mapping, you were actually becoming a cartographer at this retinal structure.

JS Yes that's right. So I found myself going with all sort of analytical, holistic desire to see that actually getting down to very detailed counting, one, two, three, four five, and yet I was able to with that to get the data on which I could see patterns. I could see patterns of specialisation of the retina. We saw how the retina divided its projection into the two halves of the brain, and began to pick up morphological differences among ??which then again the basis of the power in the story??I do of course and other around. I said I was alone there, but two of Peter's collaborators, Caswick, and George Vaccar, had started to look at that, but hadn't concentrated on, and I picked up from them, and got then down to the microscopic level, which enabled that.

MB This was the essence that first period in Peter's laboratory, those six years. You did a PhD at that time with Peter.

JS Yes.

MB Was Peter your supervisor.

JS He was my supervisor. The study had physiological parts, which I did with Bob Bradwick, the American collaborator, and it had an anatomical parts, which were much more my own.

MB Do you want to just reflect on the physiological aspect, just so we have the total balance.

JS Yes. So we picked up a point in the study of visual pathways at which people had started to look at what are called the receptive fields of the cells. It was realised that the cell wouldn't respond to the whole visual field, would only respond to part, and once that was realised, you could define it, you could analyse it, you could start to construct it, and then when you had surveyed many, you could start to see the differences. That had been begun in America by Hartline, in the late nineteen thirties, he got the Nobel Prize for that work. It had died a death during the war for obvious reasons, but this was its renaissance, and certainly in Australia, and that work culminated in really a mathematical bottle that Bob Bradwick produced, he called it a convolution model, and I went a fair way down that stretch doing models, not full way, because he did the mathematics. That became a paper of reference in literature from which then we could begin the classification work.

MB Actually patterns and populations of cells, some population of cells, that have very, very precise influences that turn them off or switch them on.

JS Yes, that is right. And that was the excitement that came out off Hartline's work. Now buried, small, in that thesis is a chapter, an incomplete and untidy one, in which I describe receptive fields that hadn't ever been seen before. When I look back it was an incomplete description, it got published in fact in Science, and was exciting in the time, and then I couldn't do anymore with it, they were not easy to record, but it was there somewhere in my memory traces after my post doc years which were exciting in themselves. Peter was quite insistent that I should go overseas, and in fact arranged for me to go and work with Jack Eccles, who was by then in Chicago. That of course was a terrific experience. Eccles, was such a figure, a giant of man, he was in his late prime by then, and so I knew I had a lot to learn, and I was prepared to absorb, and I did, and I did intracellular recording. Two of my collaborators, Henry Cohen, is now a major figure in French neuroscience, and M?? of the Hiro is rising in Japanese neuroscience, until he was on that Jumbo jet, that lost its rudder and ...

MB Gosh.

JS So they were exciting times as I look back.

MB Just before I actually take you through that, Chicago and the aftermath. That leaving Peter Bishop's unit, wasn't totally without some kind of stresses that had arisen I think with other colleagues, because you were burning rather a bright light at that stage. Yes although the, certain with Peter, it was a friendly leaving, and he welcomed me back, but ...

JS You were forging a tough race, I suspect.

JS Looking back there must have been something in the chemistry of personalities that, but the substantive issues in which I found myself with tension with colleagues were conceptual, my willingness to draw large paintings in broad strokes, although I felt I did my time on the fine strokes, but perhaps, you know, I drew broad strokes were...

MB You were a very holistic thinker. They seemed to me to have very fine focus, and you seemed to be a tide away from that.

JS I knew I had so much to learn from them, because they had skills, and enthusiasms, and abilities that I didn't have. Sciences is a matter of choices, it is not a question of whether you do this, or that, or do this and that, or whether you do something, it is a question do this or another. My choice; or I was always drawn to where I thought we were breaking through into new ground. Now, science, creative science, is always done on the edge of the unknown. You are always stumbling in the dark, you will clumsy, you will fall, you will look silly. I was never afraid of that, others were more content to stay in the safe ground, do a bit explored, where they could do much more elegant work, that was a tension.

MB So you were ready to go to Eccles, in Chicago, in sixty-five. I mean you were really ready.

JS Oh yes, I was ready to go, and ...

MB How did you find Jack Eccles, himself. Just give me a little portrait...

JS He was a gorilla of a man, he was quite big, still full of energy. You could sense in his youth, I think he had been a great swimmer. He was positive, was quick to judge, and if you were on the line that was his at the time, he was there, and he supported you.

MB He was your man.

JS Yes he was your man. If you dug in your heels, he would just walk away from you, and of course he had achieved great things by then, had a great sense of self esteem. I learnt a great deal of course being in that group. Somehow, I feel I learnt more from Eccles, from his philosophical writings, not in that the writings themselves, but in the fact, that here was a man of empirical commitment, who said, 'look I've got something to learn from philosophy. I drew a lot from that.

