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An Interview with Robert Fox¹



Professor Robert Fox

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Professor Robert Fox is a leading British authority in the history of science. His many books include more recently: The Culture of Science in France, The Savant and the State, Science without Frontiers. These examine in-depth science, culture, and politics in France from the eighteenth century until World War II. He also coedited the widely used Oxford Handbook of the History of Physics. In 2006, he received from France's Ministry of Culture the title of Chevalier des Arts et des Lettres, and in 2015 he was awarded the prestigious George Sarton Medal.

Robert Fox got a B.A. in Physics from Oxford University in 1961, and changing to the field of history of science, a D. Phil. from Oxford's Faculty of History in 1967, supervised by the well-known historian Alistair Crombie. His thesis was about the study of the thermal properties of gases in relation to physical theory, from Montgolfier to Regnault. He taught at the University of Lancaster between 1966 and 1988, first as a Lecturer, and later as Full Professor of History of Science. Between 1986 and 1988 he lived in France, where he was director of the Centre de Recherche en Histoire des Sciences et des Techniques (CHRST) at the Cité des Sciences et de l'Industrie (La Villette) in Paris. Later he was assistant director of the Science Museum in London, and in 1988, he became a Full Professor at the University of Oxford, retiring from that position in 2006.

Subsequently, Fox has been a visiting professor in several universities in the USA, as Johns Hopkins, East Carolina, and Oregon State, as well as at the Czech Technical University in Prague. In 2013, he was the Distinguished Fellow at the Chemical Heritage Foundation, in Philadelphia. He served as president of the European Society for the History of Science, which he helped found in 2003, and also as president of the International Union of History and Philosophy of Science. Between 2008 and 2014, he edited Notes and Records, the Royal Society Journal of the History of Science.

¹ Transcription of interview by Raiany Oliveira, and final editing by Gildo Magalhães.

The following interview with Professor Fox was conducted by Gildo Magalhães at the University of São Paulo's Institute of Advanced Studies on November 16, 2017, with the participation of Raiany Oliveira, Flávio Magalhães, and Sara Albieri.

Gildo Magalhães (GM): Professor Fox, you have just participated in a symposium of history of science and technology at the University of São Paulo, which was intended for researchers, professors and graduate students of this University. What was your general impression on that?

Robert Fox (RF): I thought it was an extremely impressive event. I thought the number of people attending simply was a testimony to its success, but the most important thing was the quality of engagement. The questions and the engaged interaction between speakers and people in the audience was really impressive, and also, my sense is that you've created a very strong *esprit d'équipe*, as they say in French, and I think that's important that you've got good relations between professors, students, outsiders, people who come from outside the university, so it was a very impressive occasion and it was an honour for me to be involved in it.

GM: You also participated in the Brazilian Society of History of Science (SBHC) National Conference, in Belo Horizonte (2014). At São Paulo University, this was only a local event, but at any rate we are here trying hard to develop history of science and technology, not at the same level as a country which has that for almost 100 years as the UK. Would you say that you see signs of increasing interest in this field in Brazil, perhaps also linked with your knowledge of other Brazilians abroad?

RF: I would have thought there's no reason for you to feel that this is a lesser exercise, I mean it seems to me that the attendance in Belo Horizonte and the attendance this week were testimony to the fact that history of science is doing very well, that must be the case and my impression of the meeting in Belo Horizonte was very similar, namely for many people there were good interactions, good relations between what you might call the senior people and the students, and I think that is so important. Here certainly you have managed to create that sense of a community in history of science. I thought the exchanges were respectful, incisive but respectful, and you cannot ask for more.

GM: We know that you have changed your view on the history of science. Could you tell us something about your personal motive for such a change?

RF: I think my background was somewhat unusual, in the sense that my intention originally with regard to university was to study ancient languages, so my sort of background was very much in Greek and Latin. I had always been interested in science, and there was the opportunity, which was very unusual, and it was very short-lived in the mid-1950s, to take an extra year between school and university in which you would sort of refashion yourself in the sciences, so that's

what I did. After sort of getting the qualification for university entrance in ancient languages, I then took this year, which was an intensive year of maths, physics, and chemistry, and then I went to Oxford as an undergraduate. I actually had physics, so that meant I think in a way I always had this sense of a dual background. Although I read physics in Oxford, I rather felt always that I wanted to do something that might bring the two together. I never knew what that would be, it went off, and I taught physics in the school for a couple of years, and then discovered by chance there was this wonderful subject, history of science, I discovered that actually you could study it seriously at university. So I went back to Oxford, and just felt that I had brought together these two elements in my background, so that's how I saw it at the time.

GM: And was it easy to find a supervisor?

RF: It was difficult, because I had been an undergraduate at Oxford, so sort of almost inevitably drifted back to Oxford, and it was the easy solution, in a way. There was only one historian of science in Oxford, and that was Alastair Crombie, who was a medievalist and he supervised my thesis, even though I was working on 18th and 19th century theories of heat.

GM: So, despite very interested in Latin and Greek you never went to the old passion...

RF: Oh, no, no, that's true, in that sense the story is not quite as elegant as it might be...

GM: And you'd say you took the right decision at that time?

RF: Looking back, it was a miracle that I found the history of science. Oh yes, it was for me on this question the right thing to do.

GM: Because it's interesting that many people here, who had never heard of history of science, when they discover it, and it has to be a discovery because there are almost no undergraduate courses on that, then they say "well, why had I never heard of it?"

RF: That is exactly my feeling. Nobody told me about the history of science, otherwise I would have been converted, if I can say that, much earlier, but anyway I did find my way, went back to university, and did the doctoral thesis in history of science, without any master's degree, I hasten to say. I mean, there wasn't such a thing, and really having a background in science, in physics in my case. I think that was seen as quite enough, quite sufficient to begin doing history of science. So, I never did any general courses or anything like that, and just started doing the thesis and that's how it was, it wasn't exceptional in my case, the few other people who were doing history of science would have begun exactly in that way, but we are talking belong a time ago, this is 55 years ago now.

