Conversations with Cambridge Nobel Laureates

James Kennedy

In the last 104 years, 74 Nobel Prizes have been awarded to scientists from the University of Cambridge for Chemistry, Physics and Physiology or Medicine. Here are some extracts of interviews with five Nobel Laureates from the University. For our full interviews, visit www.camtriplehelix.com

Anthony Hewish
Physics, 1974

©James Kennedy

How did you become engaged in war service?

I didn't work hard enough in the first year. I'm a Cornish man and I was determined to row when I came to Cambridge. In my first year I spent too much time on the river in the afternoons when I should have been in the practical physics labs; so I didn't do brilliantly in my preliminary exams. I was called up as a civilian scientist at the Royal Aircraft Establishment in Farnborough. It was three gap years as far as I was concerned, doing the things that really taught me physics; it's to these three years that I probably owe my career.

What was the discovery that led to your Nobel Prize?

I discovered a new type of star, a neutron star (they're nicknamed 'pulsars'). They were just a hypothesis in the 1960s, though they'd been predicted in the 1930s soon after James Chadwick discovered the neutron. Magnetic effects of the stars cause them to behave like giant spinning magnets, emitting radio-waves and it was these radio-waves that led to their discovery. I designed a new sort of radio telescope for a special survey of radio galaxies and extended my work on scintillation to the solar wind.

What fields of science pose the greatest opportunities today?

In science, you try to find something that isn't the bandwagon and I'd advise young scientists to go into neuroscience. We know so little about how the mind works. It's where you don't know anything that you're liable to make the big breakthroughs. The human mind can work faster than the best computers even though it's a very crude computer effectively working in a salt-water solution. If you tried to build something like that in the lab, it'd be just hopeless.

> "In science, you try to find something that isn't the bandwagon"

Astrophysics has had a jolly good run for its money but it's becoming a bit like particle physics now. We need expensive equipment and large teams working together and it's not something to which we can make our individual contributions very easily.

Is there anything we should be doing to enthuse British students back into doing science?

Teaching physics needs a lot of preparation and if physics teachers were better paid I think there would be more of them. A lot of people in that class were attracted, because they were extremely bright people, to do banking and finance, where they could double their income.

What do you think about the existence of God?

I think it's hard to avoid the conclusion that God exists. I've been a Christian all my life. Arguments from authors such as Richard Dawkins I find shallow and trivial. Tension arises from religion's historical background that leads us to all sorts of assumptions and theories. I agree with John Polkinghorne that you need both science and religion if you're going to make sense of life as a whole. There may be tension but that's a result of the history of religion.

Will science ever explain consciousness?

Can a consciousness ever understand itself? There will always be more mysteries!

Tim Hunt
Physiology or Medicine, 2001

How has Cambridge changed since you were here as an undergraduate?

As an undergraduate there were amazing physiology practicals that involved a lot of experimenting on oneself, such as the famous re-breathing experiments. One would breathe into a bag containing NaOH to absorb the CO^2 and people just passed out; I think some people would have died if the experiments hadn't been terminated! I remember dissecting out a beating rabbit's heart and perfusing it with Ringer's solution. When you take calcium out of this solution, the heart stops beating; when you add calcium back, the heart starts up again. I don't think there's any other way of explaining so graphically that the heart needs calcium to beat!

There was a famous practical where there was a cat on the bench with a ruff around its neck. The demonstrator announced "Ladies and Gentlemen, I'd like to assure you that this cat is dead!" He then proceeded to remove the head and stimulate the brainstem. The cat vomited, the cat's tail stood up on end, it arched its back, it was absolutely amazing. I don't suppose they do that very much now! It's no longer acceptable.

What do you think of the feasibility of WILT, Whole Body Interdiction of Lengthening of Telomeres?

I think this WILT stuff is terribly overblown! The thing with ageing is that stuff just goes wrong anyway... it's a very deep biological question... we're all at least 3000 million years old, right? But it's all gone through the germ line! Spores carry on forever; we're like the little mushrooms! We pop up and have our day and then start getting pretty ratty after a while. The interesting thing is how the spores carry on: the answer to that is presumably selection. Mistakes happen every time DNA is replicated, so you have to revive the whole genome at some point—put it through a sieve, so to speak—by going back to haploid gametes. We cannot avoid ageing.

How did the Nobel Prize change you as a person?

It's made me a great deal more self-confident than I used to be. People treat you with exaggerated respect and let you stay in very nice hotels and buy you nice meals. If people find out that you're a Nobel Prize winner you'll be

©Aventis Prize

very well-respected and asked to comment on world peace and harmony, of which I know nothing!

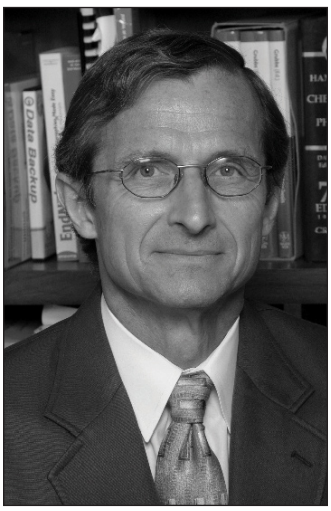
Did it change your scientific research much?

