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Michael Rosbash

The Nobel Prize in Physiology or Medicine 2017

Born: 7 March 1944, Kansas City, MO, USA

Affiliation at the time of the award: Brandeis University, Waltham, MA, USA; Howard Hughes Medical Institute, USA

Prize motivation: “for their discoveries of molecular mechanisms controlling the circadian rhythm”

Prize share: 1/3

Life

Michael Rosbash was born in Kansas City, Missouri, and grew up in Boston, Massachusetts. His parents were of Jewish descent and had fled from Nazi Germany in 1938. He studied at the California Institute of Technology in Pasadena and at Biologie Physico-Chimique in Paris and then obtained a doctor's degree at the Massachusetts Institute of Technology in 1970. After spending three years at the University of Edinburgh in United Kingdom, he began work in 1974 at Brandeis University in Waltham, Massachusetts. Michael Rosbash is married and has a stepdaughter and a daughter.

Work

In our cells an internal clock helps us to adapt our biological rhythm to the different phases of day and night. Jeffrey Hall, Michael Rosbash and Michael Young studied fruit flies to figure out how this clock works. In 1984 they managed to identify a gene that encodes a protein that accumulates during the night but is degraded during the day. They also identified additional proteins that form part of a self-regulating biological clockwork in the fruit fly's cells. The same principles have been shown to apply to other animals and plants.

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Nobel Prizes and laureates

Nobel Prizes 2022

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NOBEL PRIZES 2022

Michael Rosbash

Biographical



My parents and Germany: tough times

My parents were born and raised in Germany. My mother Hilda was born in 1914 and came from a secular, quite comfortable family in Berlin. Her father, my grandfather, Magnus Sonntag had a pharmacy, which still exists today with the same name and in the same location (Marien-Apotheke, Wilhelmsaue 110, 10715 Berlin). As the story was told to me, Magnus was a soldier in WWI and home on weekend leave when he discovered his wife, my biological grandmother, with another man. Magnus kicked her out, she moved to Holland, which left her 3-year-old daughter with a father at the front and no other parent in Berlin. My mother was sent to live with her grandparents for a few years and never saw her biological mother again – although there were some subsequent communications (see below). My grandfather remarried,

and my mother thankfully adored her step-mother. There were two much younger children from this marriage, and all 3 siblings have now passed away.

My father Alfred was born in 1912 and raised in Baden-Baden. My grandfather Joel Rosbasch (my parents dropped the c upon arriving in the US) went to Germany as a young man sometime around 1907 to escape from difficult economic times in the Ukraine. He left his family including 3 young children behind in Kremenchuk and got a job in a cigarette factory in Stuttgart, not very far from Baden-Baden. Cigarettes were rolled by hand in those days. My grandfather was skilled in the art and so had no problem securing a job in early 20th century Germany. He sent for his family, including my father's 3 older siblings, who were all then raised in Germany. According to my father's one younger sibling, my Aunt Lotte (she passed away at the age of 98 in 2013), my grandfather saw the handwriting on the wall and left cigarette-making shortly before that industry was mechanized. He moved his family to Baden-Baden and ran a small grocery-dry goods store there, together with my grandmother; they lived above the store. Although the Rosbasch family was quite religious and kept kosher, the children – my father and his siblings – were educated in the secular German system. My father was a top student at Gymnasium and was asked to tutor those fellow-students who were struggling with math – again according to my Aunt Lotte.

Both of my parents were in university, my father studying law and my mother medicine, until Jews were no longer allowed to pursue these professions – in about 1933 I believe it was. They then both turned to Jewish professions. My mother studied some aspect of Jewish education, and my father – who had an excellent voice as well as a religious background – became a cantor. My parents were married in 1937 and in that same year my father got his first real job as a cantor in a synagogue in Breslau, which is now Wroclaw in Poland. According to my mother and my Aunt, my dad loved that job as well as the Germany of his youth (see below). He didn't want to leave; like many German Jews he found it incomprehensible that the madness of the mid-late 30s would not somehow dissipate and then evaporate. My mother was more pessimistic, realistic one can say in hindsight, and insisted on going to the US – where there was some distant family who helped with visas. I vaguely recall that her biological mother sent her from Holland the money for passage. My mother was never one for negotiating or discussing something that she felt strongly about, and so just said to my father that she was going to the USA either with or without him. Being besotted about my mother (yes – story from Aunt Lotte once again), he left for the States with my mother in 1938 a few months before Kristallnacht. The next morning after this wicked night, the local Baden-Baden Gestapo came to my grandmother's home for my father, demanding “the tall one,” to which she defiantly responded, “You're too late; he's gone to America.”