GM: We have here what is called the direct PhD, which does not need to go to masters, but it is not the usual way.

RF: No, it would not be in England either. I can't imagine anybody now starting on a doctorate without having gone through a master's program, but that's fairly recent, certainly in Oxford it's now compulsory, but it's only been compulsory for the last 15 years or so.

GM: Do you think that a person can change easily from the hard sciences, and become a historian?

RF: It depends on what sort of history you're doing. I think, if I could be autobiographical, the work that I did in those early years had to do with theories of heat in the 18th and 19th centuries, and I really think that what you needed was some command of the relevant physics, but it never occurred to me at the time that I needed particularly to contextualize what I was doing. I mean, I was conscious that the great figures, Laplace, Sadi Carnot, and so on, taught in a particular social and educational cultural context, but the wider context I don't think I really thought about very much. That's just not how you did history of science in those days, it was not very much the case, and I saw it that way. I think Crombie saw it that way, as being the core activity, it would be something like what the French called *l'explication du text*, you would engage in a detailed analysis of the text, and that would be your core activity. Of course, you needed to broaden out from that, but that was the essential activity and that's how I conceived history of science in those early days and I'd have to say, Gildo, that for what I did, it was this quite technical sort of history, I'm not sure that I needed all that much context, to be honest. I think, if I was doing it now, I probably would be looking more actively for context, but I am not sure I needed it at the time for what I was doing and for the problems I set.

Flávio Magalhães (FM): Good morning Mr. Fox, I have a question, a more theoretical and general question; it's about science in general. The hard sciences have scientific statute, and history nowadays doesn't have this scientific statute, so which contribution do you think that history of science can give to this more general problem between science, the hard sciences, and history as a science?

RF: Well, I think history of science has a potentially very important role to play there. We have two problems as historians of science: one, is to persuade our historian colleagues that this is an important bridge that they need to make; and also to persuade our science colleagues that they, and their courses, would benefit - and I'm not sure what they're doing of science would necessarily benefit, but certainly their teaching would benefit - by having this injection of history of science. So, in a way you might say that history of science might help historians at least to think about the possibility that their work is a science and also perhaps persuade the scientists at least to think about the possibility that their work is more humane, if I can use that word, rather

than exclusively, rigorously scientific. But yes, I think we have a very important bridging role and I just hope that we will play that role more and more energetically as the years go by.

GM: I think that one question deriving from that is whether history is a science.

RF: Yes, it is a science, and looking back at the way history has been written, I think whenever it's become too much of a science, the result has often been pretty bad history. I would say: yes, a science, but one that constantly needs to be tempered by the more humanities-related approaches. I don't know whether you want to make a distinction between science and social science. I mean, I could be quite open to the idea that it's a social science, I'm less confident about it being in some other sense "science".

FM: Can I make a comment? I think the problem is that when you consider history a science it needs to be as scientific as the hard sciences, to have the laws and have that strong core, but I don't necessarily see that history needs to have these laws so strongly firmed.

RF: But do you feel that in history of science we do need laws of how science has evolved and evolves? Is that where you'd want to end up?

FM: No, no, I think the problem is that history is not considered a science because it doesn't have laws like the hard sciences, although the hard sciences are historical sciences, they are firmly grasped within the historical context, they are not lost floating around, and the problem is that history doesn't have this way of doing things, different from the hard sciences.

RF: I concede the problem. I think I've always been somewhat suspicious of history which is founded on, or claims that there are laws, and there are some sort of predictability about history. It may be there is an element of predictability, but I think that the historical context is so complex, and so sort of universal somehow, that the laws... they might have a heuristic value. I mean, the thought that there is a law of economic development, or something like that - it's a question worth asking, but I think the danger is that you might want to somehow turn that law into a fact, whereas I think I would want it to be a way of formulating a question. I mean: "is there a pattern of development, or something like that?", but I don't think we can ever arrive at it. I think that's what you're suggesting; we can never arrive at a law, a scientific law of history in the sense of the hard sciences.

GM: Well, in a way Auguste Comte thought there would come a day when we would discover such a laws.

RF: Yes, yes.

GM: In the present, there are quite a number of historians, sociologists and others with background in humanities, who do work in the field of history of science and technology. Previously, we had more chemists, physicists, biologists, geologists that would investigate their own field history. What are the implications you see in this contemporary trend, I mean, this change from the physicists' history to the historians' history?

RF: I think it's transformed the whole subject; you've only got to look at the journals to see the effect it's had. I think that there are advantages in this. Undoubtedly, it's enriched an awful lot of historical discussion, and so I think I'd welcome it on the whole. I think there are dangers for the history of science, for certain areas that clearly do demand a command of the scientific content are increasingly getting neglected, and they're falling out of what you might call "the mainstream canon of history of science". In a way, I still have a sort of vestige of being historian of physics, and I think one thing that does worry me there is that the history of modern physics now is no longer the sort of thing that would be taught to history of science students at the Masters level, and the research in that area will increasingly be left to scientists. It may be that will be a good thing, and if you're talking about the history of modern physics, they are the only people who can really talk about it with authority. I think it does present a challenge for us, and that would certainly be true in the history of, for example, biotechnology. I think again you do need a command of the scientific issues in order to say something that will have authority. Now, maybe it's okay then to leave it to practicing, or perhaps retired physicists, biochemists and so on. I think that is an open question, and the way forward may well be one that a French colleague, Muriel Leroux, has been developing in recent years, and that is what she calls *compan-ionage*, you put together what you might call a trained historian with interest in the modern period, and with some command of the of the scientific issues, and that person should work with a practicing, or recently practicing scientist, and that might be the only real way forward that we can keep the history of very recent science in the domain of what you might call history of science, globally.