It came at a rather low ebb in my scientific life, compared with now, when things are going rather well. If you solve a scientific problem then you find yourself 'out of a job'! The only fun thing is to be on the track of something. It feels wonderful when you're making progress and I'm currently in that happy state!

Do you have any important lessons that you think today's scientists should know?

All this talk about scientific career is misplaced. It isn't a career; you've just got to love doing it. To put it slightly tongue-in-cheek: "Keep your nose to the grindstone and your eyes on the horizon."

Richard Schrock
Chemistry, 2005



Courtesy of Richard Schrock

What subject areas are you currently working on?

Metal-carbon double bonds and applications of them. The second significant project is the reduction of dinitrogen to ammonia which happens in nature. Of course we do it using the Haber-Bosch process at very high pressures and temperatures. [Each] of these processes, both the natural and the Haber-Bosch process, produce about 10^8 tons per year. It would be very valuable if we could do it more simply and under milder conditions.

As concisely as possible, explain the discovery that led to your Nobel Prize.

It's about a new kind of transition-metal-Carbon double-bond. It turned out to be the key in a kind of reaction that's been known for 50 years but nobody had really made such species and shown how to design a catalyst to carry out this reaction. The Nobel Prize was for the discovery that you could make a certain kind of metal double bond that could be a catalyst for this marvelous new reaction.

John Walker
Chemistry, 1997

What was the discovery that led to your Nobel Prize?

Because of Fred Sanger's activities in the late 1970s in sequencing the small DNA molecule in the mitochondria, the cellular power-houses, I became interested in energy conversion, that is how energy in foodstuffs becomes stored in ATP [the energy-carrying molecule in cells] Encouraged by Fred and Max Perutz, I decided to try and work out how ATP is made by defining the details of the structure and mechanism of the ATP synthesizing enzyme in mitochondria.

What was it like to work in America during the Vietnam War?

I spent two years in Madison, Wisconsin from 1969-71. In 1970, President Nixon bombed Cambodia. Madison was a very radical campus. Many of the students would have been drafted into the armed forces if they had not been studying, and some of the students I knew had already served in Vietnam. Many others were opposed to the war on principle. This single act caused wide-spread outrage on the Madison campus. There were riots involving battles between the students on one side and the State Troopers and the police on the other. The State Troopers marched through the students with bayonets fixed to their rifles and

> **"I think it's essential that children are taught evolution properly in schools"**

they lobbed tear gas bombs through the windows of our laboratory where we were gassed. I sympathised with the students' cause although I didn't go around rioting with them! Late one August Sunday evening, two brothers and their cousin detonated a bomb in the Army-Math Research Center in Madison and destroyed the building which was situated next to the institute where I worked. The explosion killed a young scientist who was working there. It blew out all the windows of my lab. When I went to the building, the doors were hanging off their hinges, there was water everywhere and there were shards of glass stuck horizontally in the walls. All our experiments were destroyed and we were kept out of our labs for some time. Eventually, the university boarded up the windows of the building and we were able to return to work.

Can science and religion co-exist?

It is essential that children are given a proper impression of geological time scales and the fossil record, rather than the short time scale suggested by the Bible. I do realise that the clash between religion and science can cause mental conflict in some teenage children and, as I was brought up in a Christian family myself, I suffered from this problem. Once I became interested in Science, I found it very difficult to reconcile the teachings of Science with those of Christianity, and quickly realized that it is not possible to do so. I think it's essential that children are taught evolution properly in schools. It should be taught in Science classes in a clear an unambiguous way, not mixed up with religion, although there is no reason why the apparent inconsistencies between evolution and religion should not be debated in a separate forum. Evolution is not a

> **"Science has also been demonised due to perceived misuses"**

theory but an established fact for which there is overwhelming supporting evidence. Supporters of intelligent design see the ATP synthesizing machine that I have described as supporting their views since they argue that its complexity defies a Darwinian explanation of its origin. However, when challenged, I offer them an explanation of the evolution of such complex protein machines. The general idea is that complex molecular machines evolve by putting together other already-evolved simpler molecular building blocks, like constructing a complex structure from pre-formed Lego® pieces.

Should we be worried that there is a declining interest in science among young people?

One difficulty is that science is sometimes taught by people who are not graduates in the subject they are teaching, and without a deep knowledge and understanding they may not be able to convey the excitement of the subject and so inspire the children they teach, as I, for example, was inspired by my Chemistry teacher. Science has also been demonised due to perceived misuses, such as the development of the

atom bomb, and this negative image can put children off studying science. Another factor is economics; sometimes students study Science to a high level even to a PhD, and then decide to abandon a life of Science for a life, for example, in finance in the City of London. Some of the best young minds in science that I've encountered have, unfortunately for Science, taken that route primarily because the financial rewards are greater in the City. Following recent economic events, a life spent in Science may now appear to be more attractive than it used to be.

