

**Brian Josephson's 80th birthday speech, delivered in Hall
on February 8th 2020.**

Thank you, Master, for your kind words. First of all I'd like to thank both the college as such, and the individual members whom I have come to know and be friendly with over the years, for all their support. And I must also thank my wife Carol, to whom I have been married for 44 of those years. It can be difficult being married to an academic, because of the importance academics rightly attach to their research, and the fact that research is not a 9 to 5 job, and in many cases continues after retirement.

There are very many things that I'd ideally like to talk about, but it would take some hours to cover all of them so I need to be selective. I'll talk first of all about the changes that have occurred over my lifetime. One of these is the very fact that there are women in this gathering, which would not have been allowed when I became a fellow. There was one exception to the rule however: when Professor J E Littlewood became 80, his long time collaborator Mary Cartwright was defined as an honorary man, and so allowed to be present at the celebration. One fellow, when the possibility of allowing women as guests in Hall was being discussed, made a memorable comment to the effect that he would prefer hall to be as free of women as a well-conducted gentleman's lavatory. And, at a college meeting that discussed the possibility of women fellows, it was said by a Fellow present that deceased fellows would be turning in their graves at the prospect. But now of course we have, for the first time, a woman Master of Trinity.

Before leave this subject, I'll just mention one aspect where I played a small part myself. Council, in a discussion regarding guests in fellows' guest rooms, solemnly pronounced that owing to limited numbers only male guests could be booked into these rooms. This led to protests, and a poem entitled

‘women and children last’ appeared on the fellows’ noticeboard. Council responded to this criticism by appointing a committee that included myself to consider the matter. We dealt with it by arranging that for a trial period two of the guest rooms would allow female guests, so it could be seen how it worked out. When the trial period came to an end we announced that there did not seem to be a problem with women guests, and the restriction was removed! The same professor Littlewood hadn’t heard of the rule change, and on one occasion challenged my mother, accusing her of breaking the rules, when he saw that she was staying in a guest rooms with my father during a visit.

Back to changes over my lifetime: apart from changes such as there no longer being horse-drawn vehicles in the streets, or steam engines to propel trains, the most dramatic changes have involved computers. When I was a student there was just one computer in the university, EDSAC II, and as it used valves instead of transistors it was an enormous device, and to use it you had to go to the computer laboratory yourself, and feed it information by punching holes in paper tape and feeding the tape into a tape reader. Then came the transistor, the chip capable of holding large numbers of transistors, and the mouse, and the touchscreen, allowing you to point effortlessly anywhere on the computer screen; then networks that allowed computers to talk to each other; and thence the replacement of snail mail by email, the world wide web and the search engine, so nowadays if you want information about something you just type in appropriate search terms and, if you are lucky, the information you want will come back instantly. In the 1960s I had to type my fellowship dissertation and Ph.D. thesis using a mechanical typewriter, with something called carbon paper inserted between sheets of paper to make copies, and make corrections with the aid of a rubber.

I'd now like to say something about my own life. Both my parents were teachers and my father was very interested in mathematics, and had books on things like conic sections that I studied avidly. My mother was also a poet and a short story writer (if you are interested, the [cultural section at the bottom of my home page](#) has links to a collection of her poems, and also to music by the band that my daughter Miranda, who is here tonight, plays in to entertain local people in the evenings, and my own composition [Sweet and Sour Harmony](#), which has been played a couple of times at TCMS events). Miranda is clearly a 3rd generation poet: at our celebratory tea earlier today she handed me a birthday card with this poem:

*“As we mark Brian Josephson’s eightieth year
The professor deserves a big cheer!
He predicted with gumption
The Josephson Junction
And pursues other thoughts without fear.”*

I found maths fascinating, particularly in regard to the way you can prove surprising things starting from axioms, and later became very interested in physics. I had considerable support from my masters in these subjects at Cardiff High School. My physics teacher lent me a book on theoretical physics, from which I learnt to my surprise that it is possible to use quantum mechanics to calculate how substances behave, so physics is not just a matter of making measurements.

I came up to Trinity when I was nearly 18, and took Part II Maths in my first two years before changing to Part II Physics in my final year. For the second year in maths I had to choose between pure and applied, and chose applied on account of the fact that I got higher marks in that subject in the Tripos. Later I realised that this had been a mistake, as the reason I got better marks

in applied is that solving an applied maths question is a routine matter involving setting up the relevant equations and solving them, whereas more creativity is required in pure mathematics. I remember once saying about a Tripos question 'after thinking about it for half an hour you can see how it can be solved in five minutes'.

I found the applied maths course rather dull as the situations addressed there seemed to have little to do with the real world, which is why I decided to change to physics, having discussed the possibility with Andrew MacLachlan who had recently done the same thing. I have no idea what is taught in Part I, as I don't seem to have missed anything through not having done that course.