GM: Yes, teamwork would be good, but in my experience, I see that many history students, when they want to do history of science, they start at least studying some science, so that they are not completely outsiders.

RF: Yes!

GM: I have had good experience, I mean, they may not command that field, but they know enough to investigate the main historical questions.

RF: I think that is enough. I mean, if they come from a humanities history background and they're willing to, you know, sit down and just engage seriously with the science, I think that's fine, but when it gets to the cutting edge of the science then I think they do need help, almost certainly they're going to need help, I would have thought.

GM: Well, even the scientists need it...

RF: They need help too, yes.

GM: Now, a very general question: how do you see the relevance of the history of science and technology for society in general?

RF: I think we have a duty to make our stuff better known. The *History Manifesto* has really raised that issue, its thrust was that we're not talking, as they say, to power, i.e. to decision makers in government or in industry or wherever, and I think that we do need to improve our act in that respect. I don't think the *History Manifesto* is entirely relevant to what we do, I mean, there may be a problem in general history that we don't particularly have. The thrust of the *History Manifesto* was that we should do more *longue durée* history. I think that in history of science we do have a very good record of doing it. There was this suggestion in the *History Manifesto* that microhistory was somehow a bad thing, well, we do a lot of microhistory in history of science and I would have thought some of it has been a very good thing. We've been able perhaps not to cover long periods, so in that sense it's not *longue durée*, but we have managed to raise issues of general interest that are relevant to other periods, other disciplines, and so on. Well done microhistory has actually been a very productive field and if there's some content or some conflict between *longue durée* and microhistory, I think that's dangerous, because we can do both, not at the same time, but our discipline ought to be doing both, and I don't think our mission as historians of science is particularly to speak to power. That strikes me as probably somewhat politically motivated, but I think we do need to speak to society much more, and there are historians of science who've managed to do that. In Britain though, what I do notice is that when some issue is raised that has a historical dimension, the media soon will tend to turn to scientists rather than to professional historians of science for comment. I think we've just not sold ourselves all that well.

GM: But should history of science speak to the scientists?

RF: Oh, it should! That said, it should speak to the general public, but I think one thing that's happened particularly since this big change in the history of science since the 1970s is that we've increasingly lost our access to the science community. I can only speak about Britain, probably about the USA, and I would think in both those of the Anglophone world that has happened beyond question, and the scientists have just not really recognized what they do in what we describe. This is a big problem and a challenge for us in the history of science. If you ask a practicing scientist you know whether he/she would appreciate the sort of rather sophisticated sociological, anthropological, psychological analyses we offer now, whether he/she would see his/her activity in those analyses, I think the answer would often be absolutely not. Now, that might, and I know in some cases it would, reflect a refusal on the part of the scientific community to engage with the sort of issues we address in the history of science, but I do think that we have

a responsibility on our part to make what we say accessible, and not to shroud it and protect it, conceal it in jargon which is only of interest to a few other historians of science who happen to be in the same school of thought as the author, and it's become a very sort of excluding mechanism.

GM: So, in this way, the *History Manifesto* would apply.

RF: Yes, exactly. Perhaps not speaking to power, but it would be important namely speaking to decision-makers, and my feeling about history of science is that our students, for example, should be ready to engage certainly on the public scene with debates, they should be more willing to, perhaps, write accessibly and write well. I think that's another thing, you know, to write attractively, but also to be present in decision making itself. I remember one really striking case we had in Oxford, one of our graduate students who having done the D. Phil., what we call the PhD, in history of science, then joined the Treasury, which is the Ministry of Finance. Somehow, I feel that's really potentially quite constructive, that you have somebody there in a probably very influential position in a few years' time, who has this background - who knows what it might lead to?

GM: What are the prospects for a historian of science in Europe and the United States nowadays? I mean, in terms of career, salaries and others benefits.

RF: Well, they're not good in Europe or in the US, so the answer is that, in the sense of going on to a traditional academic career, of the kind that you and I have pursued, no, the chances are not rosy at the moment. I think that perhaps it comes back to what I was saying about our speaking to the wider public. Student historians of science, perhaps, should be thinking more widely about career options afterwards. There are career options other than purely academic life, and maybe in the training we give to historians of science, perhaps we ought to think a bit more about preparing them for other lives other than our own, so to speak.

GM: Could you think of other careers as an example?

RF: Well, I could think of, certainly, science communication, museum work, for example, certainly administration. I mentioned the case of somebody who went on to the civil service, why not, you know? People who have done history, straight history degrees, they go into the civil service, why cannot our people do the same? And after all, our people do bring a sort of another culture, they bring a science culture along with them, but in communication, media, journalism, that sort of thing, there are opportunities, and I think history of science is a good foundation for that sort of work.

GM: Coming back to the field of history of science *per se*, how do you see the recent trends in methodology, theories and ideas of history science, particularly all those “isms” like “sociologism”, “relativism”, and so on?

RF: I think they've revitalized history of science over the last 40 years or so. So, I'm entirely in favour of them. My only worry about methodological debate, historiographical debate, is that I prefer to see it as preparing the tools for writing history. What I always used to say to the graduate students in Oxford was: the methodology should be a sort of scaffolding that will help you to formulate questions, perhaps, to have ideas about possible solutions, and so on. But I'd like to see this gap when the work is done, namely the work which is writing history, I would like to see the scaffolding taken away and become at least something more discrete. I just have the slight feeling at the moment that historiographical discussion has been aimed at, or has resulted in, people feeling they have to join a particular school, whereas I feel that what we should do with graduate students is to present a broad menu of methodological options, and really just say: well, you will need some of these, you'll need different options for different problems, so choose your problem and then go to the menu and use the bits that will help you.

GM: Maybe even choose several.

RF: Yes, I know there was a more and more eclectic approach rather than belonging to a particular team or a school, that is where the danger arises. I would be for openness and toleration.