MB And like you were saying, he was also not afraid to be on the frontier of science, and to get things wrong and to stumble.

JS Yes. He wasn't, and I can remember...

MB He was comfortable with that.

JS I can remember a conference where somebody put forward a fairly radical idea, and who was in favour of this, and Jack said 'I'm going for it', and just wasn't afraid. I think it was the proposition that all the climbing fibre inputs to the cerebral had come from the olives, was it true or wasn't it. He was just willing to lay it down, and he had real judgement. Just to give you a bit of background on him, and this is the other thing I learnt again, not from Eccles, but from Jack Coombes, who had worked with him. Jack could remember Eccles, one of Eccles' great discoveries, he was working on something, and suddenly a synaptic potential inverted on us, on the screen, and Jack clearly said to me, Eccles, after that happened, two or three times he said forget about what we are doing, that is what we are investigating.

MB He was quickly adaptive.

JS And he'd seen an ??phenomena. that's what we are in, that's it, and out of that came his book on ??Basis synaptic transmission which was his key contribution, and I have learnt to watch in the periphery of what you see down the microscope, on the silicscope screen, and that is what happened in that transition from Germany back to Peter's group. I had in Germany worked on a very detailed study of conduction velocity of cells with difference receptive field types. I had seen variations that no one described and they were very interesting, with precision, but hanging out on the end of the traces were cells that didn't fit into the two major types. I saw them there and I put them aside.

MB I am going to come to that in a moment, because we haven't quite got you to Germany. It is a fascinating story. I am just going to shackle you back.

JS OK

MB Because at that time, the Eccles lot. It has got a philosophical time as well. I think you probably read Popper, it is an exciting time. It was a time of transition. There were five years out of a stable of the kind of Bishop world.

JS Yes. Although I must admit I did really tackle the velocity until I went back to Peter's group at Canberra, and started carving out a new trend, new paths, and that's when the fire really started. I found myself under a philosophical attack and as well as spherical on. That's when I went back to Eccles.

MB Right, but before we get you there, you lose contact with Eccles, because he pushes off to Buffalo, for Chicago.

JS Yes, he was in transition.

MB You are taken with him. Or you choose not to go.

JS I was offered a position in another lab next door, and I said 'No'. I had dragged my family around enough.

MB So you weren't to one of is first rank boys, quite....you hadn't....

JS The Rudolph Lemus group, I stayed with them. .Worked with a brilliant young American called John Freeman. John, showed me how brilliance, and good hands could take you a long way very fast. I greatly enjoyed that year.

MB What technically did you come away with. I mean you had done the retina work. What technical...

JS It took us into interesting recording. We got into the interpretation of an insular recording, and the use of classical electrical stimulation techniques. I took those back then, to Canberra.

MB Via Munich.

JS Yes. I had a year in Munich. It was partly to see Germany, but I was luckily to get a position in the ??Institute of Psychiatry in Munich. Now the head of the lab was Otto Kreuzfeld. He was the son of the chap whose name is attached to the Jacob Kreuzfeld disease. Otto went on from there later to head a group in Göttingen, and Burt Sackman, and Edwin Neare, got the Nobel Prize a few years ago, were his protégés. He was a very distinguished neuro-scientist, but there he too, left me to my own devices, supported me, and I said 'Look I want to try these techniques I have learnt with Eccles', the work I had done with Bishop and bring the two together.

MB And that is where you stumbled across double u cells.

JS Yes. I started to see briefly when you stimulate along the visual pathway, and Bishop had shown this twenty years before. You get two groups of fibres turning up at very precise moments on the screen, and I started to work on the receptive field properly, before we started to think about them. And I started to see cells, not caring with the first ones or the second ones, but out here, a scattering of them, occasionally. I took a guess that they were small cells, literally small neurones, that others hadn't seen them in the twenty years in between, because of micro-electrode technology. I said I am going back to use the glass electrode technology that I had learnt with Eccles, and go back in. Then they started to turn up, one in five,

MB That was something.

JS Yes, that was something.

MB Oh you were onto something.

JS And then when I did the receptive fields, they were quite different, and I said 'Look this is just something that hasn't been recognised. I reached back to that early paper in my doctoral thesis, the one that had been published in Science. It look a bit untidy but it looked better with passing years. Yes.

MB That's incredible. So you came back. You came back to Australia, to Canberra.