John Sulston
Physiology or Medicine, 2005

What was the discovery that led to your Nobel Prize?

It's not one of those $E = mc^2$ moments like discovering the structure of DNA. It is for contributing to determining the cell lineage and observing programmed cell death in the lineage of *C. elegans*.

How do you think Cambridge has changed since you were here as an undergraduate student?

The most important thing is the enormous increase in the number of women. Secondly, research has seen increasing commercial involvement and private finance coming into the university with some number of strings attached.

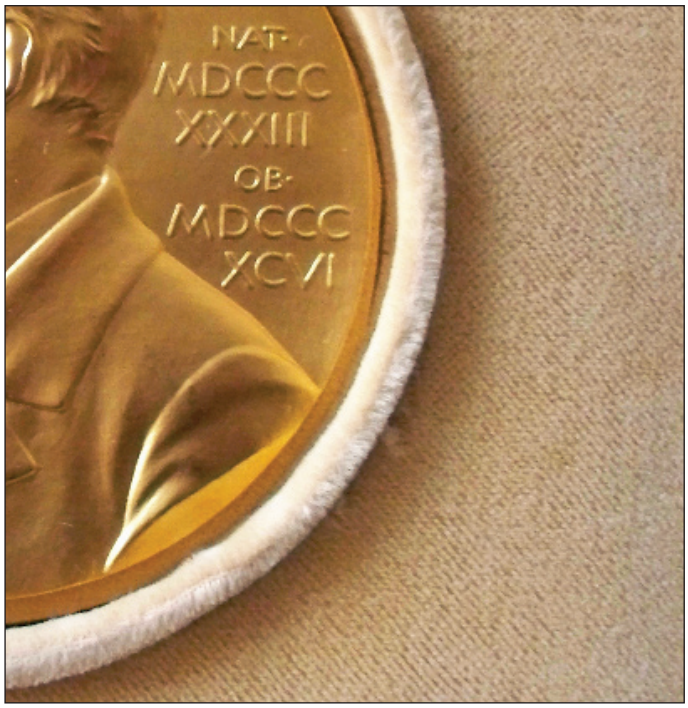
You say that these days you probably couldn't walk into research with a 2:1 degree. Is this because there are too many universities or too many undergraduates?

In my day, there was not the same pressure as today. Perhaps as a result, some undergraduates didn't take their degree particularly seriously... I dropped to a 2:2 or even a third on some subjects in my second year because I was much more busy in the ADC sitting up all night doing theatre lighting. Frankly, I was pretty bored, I was tired of book-learning then I had a shock: I realised there was no point in coming away from Cambridge without a degree! So actually I dumped a lot of that, started learning and achieved a 2:1, which is a sign not of brilliance but of application to study. That laid-back, casual approach would not wash so well now. I do see people taking themselves much more seriously about their careers now.

Who was your inspiration in your undergraduate years and in your science career?

It's bad to single people out because there are all sorts of people one gets things from. As an undergraduate the person I always mention is Ian Fleming, now an Emeritus at Pembroke College. He supervised me for organic chemistry and I found him fascinating. I've been extremely lucky to rub shoulders with Francis Crick, my own boss Sydney Brenner, Fred Sanger - he's always been an icon for me - it was a wonderful galaxy of people down there. About the LMB, it made us incoming post-docs feel that we couldn't live up to what had gone before.

©Suryani Lukman



©James Kennedy

In your autobiography, you describe being director of the Sanger Centre as a strange experience. What kind of strangeness did you experience there?

I'd also not been social before taking up that directorship. I'd worked on my own lots of the time and in a small group in the 1980s. The opening grant was 50 million pounds and I'd never had anything to do with that kind of money at all. It wasn't frightening—we were doing the right thing with the money. We could sequence the nematode and go on to sequencing the human. Within a year we were up to 50 staff and by the time I finished we were 400 people. That was amazing for someone who had never run a group before.

Would you sequence your own genome?

No, however it will be valuable to compare people's genomes. Biobank, where we have 500,000 people, is finding correlates with lifestyle in the human genome. Whether in the long-term we get accurate predictions from the genome remains to be seen. Eventually, an awful lot of things should be computable from our genome. But those interact with the environment in ways that are very difficult to measure.

What do you think of the peer-review system?

It's like the old aphorism about democracy: that it's a terrible way of doing things until you think about the alternatives. I think we need it.

Did the public win in the human genome-sequencing race against Celera Genomics?

The public won with regards to getting the job finished and published in the public domain. Both sides put up a jolly good performance. It was a real shame that there was conflict and I think it was completely unnecessary. It was driven by Tony White of Perkin Elmer: he came in to raise their share price. Celera thought that if they could own the human genome they would be onto an absolute cash cow—a tragedy which fortunately we overcame. ■

James Kennedy is a second year studying Biological Natural Sciences at Fitzwilliam College. He is currently Assistant Editor-in-Chief for The Triple Helix Cambridge.