GM: Well, that brings us to another related problem, which is “Sources”. Can you tell us something particularly about sources for the history of science and technology?

RF: That has been transformed within the last 15 or 20 years with digitization and that sort of thing. We're now drowning, or we potentially drowning, in sources, and I think that is a new challenge, you know, how do we navigate, now that we have so much material to go at. The more sources there are, it must be good, you cannot argue against having more and more sources. I just think the move towards the digital world needs to be controlled, managed, and reflected on - for example, there is a danger in just putting huge amounts of material online. Now, you could argue that is good because it is up then to the recipient to decide how he or she will use the material. I just hope at the same time we can preserve the great editions, and particularly editions of correspondences, and so on, which I think is still so valuable. I hope we don't sort of move to a position where we say: so long as the material is available online, we can then forget about it. I'm thinking of that because of a new two-volume edition of the correspondence of Magellan [João Jacinto de Magalhães], the 18th century physicist, which has appeared very recently. There was a very scholarly edition, with very helpful notes and so on, and I think there's a critical apparatus there, which is something worth preserving. As you could imagine, in a new world, all those letters could have been just put out online without any sort of controlling spirit. Of course, the control can become excessive.

GM: Yeah, but will there still be room for the old-fashioned way of going to archives? Because there's a cost for digitalising and not everything is digital.

RF: No, that's true. I think there will be, and I do sort of worry about the profession of the archivist, you know, to what extent this will change, I think this could become a very different activity. One thing on sources, I would say, is that I'm very concerned about the neglect at the moment of the papers of modern scientists, and I think we do need to reflect on how we're going to handle that. In Britain, we had quite a good system going back 20 or 30 years, and if we had a major scientist, the papers would be sent to an archiving centre, and they would then be archived, inventoried. It was probably at a fairly elemental level, and then they would be deposited in the most appropriate centre, it might be the Royal Society, if it was a fellow of the Royal Society, it might be a new University or somewhere else, and that worked very well, a lot of personal archives of scientists were preserved, and at least roughly catalogued in that way. Now, the funding for that has disappeared, and nobody seems to really feel that's been a great loss, yet I think it has. An awful lot of science that's been done, that's the other thing I feel about the history of science, all the work on the early period, medieval, early modern and so on, if you look at just the amount of sciences, there's more being done today than in the whole of history before.

GM: That's right. I've seen some trends like corporations hiring archivists and some of those corporations are scientifically-oriented, in the sense that they have research and these archivists; they may also be a gate to the development of certain products or certain technologies. In this sense, there's maybe more attention to the archives of technology, then to the archives of science.

RF: Yeah, I think company archives really have improved enormously. I suspect scientific archives, the archives of scientists, they do present more of a problem, but company archives, yes, when it comes back to, you know, careers for people trained in history of science, why not that sort of work? Because it can be extremely creative, and it's certainly valuable and worth doing.

GM: My next question has something to do with this, because you have been active in both history of science and history of technology. Is there a conflict or a cooperation between those two?

RF: I'm sad to see that there is something of a conflict. If you look at the American situation you know people who go to the meetings, the annual meetings of the History of Science Society will not necessarily go to the meetings of SHOT, Society for the History of Technology, and I think that's rather sad. Again, it all depends on what your problem is, what your area is, but if you're looking at the history of fairly recent, say 19-20th century technology, electrical technology, both you and I have worked in that area, then it's very hard to make a division between history of science, history of physics, on the one hand, history of electromagnetism, on the one

hand, history of the area of transmission lines and so on, and the history of technology on the other. I think we need to keep the two together, but the fact is that the two communities are not all that much together, they might find some common ground here and there, but I don't think they see themselves as doing the same thing. I feel we are historians and that somehow we ought to be able to turn to history of electromagnetism, transmission lines and all that sort of thing. You know, to be historians of technology in the sense that we know about, we would be willing to study installations, distribution networks in towns and that sort of thing. In the ideal world, we should stay together, but we're not staying together all that well at the moment.

GM: To be like Lord Kelvin.

RF: Yes, you see, there's a wonderful example, what you call him? You know, he's many things, he's a physicist, and obviously a major physicist, he's a major engineer, he's a businessman as well.

FM: About this problem of history of technology, nowadays we use all kind of devices without knowing what's behind them, how they function and I want to know what you think is the importance of the history of technology in this sense, and if the history of technology can disclose the social relations that lie behind these devices.

RF: I think the history of technology is very good at that, history of technology well done can reveal things of that sort, precisely that sort, that are very hard to unravel if you just look at the present situation. I think that's true of history of science as well, in a sense in which, if you go back in time, the issues can be more clearly defined. The issues on the whole are, you're not supposed to say that these days, but I think the issues aren't just a bit simpler if we're looking at the present time alone and the history of technology, that would be manifestly the case for me. I think by reading the history of technology, you'll gain some really serious insight into technological development today, and if I can just cite one of my favorite examples in that field, it would be Thomas Hughes' book *Networks of Power*. You know, that book is about electrification in the West, in USA and Europe, mainly in the 19th century, early 20th Century, and I think you can see the issues there, he takes three cities in particular: Chicago, Berlin and London. If you look at the way that electrification happened in those cities as described by Hughes, you can see the sort of issues that must be pertinent today about investment and civic interest, political conflicts coming into play, and I think of a somewhat more straightforward situation. If you look at Chicago, or you look at London, or you look at Berlin, it does raise issues that ought to be in your mind when you're thinking about technological development in our own day.

FM: I agree because, I think it's a contradiction: the more technology nowadays is useful and present in our lives, the less we know about it as we know how it functions, and we do not have this concern. I think it's a contradiction.

RF: You're right, the technology is impenetrable. The technology itself is impenetrable and the decision-making about it is even more, so you're right, and we do need to be more reflective about what's going on in our own time.