JS Yes, and had five fruitful years with Peter Scruton. He put me in a lab. He gave me tremendous support. I got technical support. I didn't have to write a gram. Just go. The first story that we pulled out was this one, of the new class of cell in the retina. Now, once you have got over the excitement of that and absorbed that. Then what I argued was that we now could/can?? see that the retina by getting itself the output cells of the retina in????there are a million of them, each of them has its own private line into the rest of the brain. There are clearly different cells doing different things. So the idea that was driving me was that OK, the retina is not just a light processor, it is in fact specialised through these different output cells, to form different things, movement, shape, colour in the primates, out of the system, and channel them into different parts of the brain. Our understanding was that when you then trace them in the brain they would go to different areas. This worked, there were others working in the same area in Canberra and I mustn't fail to acknowledge the superb work they did. We drove the idea right through to the visual cortex, that is that we argued with colleagues, who made tremendous input, Peter Hoffman, ??Brockman Dreyer??. We argued these ??cells are reaching for cortex, without mixing and are driving some of the variation in the cortex, which the great American workers had interpreted as serial processing. They had seen the same variation, but they said look, getting information that is processing hierarchical manner, and one of the papers that I liked to read, that we wrote together, was on Hierarchical and Parallel Processing. There were large areas of analysis in that, that I still am pleased to read, and ...

MB Parallel Processing was it.

JS Yes. And so that was the driving idea, which was resisted by the Americans, because they had done such a lovely constructive job. They had broken open so much, and were rightly rewarded with great honours.

MB You were not thirty and you were pushing against big established ideas.

JS Yes, and was stupidly fearless about the matter. It was, I must say, Peter Bishop, he understood it, he saw it was happening, he welcomed the firm end. His philosophy was that out of the firmament will come the testing, the hardening, the heart testing, the discarding of what was wrong. So he gave us great intellectual freedom, and I like to thing that he found that a very productive period. So it then established those ideas, and I believe they are now the heart/part of the mainstream.

MB Right.

JS So much so that, as my father used to say in his own field, there comes to a stage son, where not only can't they remember the battles, they forget the details of the battles, they forget that there ever was a battle. I think that we have got to the stage with that now. I haven't done the cortical work since then, but we have seen evidence that different areas of visual cortex are handling, motion information, movement information about colour. Even, you will be aware of the ????????even the recognition of faces seems to be packaged in parts of the cortex. I didn't believe that we would go so far, but it has. Quite extraordinary.

MB Incredible isn't it. Jonathan I am going take you back a little bit, because it is exciting thrust that we had, that we couldn't hold back. At some stage in your early work with Peter Bishop, you actually taken a wife, become a family man. We have missed that side of the story. So I want to just go back and just put that into context.

JS Yes. It is one of those personal things. Margaret I met as a lab technician in Peter's lab. She was then studying arts part-time. We rubbed along well enough in lab, but struck up a relationship after a few years of being together in the lab, and its been a warm an successful marriage, that I have relied on, and I have drawn on her intellect and warmth as a person.

MB She has gone on to have a very successful law career.

JS Yes indeed. We have three daughters, but after we returned to Canberra, she enrolled in law, did beautifully well. Got a job when I came up to Sydney in 1976, and began her own career. She stayed with the New South Wales University Law School, for ten eleven, fifteen years perhaps. She is now with one of the big law firms in town, and going strong. That has been a very positive, warm, stable, family life.

MB But not so strongly Jewish, as your background. I think you overcame some of the religious pressures, and put those aside.

JS Yes. The issue of ethnic involvement is such a fascinating one for anyone brought up in that tradition, because obviously there is a religious core to it, and on this, I am a sceptic. I am agnostic. There is a religiousistic core to it, and I am not an admirer of ritual. It has both strengthening, and divisive aspects to it, but nevertheless it wasn't a century in which one could escape, and nor did I really want to escape, and in fact I have close colleagues, and work from time to time in Israel, and enjoy and am fascinated of course by that extraordinary history, of that place in time, and those people. So yes, I have become.

MB Ethnically associated, rather than religiously.

JS Yes that is right. Every religion goes through its own evolution. It seems to me that the evolution of Judaism was stunted by its diaspora, by its being spread out, but now having its own space and patch in the sunlight its starting to evolve again. But that is another story. I am part of that, but just a part.

MB Jonathan, also sometime later, as this career took off. You found the odd leisure opportunity, to become a sailor, you hadn't been a sportsman before. You just ground away at it all.

JS Yes. I had played a few games. I used to play a bit of squash, and so on, with enthusiasm, but I didn't come to it till I was four years racing dinghies, and I realised I had grown up in Sydney with a superb harbour and not sailed. I have since learnt, and enjoyed, and I have learnt in a small harbour side club, and I have made as many friends there as I have in the rest of my career. So it has been a wonderful.

MB Now that we have caught up a little bit with the more private side of your existence. We have still got you in Canberra. I was going to ask what you found Canberra like. That must have been a cultural shock as well.

JS Yes. Although we were at that stage with young kids, where Canberra is ideal. Just laid on for young families. So for us it was great. You complained then, even now, that it is less culturally rich, and that is certainly true. Canberra, was a middle class town, it still is a middle class town, and if you take it as it is, it is just great. You can grumble, we didn't. We thought it was wonderful, and had a wonderful time.