My first physics paper was published while I was doing Part II physics. I went to a lecture on the Mössbauer effect given by Trinity Fellow Robert Frisch. This effect was being used to test a prediction by Einstein that a clock at a height will go slightly slower than the same clock at sea level. The experiment took advantage of the fact that in the case of iron-57, radiation is produced at a very precisely defined frequency. I tried to figure out how it worked, and wondered whether the fact that objects have a higher mass when moving than if they are stationary might have an effect on the frequency. Changing the temperature makes atoms move faster, and my calculation showed that a change of only a degree would have as much of an effect on the frequency as the difference they were trying to measure, which could be rather important if you weren't controlling the temperature precisely.

I approached Frisch about this, and he passed me on to someone else who suggested I contact the people at Harwell who were doing the experiment. The outcome was a car being sent to the college to take me to Harwell to

write a paper. A friend of mine who saw the uniformed driver crossing Great Court to collect me was most impressed!

For my PhD I decided I would do an experiment on superconductivity, as I did not want to spend all my time sitting at a desk thinking. But as I was the only person in the Mond Laboratory who could understand the theory, I had the job of understanding everything so I could help the others in the group with the theory. I came thus to understand things like broken symmetry that were to prove useful later. One day my supervisor Brian Pippard came to me waving a paper by Ivar Giaever explaining his mechanism for studying superconductivity. "That's wrong, isn't it" he said, referring to Giaever's equation for the current. Giaever had left out something called the coherence factor. I thought broken symmetry might explain it, which led me to do the calculation for which I got the Nobel Prize, adapting a calculation by Cohen, Falicov and Phillips to do so. I found out later that I'd been very fortunate in that Falicov had been asked by the others to do the calculation for the two superconductor case, but was baffled by the coherence factor issue and so, fortunately for me, they decided to leave that case out of the paper, so it was left to me to figure it out.

John Adkins and I tried to observe the effect, but chose an unsuitable material to observe it, and it was only nine months later that my prediction was confirmed by Anderson and Rowell. Meanwhile Bardeen, one of the inventors of the theory of superconductivity, had declared my theory incorrect, and added a footnote to a paper of his saying that. A special session was set up during the 9th low temperature conference in London for Bardeen and myself to debate the issue, and I believe on the whole I won the argument, with support from experts in the audience.

After my PhD I spent a year at Bardeen's university, the University of Illinois at Urbana, a place that is even flatter than here! The local dogs were not used to bicycles, and the sight of the pedals turning seemed to excite them and they would give chase, which was rather frightening. For recreation, the ice rink was open once a week — I had learnt to skate on the Cam, which was frozen for six weeks in 1963, on speed skates lent to me by G Kitson Clark.

I decided instead of working with Bardeen on superconductivity I'd work with Leo Kadanoff on critical phenomena, but on my return decided to move away from physics, which I then found not so interesting as a subject of research, and turned my attention to questions relating to how the brain works. This included incidentally a paper '[Multistage acquisition of intelligent behaviour](#)' involving a collaboration with Hermann Hauser, founder of Acorn Computers and ARM, who was at the Cavendish at the time. Later, in his shop in King's Parade, he proudly showed me his electronic fruit machine, Acorn's first product using a chip.

However, at about this time I got interested in other things, and my scientific activities took a different turn, initially as a consequence of conversation on High Table with one of my subversive colleagues, mathematical geneticist George Owen, who introduced me to the subject of the paranormal. The college has quite a history of connections with the paranormal, and I am fond of pointing out to people the portrait of Henry Sidgwick on the way into Hall, noting his connection with the Society of Psychical Research (he was its first President). I was interested in the fact that there seemed to be parallels between quantum physics and the paranormal. Later, after he had moved to Toronto, he invited me to a psychokinesis conference, where there were impressive demonstrations of metal bending by Matthew Manning (I still have a [desk key that he bent](#), with no visible tool; fortunately there was a

spare). He also was able to make a compass needle move and suddenly stop, and measurements of his EEG showed that his brain rhythms changed to an unusual kind when he was performing psychically.

It's quite likely that my interest in such matters was the cause of [extraordinary hostility from the department](#). Once I heard that the head of dept. got extremely worked up by a newspaper article that revealed that a visitor on sabbatical was doing experiments on psychokinesis. He feared this article would damage the reputation of the laboratory, but it seems to have survived! The dept. would do all it could to discourage people from working from me, including telling them that they could have funding from the laboratory if they worked with anyone other than me. It was also claimed, on dubious grounds, that I was unsuitable as a PhD supervisor, a point disproved subsequently by the fact that a student who had somehow evaded the laboratory's negative propaganda successfully got a physics PhD working under my supervision. Another student was very successful initially but then ran into problems with the department. He had written a [computer simulation based on a concept known as hyperstructure](#), which he had used to simulate the process of balance. The plan had been to go on and try to simulate walking, something of current importance in the field of robotics. But then the powers that be intervened, insisting that he stop working on that project, on the curious grounds that it was not physics.