GM: Now, going back to your personal life as a historian: can you tell us something about your main topics of research, which, I understood, was French science from the 18th to the 19th, 20th Century, and more recently, scientific cosmopolitanism versus nationalism?

RF: I didn't really set out to be a historian of French science and technology, but working as I did initially on theories of heat and early thermodynamics, it was plain as day that the key figures in those early days were predominantly French, as Laplace in mathematical physics, Sadi Carnot, more in engineering and in physics. They were major figures and, of course, there were other major figures as well. I sort of drifted into the French world, I wouldn't say by accident, but just I was led along in a way into that world, and I've always felt I wanted to talk about science in France rather than French science, because French science would imply that there was something distinctively French about the science. I mean, science I always wanted to feel was international, but of course it took a particular form when it was pursued within the structures, the social structures, the economic structures, the finance structures, university systems of France, as opposed to Germany, for example, or Britain, or America. So, in that sense, as I said, I wanted to talk about science in France, but also to keep open always this idea that science was a transnational, supranational, cosmopolitan activity, which then took forms because inevitably it's going to be fashioned in detail by the structure, by the national structure, which is implanted. In a way, moving towards more, as I've done in recent years, more towards cosmopolitanism and science internationalism, it's been, perhaps in a way, looking at the historical question of how does a cosmopolitan, transnational or supranational activity, how it is pursued in what's inevitably a national context.

GM: When there was such an intense rivalry between France and England, or France and Germany, science in France became also French science, and do you see any such a trend nowadays?

RF: I would say that one of the most dangerous things that happened in the history of science I would associate with the First World War, and I do feel that there was a dramatic transition between before 1914 and after 1918. There really was a genuine attempt to treat science as an activity that transcended national boundaries. That's the age of international congresses, and an awful lot of communication between scientists, of a feeling that they really wanted. They should get beyond their national traditions and national boundaries, and what happened after the First World War is what you might call a *national turn*. I think that science became somehow an arm of the state, it became partly national property, and I that's when perhaps you really do have to begin talking about a German science. Of course, in the 1930s there was an attempt, an explicit attempt to create a German physics. Philipp Lenard's great textbook of physics in the mid-1930s was entitled *Deutsche Physik*, and his preface says quite clearly that Jewish physics,

meaning relativity, quantum mechanics, modern physics as we now call it, that can't form part of German physics, so there is a sense in which it has happened in the past. You have the Ly-senko affair in the Soviet Union, and I think it is a fact that now science is seen as part of the state apparatus, there is a danger there, and scientific communities have to fight against it. On the whole, my sense is that they do fight against it quite effectively, but it's a danger that's always there.

GM: You had an intense activity as editor for the Royal Society, of *Notes & Records*, their scientific journal for history of science; can you tell us something about this experience?

RF: Yes, I came to that rather unexpectedly. I had entered a journal, the British Journal for the History of Science (BJHS) in the 1970s. After that experience, I said I would never, ever edit a journal again, but, anyway, it happened, and I saw that as a slightly different experience. BJHS in the 1970s was part of our attempt to promote history of science, I hesitate to say as a discipline, but certainly as a recognizable activity. It had a professionalizing mission. *Notes & Records* I saw in a very different way. It had always been edited by a fellow of the Royal Society, therefore by a practicing scientist ever since it began in 1938. The Royal Society was anxious about this, because its other journals like *Philosophical Transactions*, the *Proceedings of the Royal Society*, and so on, those journals were deemed to be among the top journals internationally in their various fields - it might be physical sciences, life sciences or whatever, but the *Notes & Records*, they felt was not recognized by the history of science community at the top level. Most of the articles had come to be written by scientists, or recently active scientists, so what they wanted was to have a professional historian of science editing the journal. Now my feeling on doing that was that we should try to avoid it becoming another professional history of science journal. We have lots of those, and my feeling was that we should try to show how history of science was done at the highest level, in terms of quality of writing, quality of research and conceptual sharpness, but accessible to a wide community, in particular the community of scientists. I had this sort of mission, but somehow by professionalizing history of science we have turned our back, or we risk turning our back, on the scientific community, so what I tried to do as editor of the journal was to encourage stuff that would be readable by scientists, that would probably have pretty tough scientific content, if that's what it required, but would certainly not have the sort of jargon and the in-talk that have become so common within the history of science, and I think, on the whole, we managed that.

GM: Are there any other attempts of that in any other countries, like France or Germany?

RF: Do you mean to make the writing of historians of science more accessible particularly to the scientific community? I think it happens in France, certainly it happens in Britain too, and in the US. You do have historical sections within the scientific professional communities, so the Royal Society of Chemistry in Britain will have a pretty active history of chemistry group. In France the Société Chimique de France will have a group d'Histoire de la Chimie. So, I

think there has been a forum where scientists engage with historians of science, and so long, that's been very well worth doing.

GM: Did you enjoy your activities of editing compendia, such as the *Oxford Handbook of History of Physics*?

RF: I could say I enjoyed it, yes. It was part of the same mission, in a way. The idea was to have examples of historical writing. We couldn't cover the whole of physics, obviously, but we took key episodes in physics and asked people to write about them in an accessible, but authoritative way, and I must say, as a publication, it's actually been quite successful in the sense that it sells. I've never had any of my publications sold as nearly as well as the Oxford handbook. Oxford University Press is very keen to have more, they would now like an Oxford Handbook for the history of modern physics, but it's interesting, going back to one of your earlier questions, that I did explore that possibility, but finding authors who would write in the right sort of way, and be willing to do so, that wasn't easy at all, so that idea was somewhat abandoned.

GM: Another activity of yours was in scientific societies, you had a leading role at the European Society for the History of Science, the British Society for the History of Science and the International Union of History and Philosophy of Science. How do you see, presently, your past activity in those fields?