MB You had five or six years there, and then got a chance to come to Sydney, to a senior lectureship.

JS Yes. I applied for and was appointed to a senior lectureship at the University of New South Wales.

MB In the department of anatomy.

JS Department of anatomy, or schools as they call them in that particular university. What drove me to that was really two things. One is that I found the, despite the scientific firmament in that department. I found the institute life, the life of turning up to work with a small group day after day quite stunting, in some sort of interactive sense. I was looking for lots of faces. I wanted to teach very actively.

MB You'd been coming into Sydney to teach, I think.

JS Yes. I had come up year after year to give a few lectures, and always enjoyed doing it, and I also, I think, I inherited this from father, who prided and loved to teach, and taught me a lot about teaching, just by example.

MB He became a great media figure, didn't he, over here.

JS He became a media figure. I can still remember, and he was very sick at the time, but he was determined to do it, he gave, and he must have been seventy five, in his last lecture, and it was fifty years from his first, and he was so determined to give that. What he taught me about teaching is that, and we live as you know, in times of educational enthusiasm, wanting to be a teacher, is knowledge, and passion, and commitment. I can remember him saying it, doesn't matter if you stand on your left foot, or your right foot, or it is a small class, or a big class, and you have that knowledge and passion, you'll teach. And so I've accepted that much, as to face value, but put thought in it, and so it has enabled me to deal with the educational enthusiasm which sweep over the teaching scene, from time to time. And to deal with it with a sort of physophysical and strength and say 'Look, OK, I'll use overheads, small groups, large groups, meaologisms can come and go. But you need to be a teacher, is have a passion and communicate that, and the kids do respond. You can stumble and mumble, they will still respond if the passion is there, and the knowledge of course, they won't let you hoodwink them of course.

MB When you got to Sydney, what did you find, and exciting department, one that needed building up or what?

JS A department that did need building up, particularly on the research side, my predecessor had been an enthusiast for teaching, and had introduced two things, which I still cherish, one was a commitment to small group teaching, which I think if you have to have a structural philosophy, that is a pretty damn good one to have. The other of that of leaving a teacher with a group for a long period, so that they could establish a relationship. We needed building up in research. The other area, that I thought needed building up was, because he had done a very good job on classical topographical ...

MB Who was this by the way.

JS Michael Blunt was his name, English by origin, but been in Australia for many years. The great science in Sydney medical school, in the turn of the century, and persisted, was anthropology. A magnificent had been built up, and a long string of very important papers on the anthropology of Australia, had been published.

MB So a lot of aboriginal remains, were there.

JS Yes. A great deal of work done on aboriginal remains, not Blunt, but my predecessor, Macintosh, was the last of the great figures there.

MB So you became curator of these remains, at a fascinating time in terms of .../

JS Yes, And help with the generous benefaction of his widow, we refurbished that museum in a magnificent way and we have now brought it back to life. Anthropology is the history of anatomy, that is the way I saw it, and it is really exciting when you realise, you can take a bone that is millions of years old, and we don't have such bones, we have clusts of them and you can see drawn out on that bone, the same tubercles, and tubercities that are on your bones and mine, drawn by the same muscles, millions of years ago. There has to be a sense of understanding that I do want to communicate to the students. So you can see that I would resist and do in the gentlest of ways the modern philosophy of teaching medical students, related to clinical problems only, because that will learn about he clinical problem, but that scientific background history. I think they need to experience that too.

MB Well I always take mine back to Greek times and try to bring them in from there, but you were giving them a richer experience. You were giving them the cultural backdrop to their Australian existence.

JS Yes, well we don't really get time to get into anthropology in Australia, but that legacy also brought its burden, because as you know there is a fierce debate that I think we had to have over ownership control of these remains, and I have had to deal with it in a deep and analytical, and thoughtful way, as I can with the issue of the aboriginal claim to control all bones of aboriginal origin and work through it in a sympathetic way, because I have as clear understanding as anyone can have, because I come from a victim group, not in this continent. Curiously when I travel to Europe, in middle Europe I belong to a victim group, and when I come back to Australia, I am a member of an oppressive group. I can tell you when the shooting is done, it is easier to be a member of the victim group. I had every reason to think sympathetically through the aboriginal

claims. I have done everything I can to fit in and always will. I must say, and I would like to put down my position on this, that the aboriginal and all indigenous peoples claim absolutely rightly to be part of the human family and to deserve recognition, and that must be. If that is true, then their history is also my history, because I am part of the same family. The claim of only the most extreme to exclude people like me, or anthropologists, from the study of these bones, in that sense to me seems to be flawed, and I am sure that will come to be accepted.

MB To narrow a view isn't it.

JS It will come to be accepted, and I hope that we can with care and responsiveness work through to that position over the decades. But it will take a few years to work through to that.