Interference by the bureaucracy is if anything even more of an issue today: at this time admin at the Cavendish is denying someone who has been assisting the department with its outreach programme access to the department as he hasn't got the credentials upon which the rules insist, making it difficult for him to continue to assist in that enterprise, or to collaborate with people working at present in the Cavendish. Also, I am in theory blocked from applying for funding for anyone working with me as I no longer have a

salary from the university, but I am allowed to get around this by defining a willing member of the department as virtual Principal Investigator, while I will be the real one. ‘Kafkaesque’ is I believe the word used for this kind of thing. The recipient of such funding would also, in accord with the rules, also not be allowed to be in the department other than for meetings with me, with admin saying to me ‘I am not minded to make an exception in this case’. I gather also that the university would like people covered by its travel cover to do a safety assessment if they intend to travel to London!

I sometimes refer to myself as the Resident Heretic, and have come to appreciate over the years that science is far from being the objective mechanism for discovering the truth that it claims to be. It has its dogmas, supported by arguments that don’t hold up under close examination, that it is dangerous to challenge. Heretics are not burnt at the stake nowadays, but they can come under unwarranted attack, and on occasion have lost their jobs as a result. Let me tell you of [the case of Michael Reiss](#), former Director of Education at the Royal Society, who gave a lecture once where he suggested that if pupils raise the issue of creationism during a lesson on evolution then instead of just dismissing the idea out of hand it would be good to discuss the issues with them. Unfortunately some newspapers reported this as his advocating the teaching of creationism in schools, which was not at all what he had said. The outcome was that three fellows of the society, all ‘knights of the realm’, namely Harry Kroto, Richard Roberts and John Sulston, demanded his removal, apparently never having troubled themselves to find out what he had actually said. The outcome was the following, as detailed in a public announcement by the Royal Society:

“Some of Professor Michael Reiss's recent comments, on the issue of creationism in schools, while speaking as the Royal Society's Director of Education, were open to misinterpretation. While it was not his intention,

this has led to damage to the Society's reputation. As a result, Professor Reiss and the Royal Society have agreed that, in the best interests of the Society, he will step down immediately as Director of Education”.

Well! In reality, doing this surely caused more damage to the society's reputation than doing nothing could ever have done (the Society had already made clear what Reiss actually meant).

I seem to have inherited some of my mother's poetic skills, and this kind of thing sometimes inspires me to write poetry. In response to a similar event, I was inspired to write the following haiku:

*Madness season is here
Scientists waxing furious
To what end?*

In a similar context, I amended verse by Laura Marling to read

*They'll come and get you in the dead of the night
They'll come and get you, if it's not what they like*

That verse would seem to apply particularly to a situation involving John Maddox, editor of Nature, going after the unfortunate immunologist Jacques Benveniste, whose discoveries I learnt of prior to his tiff with Nature, and who also lost his job as a result. Let me fill you in with some of the background. You have no doubt all heard of homeopathy, and I believe there are a couple of Fellows who have tried such remedies when conventional ones have failed (people violently opposed to the subject may stop listening at this point, I will not be offended). The basis of these remedies is a special dilution procedure involving biologically active molecules, intended to

influence the water so that the water itself acquires biological activity that can be used as a remedy as may be appropriate.

An argument typically used against such remedies is Edzard Ernst's dictum 'no molecules, no effect'. What Ernst and others evidently do not realise is that there are entities known as hydrogen bonds that can [bond individual H₂O molecules into larger entities](#), and while individual entities of this kind may be short-lived one cannot exclude the possibility that there may be some associated long-range order that may be facilitated by the procedures used in homeopathy. There are certainly, at any rate, numerous indications that water is an unusual substance.

I once arranged a [lecture on these 'supermolecules'](#) by a visitor, which had a bizarre outcome. All was well until I invited a prominent critic of homeopathy to the lecture. He promptly passed the information on to his Twitter followers, with the result that the Head of Dept. received dozens of letters asking why the Cavendish was hosting a lecture on this subject. He tried to persuade me to cancel the talk, but I ignored his request. On the day, he sent someone round to stop it being videoed by the son of the speaker, but he hadn't thought to forbid audio recording, so when the acolyte left I pulled out my iPod and used that to make one, and this is included in my audio and video collection on the university's media server.