RF: I got involved because, having worked in France and, to some extent, in other countries as well, I was conscious of the different ways in which history of science was done in different countries. There were different reading habits, there were different citation habits, there are clearly linguistic problems, barriers to be overcome, and so on. I felt that with that sort of society, particularly I'm thinking of the International Union and the European Society for the History of Science, in those two cases the mission that we had was to somehow try to overcome these barriers and make communities of historians of science talk to one another more readily. Whether we've succeeded I'm not sure. I think we have made some progress, but there's an awful long way to go, so yes, let's cross these boundaries - not only, you know, we talked earlier about crossing of boundaries within science - but there are boundaries within the history of science too. That certainly struck me, particularly I think working in France and working on France, the habits of citation, particularly, there's a sort of rather predictable circle of sources that are referred to, and that's true of Britain as well, I don't want to suggest that it's a particularly French thing, and of course in Britain, and probably in the US, we don't read foreign languages, and that is a problem, so I was conscious of a lot of work being done in France that was not reflected in British historiography. I think things have got somewhat better, but we're still on a long way to go.

GM: It certainly is a barrier here for Portuguese-speaking historians of science to write in English, and to be accepted by those major international journals, and we would probably need some help to get over this.

RF: I wasn't the editor, but I was somewhat involved with *Annals of Science*, this is going back perhaps 30 years now, and we did have a system: we created a fund that would allow people who wrote in French, for example, or German, they could send their article in their language and we would pay for a translation and that was particularly directed at the French and I think we had that system up and running for two or three years - we had not a single application. It was very disappointing because it was well-intentioned, but it just didn't work, and again it's something sort of cultural, there was a barrier, it wasn't just a linguistic barrier, there was something else preventing that. You'd have thought it would be a very attractive possibility for a French scholar, but it didn't work.

Raiany Oliveira (RO): In relation with this, we are talking about on how the history of science is done in Britain, how do you see this is going to be done, which are the trends on history of science and technology in Britain nowadays? May you comment with us briefly?

RF: Yes, generally, where is it going, I would think we are still in this, what you might call the sort of "social science approach" and I think that's probably still going to last for some time to come. You'll find a broadening of the sciences that are being considered, certainly an increasing interest in the history of the human sciences, that is very marked. I think also we are very caught up in Britain, and that's probably true internationally, in global history, and it comes back a little bit to the *History Manifesto* because in a way the people who are promoting the *History Manifesto* are particularly interested in global history. I think there may well be an attempt to really engage history of science in that movement of global history, certainly in Oxford at the moment, in the History Faculty. I would say it's the area that now the University, or the History Faculty, most wants to develop, and I think history of science, if it wants to, could well find a home or find some natural allies within the global history movement, but that will certainly lead us to be doing much more dramatic, much more ambitious topics.

RO: And do you see the same trend in France, for example?

RF: I would think France in a way has almost been ahead of us in that, so we're slightly following in their wake, I would say. I just hope, it goes back to something we were saying before, I would like to think that there will be some sort of renewal on the awesome engagement with the problem of how we write the history of recent science. I really think there is a major problem there, and I know that several colleagues are thinking about that problem: how do we engage, and can we engage as historians the specialized technical knowledge which people with a high-level scientific training really can offer us, and we, on a whole, as historians, don't have it, even if, you

know, we were physicists or whatever a long time ago, I mean, that's a world away from writing about the history of current physics or very recent physics.

GM: England has some very important museums like the Science Museum in London, or the Museum of Technology in Manchester. Do these museums convey an interest in the history of science and technology?

RF: Well, they're divided, they have two missions. One role is, taking the Science Museum as example, to preserve the national historical collection of science, so there's a sense in which we had a historical dimension necessarily for the collection, but we also were developing, when I worked there in the 1980s, a much more pedagogical role. We were trying to communicate the principles of science and technology today, and I think in that respect we were quite successful, particularly with children, and one thing that did strike us, and we saw as something of a problem at the Science Museum, was that our exhibits had this pedagogical role, they were sort of an extension of the classroom to some extent. We could do things better than you could do in most classrooms, but nevertheless, there was that focus on education, particularly educating younger people. The challenge we had was: how can we encourage adults to engage with the sort of things we had on show in the science museum? We always said that the problem, the challenge for a science museum, was that people came three times in their lives, only three times: once at the age of eight, once at the age of 38, when they had their children and then at the age of 68, when they came with their grandchildren. I have been present at all three of those stages myself, and I think the problem is that science museums have not sufficiently become a place that attractive to the adult audience. If you look at the Science Museum, just opposite us we have the Victorian Albert Museum, which is a museum of furniture, clothing, and sort of, you know, art. I suppose you won't see many children there, whereas if you go to the Science Museum, there are children everywhere, and it's a different sort of museum. I think it's wonderful what they do for children in the section, it's really incredibly creative, but somehow we need to engage the adult audience and provide something that will encourage them, as something you were saying, you know, to reflect on science and technology today. They might be attracted, and you've got to use, in any museum, every tool you've got. One attraction is the beauty of some of the objects, we have the George III collection, the King's collection of the late 18th century. Even if you don't know what these instruments do, they're just so beautiful to look at. You look at the Galileo Museum in Florence, that would be the same, the Medici collection, but we need to bring adults in, and I would say, by all means: use the attractiveness of the objects to bring them in, but somehow you've then got to add more than that, to make a museum a sort of place where adults will be, will reflect and somehow debate current issues. I know that now has become a major priority for the Science Museum in London, and I think to some extent they're making progress, but it's a big challenge.

GM: Do you think that with history of science and technology we could engage more, in terms of interest in science, but also awakening the interest on how that developed to become what they see?