MB Jonathan in those years, those first nine years, before had a personal chair. How did the research and the lecturing go hand in hand. How did the research evolve.

JS The years at New South Wales were years in which I shifted from the para-processing model, to study development, I became more and more interested in the ontogenetic development of the brain, and the fascination of how the organ could wire itself together, and that included a period of sabbatical at Yale, with Patrick O'??, which was very influential, and I found him a very powerful, thoughtful figure. But I got stuck into the teaching and balanced them as best I could, and we had good productive years. I must say looking back not quite such a theme developed from them, although the themes have perhaps started to develop in the last three or four years. I responded to the university environment, then by getting involved in the university, initially as head of ?. That was a good and bad experience, you realised how much management was required in an institution like the university. I was trying to live up to the old model in which a professor took some of his or her time out from scholarship to build up the discipline, and the got as quickly as possible back to the lab. I found the universities in a mood which they are requiring more and more management and they didn't want professors who, or associate professors who were wanting to get back to the lab. They wanted people who were happy to stay sitting at the committee table and deal with the flow of reports that the modern ???need. I stuck with it perhaps a little longer than I should have, but the point came to get out and I got out still full of energy and through my self in. By then it was time to become trained in molecular work, and this was nineteen ninety two. I took that opportunity and it has been a wonderful years since and I am looking forward to the next, ten, twenty years.

MB Jonathan, just take me in the nineteen eighties, you got a personal chair and then became Challas??professor of anatomy there, about nineteen eighty six or so.

JS That appoint was eighty seven, and that involved moving from the University of New South Wales to the University of Sydney.

MB Right. So that brought you across, so we will get that accurately on the record. The nineteen eighties also brought you an influential contribution to the Academy of Science, for whom we are recording this interview.

JS Yes, and I was privileged to be asked to be their biological science secretary, and have thoroughly enjoyable and instructive four years, seeing science as academies do, as

groups of energy and needing to be brought together as best you could. So that was a fascinating period.

MB I don't want to let you escape further discussion of brain development, ontogenetic development. This sounds a fascinating thing. Was that a rewarding line to take.

JS Yes. I realised in the last few years, how rewarding, because in the last few years, it has been going better than I deserved. It wasn't a dry patch, because we published paper after paper that I was interested in, but I had to deal and get the concepts of development, the data of development in my mind, I had to understand, not just the neurones of the brain to which Peter Bishop introduced me, but the neuroglia cells, the supportive cells, because they are the architects, the scaffold of development. So I spent several years getting into understanding those glia cells, neuroglia cells is the name for them, getting the techniques to study for them and I can remember introducing one talk and just off the cuff, but I said 'Look techniques, techniques give you power, but they are also prisms/prisoners', and I thinking of this Horner preparation which I had always studied with stains which showed neurones, and I had worked at it. I had walked across it this way, I had walked across it that way. I said 'Now we have techniques that show us glia cells, and they break out of the prison of that old technique, but of course you admit you are only in another room of the prison, but nevertheless years of years of fruitful work opened up, and we began to understand the conversations that glia cells have with themselves, neurones and the roles that they play.

MB You began to see something about the kind of stimulation the survival risks of kind of neurones.

JS Yes, yes. Then we began to understand the interaction of neuroglia cells with the stress of birth of these cells and I guess that is the concept that I am now developing that as your brain comes on line, it goes through a period of stress and it is stress related to its enormous oxygen demand, and as it develops it goes through episodes of hypoxia, lack of oxygen, and we became tremendously interested in the role of oxygen levels in control of events, in control of your own birth, your own death, your own movement. Just to give you a feeling for the fruits that have come off the tree, there exists a series of human blindness', which result from the death photoreceptive cells of the eye, and our contribution there has been, and we are still in the midst of the excitement of it, is being to pick up that the degeneration sets in, in the birth period of stress, and realising that if we can relieve that stress, we can rescue.

MB So there categories of blindness that can actually be rescued.

JS I believe so. We have done it in animal models, and now we have to go through the difficult, demanding, process of transferring it to the human models. How will we do that. Well we have done it animals models where the gene defects probably like the human ones, but we have been lucky to get a transgenic mouse in which the condition has been produced with a human gene, and if we can save this one, and we haven't done it yet, but that is the gleam in our eyes, then we can go to the human, the people who handle the human condition and say, we have got something to offer. So that has that medical component to what has been a very basic ..

MB What it that need, that genetic pull, and that kind of work that took you to Jerusalem, or was it Jerusalem that actually showed you that avenue.