Anyway, the Maddox trap I am referring to was the following. Benveniste, while sceptical that anything would come of it, followed a suggestion by a member of his laboratory that he should use a process he had invented to investigate the effects of high dilution and, to his surprise there was an effect, as was confirmed by other laboratories. He submitted a paper on this work to Nature. Referees could not find any problem with the paper and Maddox was faced with a dilemma. He told Benveniste that the paper could

be published if he agreed to an investigation being carried out afterwards. That sounds very strange: would you not want to find out if the work was sound before publication, not afterwards? But Maddox wanted to attack Benveniste, and if an investigation was carried out before publication and revealed a flaw, then the paper would not be published and there would be nothing in print that he could attack. The investigation that followed was also unusual, because there were no biological experts in the team.

Something more shocking than this is [something that might well be characterised as ‘fake science’](#). In March 2015, the Australian National Health and Medical Research Council made public a report on homeopathy, which concluded that “there are no health conditions for which there is reliable evidence that homeopathy is effective”. This conclusion contrasts notably with an earlier draft, praised in an assessment by an expert, the conclusion of which was ‘there is encouraging evidence for the effectiveness of homeopathy in five medical conditions’. That was not the conclusion that those opposed to homeopathy wanted, so the initial panel of experts was disbanded and replaced by a new one. They carried out what can only be described as dubious manipulation of the data (see this account of [‘procedural irregularities’](#)), in particular specifying that for trials to be ‘reliable’ they had to have at least 150 participants and reach an unusually high threshold for quality, which process left only a handful of studies remaining. In this context, NHMRC itself routinely conducts studies with less than 150 participants, and does not consider them unreliable on that count alone.

Further, the chair of the committee that conducted the second review had signed a conflict of interest form declaring he was “not affiliated or associated with any organisation whose interests are either aligned with or opposed to homeopathy”, while in fact being a member of the anti-

homeopathy lobby group 'Friends of Science in Medicine'. As a result of these and other matters a complaint, which is still ongoing, has been submitted to the Commonwealth Ombudsman.

The much publicised published report was, not unreasonably, assumed to be reliable, and this had unfortunate consequences, as summarised in a video produced by the Homeopathy Research Institute entitled '[Inaccurate research is everyone's problem](#)'. In England, public funding of homeopathy ceased after 70 years on the basis of the flawed report's conclusions. And the European Academics' Scientific Advisory Council used the report to publish itself an anti-homeopathy statement, in turn used by some as a basis for attacking homeopathy; for example, a course on homeopathy for medics at the University of Lille was suspended. Again, in the US there was a lawsuit against a company selling homeopathic products, on the basis of the published Australian report. But others treated the report differently: the Russian Academy of Science rejected a document based on the Australian report, while in India the report was dismissed at government level as being 'inaccurate, flawed and biased'.

This is all very serious. As Paul Simon put it in his song The Boxer, '*People hear what they want to hear, and disregard the rest*'. This has happened before in medicine, where research showing that the extent of disease in hospitals could be considerably reduced if doctors were to wash their hands in between patients was [dismissed](#), and the consequences here may be equally serious.

Another serious issue is the behaviour of the [procedures of the physics preprint server arXiv](#), intended to speed up communication between physicists by letting them post publicly viewable preprints before a paper is published, while in fact it tends to block innovative research as a result of the

processes set up by the obsessive management. Nature published [a letter of mine on the subject](#) once, giving it the elegant title and subtitle

Vital resource should be open to all physicists

Putting control in the hands of a few can
enforce orthodoxy and stifle innovative ideas.

I don't have time to go into any detail, and all I can say here is that the founder, Paul Ginsparg, seems more interested in the question of the proportion of papers uploaded to the archive that are accepted than whether or not his favoured procedures may lead to good submissions being inappropriately dealt with. An outcome of arXiv's obsessive classification system is that papers of mine relating to quantum mechanics are generally forcibly reclassified and as a result not seen by people working in the area. I've been inspired by arXiv's behaviour to write [yet another poem](#), beginning

*The revolution will not be brought to you by arXiv
'cos arXiv deems revolutionary ideas 'inappropriate'*

Let me move on now to something much more positive, namely the progress I have been making in my research despite the difficulties I have mentioned. Again, I have no time to go into much detail, but let me say first of all that a number of people have come to the conclusion, in various ways, that present day physics suffers through failing to take proper account of matters related to mind, and the question is what can be done about it. It turns out that biologists understand the subtleties of complex systems in a way that physicists do not, and it looks as if a clear synthesis of the various approaches should be possible, some of which I have covered in [published work](#). The challenge is to persuade high-energy physicists to drop their present 'theory of everything' approach, which is not proving that fruitful at

this time except as a mathematical exercise. Hopefully the ideas will be published somewhere where they will be seen by physicists who will take them up. And I'll leave it there!