RF: Yeah, I think the Science Museum has to try to do that. It is quite difficult and we have had some examples in Britain recently, which have suggested that we are beginning to make progress. History of science, I would say, until the last 10 or 15 years, was seen as a sort of rather esoteric activity outside mainstream culture, I mean, people would know a few names and so on, but now, and I'm moving away from museums, I admit, we do now have skilful writers who are writing. I don't know whether the name Dava Sobel means anything here, you know, with the longitude, that sort of thing, so we have these professional writers who are not historians of science, of course, but they're professional writers. So I think they are making history, bringing history of science into mainstream culture, and only this morning I was listening to a programme on BBC, every Thursday morning at 9 o'clock on Radio 4, which is called *In our time*, and it's a sort of panel discussion, three guests and a mediator. It's interesting to see how often the theme that they choose is in fact a history of science theme. It could be something else, it could be history of politics or something like that, but it's always a historical discussion, and it's very encouraging to see history of science coming in there. It's recent, so perhaps, we're on the way up at last.

GM: you also cooperated with the EDF (Électricité de France), with their attempts to write the history of electrification in their country. Do you see that as a unique experience? Why would France do this? Is it because there is a national pride in their electrification history?

RF: I think there might be an element of that. It's financed by Électricité de France, and of course that means that it's quite an attractive venue for historians of science and technology. I think there was something of a national interest, in the feeling that, perhaps France wasn't as well studied as other countries had been. There also was a very charismatic leader for that activity, certainly the intellectual leader was the economic historian François Caron, and this association for the history of electricity in France owed a great deal to his dynamism. He certainly had this huge project, I think surely you must know the *Histoire générale de l'électricité en France*, and that certainly was his project. In a way, it wasn't nationalist in any distorting sense, but the focus was definitely France, and I think that was why EDF was willing to support it. I got into it, in a way, because I knew François Caron, he knew a little bit about what my interests were. I also got into it because I just do feel that, somehow in the history of science, the French have not been as well represented, as well studied as they might have been. Of course, everybody will know about the Golden Age of French science, from the 1790s to about the 1830s, 1840s, but the later period, on the whole, was rather neglected and certainly in the Anglophone world we think, of course, that Britain and America are the most important places, but we also tend to have an opening towards Germany, for example. I don't know quite why, there are cultural reasons, historical reasons for that, I think, but France has been neglected, and this was a wonderful initiative, certainly, slightly, perhaps, encouraged by the importance of bringing France back into the

mainstream of consideration, but the work they've done is wonderful. It's been very open-minded, increasingly it's opened out from the purely French context, perhaps that's where it did begin, but now it's very international.

GM: We are generally lacking funds for our research, in this context how do you see the importance of places like the Chemical Heritage Foundation in Philadelphia?

RF: Well, we must be thankful to the Chemical Heritage Foundation for what it does. What you can see there is how essentially industrial patronage, I mean that's where the money of the foundation comes from, can change our lives as academic historians of science or technology. We as academic historians, we can work within a context which is, to some extent, mediated, circumscribed by the world of industry and commerce. It's not my world by a long shot, but I think it's a world that we can work within, provided that we don't become too esoteric. It goes a little bit back to this idea that why don't the scientists, as I was talking about earlier, see themselves, recognize what they do in the sort of sociological, anthropological, etc. analyses that we tend to offer them, the same problem of communication. I think within Chemical Heritage Foundation you could have the same problem, but it is a place where historians can work alongside or at least be read by people in the world of industry and trade. I would say, just going back to EDF, I think that was another very important aspect of the work of that association. That senior members, senior people from EDF actually came along to sessions and listened, I mean they're not going to write histories, of course, they've got other things to do, like running EDF, which takes time, but they did definitely show an interest, and I like to think that in Chemical Heritage Foundation that sort of tradition of interaction and openness is there. I hope it is.

GM: What would you say to a young person thinking of pursuing the history of science and technology?

RF: I'd say it's a wonderful pursuit academically. It's enormously enriched my life and my own feeling. It's interdisciplinary; it transcends national boundaries, and so on, and so forth. As to advice I would give, and I suppose, in a way, it was the advice I used to give when I had graduate students in Oxford, is to try to think not only of a career in academic career in research and university life, but think of the other things you could do because, we said already, the jobs and the openings in the purely academic life are very limited, and there's no sign that that's going to change very much. One thing that I suppose is happening is that history departments are now opening up a little bit towards the history of science. It's difficult to put it, but I have seen one or two signs of that, and that would only point to the advice I think I'd give to anybody starting in the game: be as flexible as you can, maximize the number of skills that you've got, that could be in communication, could be writing, it could be speaking, it could be sort of debating at the sort of more political level, it could be moving into administration, and so on. I mean, just realize that history of science, graduate work in the history of science can actually be the foundation for many things, it doesn't necessarily have to be academic life, but you do have to warn beginning

graduate students that the road into academic life is a hard one, and it might even be a closed one, but if you couldn't make it, the intellectual activity is so fascinating, so enriching, go for it.

GM: You mentioned the kind of difficulty for history of science to get its own place into the history departments. Do you think there's an idiosyncratic reason for that? Is it perhaps just "the fear of science" or something like that?

RF: I spent my entire career in history departments, first at Lancaster and then in Oxford, so that's unusual in the British situation, you know, to be absolutely in a history department right the way through. I would say in both places there was great respect for the history of science group somehow implanted within the department or faculty, whatever you call it, but there was always the feeling that we historians of science were somewhat different, and I think one thing I always hoped to do, both in Lancaster and in Oxford, was to show that we're not different. We're historians like the rest of you, but I don't think we ever fully persuaded our history colleagues of that, and you have to somehow persuade them that science, after all, science, technology, and medicine, they have been very major forces in the history of the world, and that they ought to see the history of science, technology, medicine as part and parcel of world history. That's quite difficult, and I don't think that we've achieved that yet. One other thing that will happen, and this maybe comes back to the question of openings for people trained in the history of science - what I do foresee happening, and it's certainly happening in Oxford - is that an awful lot of very good history of science is being done by people who would not bear the label historian of science. We have some very interesting work going on in the English Faculty in Oxford, so these are people who don't have a science background, but they're certainly engaging with science. At Lancaster there's a current project for editing the letters of Humphry Davy. Again, it's coming out of the English Department, because their starting point is Romanticism, and that sort of period, and Davy emerges so obviously from that world, so they have to do what you were saying earlier, Gildo, they have to sort of sit down, and learn about Davy's chemistry, but at least it's not like learning about quantum chemistry, or something like that - he wrote poems...