JS I went to Jerusalem, because in ninety ninety two, that period when I said right it is time to break out of administrative shackles. They published the Right Molecule, they published evidence of a gene which turns on in hypoxic conditions, and this gene makes blood vessels grow to supply it. So I wrote to my colleague Erlich Kess??, he didn't know me from Adam. In fact I wrote to his graduate student that was first on the paper, and I got the reply from the right guy, Ellie?? ??and I have a close and warm relationship and I have to see him in a few weeks to push it along. So I found myself there in Jerusalem. Margaret and I had accepted a period of months apart, for me to do this, but I had family there.

MB It was a bit like going home, wasn't it.

JS Yes, there was an element of going home.

MB` And do you feel very close to that university now.

JS Yes. And I have good, very warm relationships. I actually deliberately spent a year there in the sixties, and Margaret came with me, just to experience that part of the world, it was sixty six, sixty seven, and I found myself in the middle of that six day war. I saw Jerusalem under siege, and fire, and even came under fire myself, in that medical school. They were bright and vivid memories, but they were already twenty five years old, and I didn't go back with those memories. I went back with this molecule. We published papers together, which I am very proud. Of course Ellie's input was determinative. What pulled me in was the publication of genes which are hypoxia induced. I knew that hypoxia was driving development ??events so he gave a touch into the moll??molecular, molecular changes, and that has been tremendous...

MB Jonathan apart from the blindness interests in that and the developmental interest. You also have been drawn into the great and fascinating sync of Alzheimer's disease.

JS Yes. It has such links and then such differences. Alzheimers disease has been with us for a long time, but it has been identified for seventy or eighty years. Alzheimers Trust, when you read in his original papers, was to distinguish it from a dementia that arose from syphilis which we don't see any more. But basically alzheimers disease has become a bastard of dementia which we don't understand the cause. Alzheimer drew attention to, two pathologies in that the plant entangles, and molecular biologists today have done beautiful work on both of those molecules, and on another protein, ???protein E. I was drawn in first through, its really a Hebrew University connection, and a Jewish business man call Jan Hammond in Sydney, who was very committed to this because of his wife's affliction. Felt his own strength failing, he is in his late eighties now and I returned from places that made sense him, and he asked if I would be a trustee, not a scientist. Well that drove me into the field and to understanding it, and I was struck then at a major meeting in Kuto, last year, by a paper, which argued, and it has this element of the loner idea. Maybe it struck a cord with me. That argued the best correlates of alzherimers disease are not plagues and tangles, but brain information/inflammation??. I knew enough of the glia cells of the brain and the cells that might be involved, that I could read his data, and it struck home to me. So I came back from Kuto with this idea that I felt had fallen on a mind that was ready for it. I don't mean immodestly, but I think that is what happened. I came back convinced that this was worth exploring, not that it was true, because science isn't like that, but obviously the other techniques were not offering anything to the patient, to the sufferer, this did. There was evidence that

anti-inflammatory drugs could prevent it. They were retrospective at the demagogical studies. There was one prospectus study, which suggests, that once it has started you could stabilise it and stop it progressing. Those drugs are available. They all have side effects, but it is so much more. So I persuaded the trustees, we convened a group of scientists to monitor it. We could convene a working party of real Alzheimer scientists, who took it on board. We have funded. Its launched. The official launch date is on Monday April???. We are going to aim to report within twelve to eighteen months, and I hope we will do enough work to convince our medical research council, that there is case for clinical trials. If so, its exactly what that transformed it, at the earliest possible moment, to produce something that could...

MB Isn't that a nice transition for you, from that kind of focus nature, on nerve cells, and on the structure of the brain, to actually come out and to apply it to a wider, a wider human need. Its the holistic bit of you, kind of coming out of that shell.

JS Maybe. But certainly it had as a tie in with the work I doing now on cell death and survival in development, because we are talking about massive neuronal death. I believe it is quite different, I don't think it's driven as it is in development by hypoxic, hypoxia, and antioxidants. I think that this is an activated microglia cell rampage that sweeps through the temple lobes, then ???and destroys the brain of these sufferers. I think, if it is true, we can stop it. That would be a tremendous ??

MB Are we talking about a preliminary clinical trial.

JS We have four projects, that we have funded. And one of them includes preliminary clinical trials. It will be carefully done, because the drugs have side effects. One of the valuable contributions of that molecular work is that it has identified a group of people, who are really likely to get at them, and who have some justification to say look 'we really think you should take on this drug, with all its side effects, if you get to a certain age'. So, yes we are beginning. I believe that there is a great deal of caution about clinical trials. I am of a view that you have to try, otherwise you are never going to break down that caution. Having said that I am not a clinician, but I do get a lot of ...

MB It is another research edge you are on, and which is pulling you forward into a wider arena.

JS Area. I am hoping that I see strong methodological ??connections that might bring me to work on Alzheimer, but I am very content with my position at the moment of having co-ordinated that group, and I am looking forward very much to helping write the report.

MB Jonathan we have taken you through the central strand of your career, neurophysiologist, neuroanatomist. We had got you into the nineties. We have got you through a nice new molecular link with Jerusalem. We have got you looking at a number of new things and a number of new cutting edges. Perhaps, we should say that that's just one aspect of the story, and this wider holistic person, has published in a number of other fields. Concerned about animal welfare, animals in experiment. Concerned about population and the future of the environment, not only in Australia, but more widely. A number of other issues. Perhaps we could take those on board, and look at that side of your thrust into the public debate arena.

JS Well there are two or three of those debates, in which, yes, I have been drawn. Drawn in by circumstance and by inclination too. One was the debate over animals. I was drawn into that by writing debate, principally in the United Kingdom, but with its edicts coming out here, over vivisection. It was a renewal of an old debate and I wanted to get to the bottom of that because, obviously I was involved. I had done a lot of animal based research and I wanted to understand the moral challenge, respond to it, by changing what I did, or not changing it. And I was drawn into that then, and came to understand the nature of debate, the nature of the tricks of debate, and also the onus of debate. I came to learn a lot about, how good hearted, and I mean that without patronising, but a good well meaning societies, like the British Union Against Antivivisection, could be raided by fascist societies as they have been. How antivivisectionism could in fact become a cloak for general anarchism and how to deal with that, how to then respond in the most creative way. And that was obviously by trying to clear away the terrible edges of that debate and concentrate on the real core issues, with the real ???people. Now that had its awful moments, because I became...because the Australian group withdrew from England and focus on people, and for some reason I turned on their focus. I decided not to delist my telephone, but to just walk out and take the flack. It drew me into public debate, and also into writing, and I think I have done both of those and tried to do them as best I can. I think we have managed to, with a lot of input, from a lot of people, to take that debate in Australia on, very creative lines, where the issues of animal ???handled by institutional ethnics, in which the debate takes place, on a weekly monthly basis, in detail, with animal welfare people brought in and now there is legislation through the states. So, yes I played a small role in that. I think that some of the writings I wrote, went beyond what was in the literature, and maybe I made a contribution there. I was drawn into the population debate really through the academy work, and asked to represent the academy at international meetings of academies, which was held in Bologna in eighty nine. It set as its theme, scientific problems of the next century, and I sat down with a blank page, and I decided that overpopulation was the great challenge. It has a lot to do with medical history because the reason we are populated is the success of medicine in reducing death rates. When I got into that debate I found that it was quite fascinating, because I began to realise that, and I began to disagree, with David Zazuki's and the Paul Erlichs of this world, not because they weren't right on so many of the issues, but because they constantly took high morale ground, and I felt they didn't deserve to do it, and taking the high morale was in fact destructive. And I believe despite that the fact that Zazuki is a biologist, and Erlich as well, they have not dealt with the reality that, we are over populated not out of carelessness and mismanagement, which is their constant refrain, but out of the success doing something which we all accept as good, and that is keeping children alive. The birth rates in fact have fallen since the middle of the eighteenth fifties, that in spite of the fallen birth rate, the fallen death rates have been so dramatic, that we have massive over population. If that is true then the bad, the evil of over population, is making a mess in so many ways, is deeply entwined with the good with what we do. And until you realise that entwining of the good and the evil of what we do, you can't untangle them, and that was the thrust of the Australian Foundation.

MB I like the start. I mean you went back to Dickens, it was the best of times, it was the worst of times.

JS And he saw that in the times of the French revolution, and he had that gift of not only seeing it, but putting it in a sentence, and I relied on him for the sentence. But it is the human condition, that the good and evil of what we do is tightly bound together, and those who would preach, are usually thinking of themselves of having somehow, being able to separate, the good from the evil, which they have not. So that was in the sense,

you can sense a loner's position, that I was not a conservationist, nor a populationist, nor a growth person, but I felt I had found the problem, and I felt it was worth arguing. People do respond to it, and the next step in that path after the talk in Bologna, the Australian Foundation Society lecture in ninety one in Adelaide, was to convene the symposium, which the academy was generous in taking under its auspices, not its opinion, but its giving its platform. We were lucky in that we met in ninety four, just as the Australian government, under Barry Jones committee, was convening its very first enquiry, and we felt that our submission was just time for that. I think that we made an important contribution there. So that was a rewarding experience. Very lucky one.

MB Jonathan you are a great crusader. Kind of private crusader, coming out on these occasions. But I know you feel strongly, and deeply in these fields. Are you an optimist, or a pessimist, because they are tremendously big issues, and sometimes I don't see them being untangled in time.