GM: I've seen that in the United States too, many studies come from the literature department, but they impinge directly on the history of science

RF: Yeah, well, maybe we have to accept that history of science can be done, at the very highest level, by people who actually do not have the label historian of science, and have probably not gone through a graduate program in history of science. Certainly, if you look at the Davy project, I'm somewhat well aware of what's going on, I still have quite a lot to do with Lancaster, certainly what's happening there is the people would not recognize themselves as, if you like, professional historians of science, but they're doing history of science.

SA (Sara Albieri): I would like to hear professor Fox on one comment or two, maybe. What you have just said about historians and their attitude towards history of science, I would make an analogy with the history of ideas, intellectual history. It's also not a very legitimate research in history departments, if you do it from an internalistic point of view, that requires reading the texts and recovering their immediate intellectual context, but living in low-key political contexts, or other wider broader situations that would be more familiar to historical research, of social institutions and political institutions, it's also interdisciplinary because of the internal reading of the different traditions in intellectual history or history of ideas, it's supposed you might follow the texts with medium expertise. If you are talking about, I don't know, lots of philosophical texts or texts in different scientific researches or even literary movements, you have to reach the resources of other expertise to accomplish your task in a more complete or competent way, and also historians have been leaving, for some time now, the research in the history of ideas to the specific fields, at least among us. Here in Brazil, for example, who has been doing the history of philosophical movements? Philosophers, if they feel like it. Who has been writing the history of literary movements or ideas in law or social thought? Usually the professor that's academically connected to those specific departments also takes this task of reporting the history of the different movements that make their tradition, and when they do history they do poor history. They may understand better what was said in those systems and movements, but they make it through an old-fashioned way of chronological sequence, main names and dates, and nothing else, as exploring the whys and the connections. So, I would like to hear you a bit on that.

RF: I think you're right, that if you look at the history of literature, literature departments like to do that sort of thing, and I suppose our problem in the history of science is that our science colleagues are not all that interested, whereas I think if you look at philosophy departments, history of philosophy is a pretty standard part of the program, whereas in probably art as well, if you look at an art faculty, I suppose, again, history of art would be seen as integral to the activity of training in art. We don't have that advantage because I think the scientists, on the whole, either they're not interested or if they do have a go at it, as you say, they're probably not doing it very well. I think our problem is, if we're going to work in departments with historians, we probably have to be sensitive to what issues interest them, and I don't think they're interested in the detailed textual internalist study of the scientific text, and, therefore to some extent, historians of science who want to do that sort of work - and that's what I used to do myself, still quite like doing it, actually - we are orphans, because the scientists don't want to know us, the historians don't want to know us. So, if we're going to sort of somehow make progress with the historians, we have to be ready to address issues that they are interested in. I'm afraid, if we want to be in their game, they are the dominant figures, which means therefore you have to perhaps address things like certainly they do. History of technology, as we've talked about, you could imagine that being of interest to mainstream historians, they want to know how Britain became an industrial power, and maybe a historian of science and technology can inject something on that, and I suppose as historians of science in a history department, if you're going to succeed and be respected, you have to really be very sensitive to what will interest them. Now it might not be

what you naturally want to do. I said that I spent all my career in the History Department in Lancaster, and then in the History Faculty in Oxford, and my feeling was that I was always having to sort of adjust to what I felt my historian colleagues might like, because before when I started as a graduate student my interest was precisely the sort of thing that you're describing, you know, take a text and read it again and again until you understand every word, why that word was written that way, and why not another word, and that sort of thing. When I then went into a history department first in Lancaster, I realized that none of my history colleagues were remotely interested in that, so I just had to, certainly in teaching, do something very different. I'm afraid we have to be, if we're going to succeed as historians of science, very flexible. We might not like it, but if we're going to succeed, I think that's what we have to do and realize where the power is.

GM: By the way, I have to teach history of science to several other units in this university: Biology students, Chemistry students and lastly Geology students, and I found that even at the student level you have to have this approach. Trying to address what their interest is, so a chemistry student may be interested in the history of chemistry more than anything else, not at the general history of science. I think that was successful, although I do not see many people doing this.

RF: You're right. We have to learn to set ourselves and make compromises if need be, perhaps it's not what we would do - if I'd been left to myself and not been in a history department, I would have gone on doing this quite detailed textual stuff. I quite liked it. It was comfortable, but I couldn't, I had to change.

SA: May I add, what about the relations between philosophers and historians of science, because you sometimes see them together?

RF: When I started as a graduate student in Oxford they were seen as two sides of the same coin, and my supervisor Alistair Crombie would certainly have seen himself as equally historian and a philosopher. I think what happened was, and I would say I saw this happening through the late 1960s, 1970s, that those worlds were separating and what, of course, was happening by the late 1970s, when you really have this great movement of changing in the history of science. It's not so much that philosophers and historians were moving apart, but they no longer had a privileged relationship, so we were having sociology, anthropology, psychology coming in, as potential partners for history of science, and, of course, that meant that the philosophy link, which had been very powerful and exclusive almost when I was starting, it became another option. You could, of course, reach out to philosophy, and I think recently in England there has been a movement to try to rehabilitate the special link with philosophy, and there's been one or two quite prominent figures who have said that by abandoning the link with philosophy we have lost something, so I would say that in Britain at least there might well be a return.

GM: Thank you so much, Professor Fox, for this quite enlightening interview!