JS It is difficult sometimes to be an optimist, but the analogy which I do in that lecture, and I did feed on it, was the one of the cold war. If you look at what was happening during the depths of the cold war, Mutually Assured Destruction, MAD for short, the constant building up of the arsenals. There was underlining that a constant series of meetings and a series of treaties on the use of the sea bed, on nuclear weapons in space. The Start One negotiations go back, I think to the middle nineteen seventies Start Two is a bit later. There was working through that, the good emerging, which was being outpaced, by the growth of the armaments and so I thought it was striking and unique moment in history when Gorbachov declared that the Soviet Union, would not again intervene militarily in Eastern Europe. It was an absolutely key moment, when a very proud revolution announced its limits. I can't remember another revolution that has done that, quite so superbly as the Russian revolution. I think the Russians deserve enormous credits, for saying this vision has come to its limits. That opened up so much and you have seen since then the first disarmament since the Romans formed the centurions brigades. It has been an up swing ever since. So, yes, I think in these times, when we can't see the solution, we must work to lay the frame work, because somewhere it will come. Now there is some element of optimism, in that birth rates of falling so universally, that the United Nations people are correct to project a levelling of the population to a very high level, that if somehow we can manage through to there, and learn not constantly to grow to population. I think, you know we are going to accept limits to population growth very soon, I think within twenty years. What is going to be harder to accept is the limits to growth. You will see for example, governments who have accepted that their population should stop. I think the Australian government is close to doing that, but they are not ready to accept that growth should stop, because it is the solution to unemployment, to the problems of the needy, of how to bring the needy, help without soaking the rich. That second stage of stopping economic growth will be much slower. Yes, I can see reasons for optimism, but no reason for stopping developments of infrastructures, with which we must one day solve these things, in good times, or bad.

MB Jonathan we have covered a rich story. A rich tapestry. We haven't talked about these wonderful illustrations, that I ought to bring on camera, because they are so beautiful, but just out of the blue can we, like the rabbit out of the hat, can we just briefly mention those before I wrap our conversation today, up. They seem to have a beautiful colour finish, almost.

JS Sure. And so these mixture of technology and ideas, and I will hold one up. So what you see here are reds and greens. These are the dyes that work so well in the

fluorescent microscope, and therefore in the modern confocal microscope, so the technical excitement for me has been to learn to use this superb new instrument. The red is showing the glial cells in a piece of nervous system, in this case the retina. The green is showing the blood vessels, and what we are exploring in these images is the death, which you see in these red blobs, the death of the glial cells, so close to the vessels, and where that death occurs, actually along the vessel, then the vessel breaks out. In this case it is breaking out of the retina into the vitreous humours of the eye, that is the very beginning of these damaging proliferative vasculopathies which destroy vision in so many people with diabetes, venous occlusion disease, and with that additional insight, I think we then have ways of rescuing those cells of, healing the retina that has been exposed to hypoxia in the diabetic and better ways than are available of dealing with these blinding diseases. So all in all a mixture of ideas and technology.

MB And I was also going to bring into the conversation this book that I enjoyed, part reading, because I have only been here for a short time to prepare for this, but *Parallel Processing In The Visual System*, which is an exciting monogram, and thank you very much for the loan that, which was a contribution to the literature that was obviously overdue.

JS It was due in its time. It picked up on that theme that, for me finished in the early eighties, of the parallel processing in the visual system and its implications. It has in it two or three chapters, which I wrote as the distillation of what I had come to understand of the heuristic debate, that underlay both the firmness and the conflicts of that time, and have been reference points for me ever since. I have tried to make it very strong and precise and I think because you become vulnerable as a scientist, if you spend too much time with the cheerlessness of the philosophy. I think I mentioned off camera that you have got to be careful to understand the philosophy, but then not to be too entranced by it, because as Boswell commented to Johnson, it can become cheerless stuff. I think that scientists do need to understand the philosophical framework within which they are working, philosophical problems within which they are working, and as I said before, Eccles and Popper were very influential with me. There is a sentence in one of Poppers's books, that if you want to understand a philosopher, understand the problems he was dealing with, which has helped me a lot. It has also helped me a lot when I go into the public debates. Why are people taking particular positions, what are they defending, what are they trying to bring forward. A very good reference point that has helped me in these many ventures.

MB The reference on that book is that was published in '83, for anybody who is looking into that work. It has been a fascinating afternoon for me to talk with you. I don't know if I have missed anything, but perhaps, I don't know, is there anything behind the story that I have missed, because it must have been a fascinating life.

JS It has been a rich one. I am lucky.

MB And it is only part through.

JS I have been lucky to be born at a time when I didn't have to die in somebody's army, just happened to be born at a particular time when I have had that good health, and the clear run to do these things. Debts all over the place, to family, to my present family, to scientific mentors. I have tried to name the important ones, but I am sure I have missed some. Still thoroughly enjoying it, and perhaps I could end on this message, that the

excitement is there, and I am looking forward to the next twenty five years worth with the same sort of zest.

MB Before that is up though, perhaps I would like to come back and talk to you some more. I hope we can have a second volume in our conversation.

JS I look forward to that.

MB For so many things, thank you very much.

JS Thank you for having me.