At the risk of a tangent, it is interesting to note that this one year as a cantor was sufficient to make my father “beamte” or tenured in the German civil service. This status entitled my father to a pension, and my mother collected a widow's pension for decades based on this one year of service; this had nothing to do with being Jewish or restitution. Few people in the United States know that all clergy in Germany are state employees and receive their salary from the federal government. This is true for rabbis, priests, imams as well as protestant ministers, and it was true in the 30s and is still true today. What is remarkable, and a testament to German bureaucracy, that all of this continued to function like clockwork (pun intended) – even for Jews – at the same time as another wing of the German government was gearing up to efficiently carry out the final solution. As Dave Barry would say, “I am not making this up.”

Moving to the US and my childhood

My parents arrived in New York with few resources and no job. While my father searched for a job, my mother cleaned hotel rooms – a fact she bitterly recounted to me for the rest of her life as if it were my doing. (I had/ have lots of Jewish guilt but this was too much even for me.) My father joined the myriad of rabbis and cantors from Europe pounding the New York pavement and looking for work, to no avail. At this time my mother was looking through some National Jewish newspaper, the Forward perhaps, formerly the Jewish Daily Forward, and saw an advertisement for a cantor's job in a reform congregation in Kansas City Missouri. She suggested my dad apply, who said “But we're not Reform Jews.” (To more religious Jews, Reform Judaism at that time was an anathema, essentially indistinguishable from Christianity.) My mother was not to be deterred. “We are now; making a living comes before some ridiculous religious division,” she replied. My dad went to Kansas City, interviewed for and was offered the job, and my parents moved there in late 1938. So my mother once again came to the rescue.

My parents loved Kansas City and had nothing but good things to say about their 8 years there. They made wonderful friends, learned lots about America including how to drive (taught by some of those friends) and had their first child; I was born there in 1944.

I have two family anecdotes about Kansas City. The first concerns a seminar that I gave perhaps 15 years ago in the Stowers Institute for Medical Research in that city. I was in the office of the Director Rob Krumlauf, when he told me that the Institute had been Menorah Hospital, a famous Kansas City hospital before the hospital building was gutted and turned into the Stowers. I vaguely recalled the name of the hospital where I was born; sure enough, the Stowers seminar room is at or very near the precise location of the Menorah Hospital maternity ward where I had been born.

The second anecdote comes from my Aunt Lotte, my father's younger sister whom I have already introduced. She was a 29 year old single woman when I was born and came to Kansas City in 1945 to help out my mother with her young child. One day in May during that stay, Aunt Lotte went to the cinema with my father. This was before TV and the only place where one could see a recent newsreel, which happened to show that day the surrender of the German generals. My father said to his sister after watching, "I am surprised to discover how sad I am, how ambivalent I apparently am about this allied victory." He was of course glad that the war had come to an end and with a victory for the US. Nonetheless and despite his religion and negative experiences in Germany during the 30s, he had been educated as a German patriot and to have respect for the German military; those sentiments had not entirely disappeared. The moral lesson: life is not simple.

My parents moved to Boston in the summer of 1946 when I was two and a half years old. Moving between synagogues is not unlike moving between academic institutions. A bigger, more prestigious synagogue offers a rabbi or cantor a job with better conditions and more salary, perhaps in a more interesting city. The offer was successful in moving my family.

We lived in an apartment in Brookline until 1950 at which point we moved to our own home in Newton, all part of the American dream. I was six at the time and began second grade at the Cabot School. As I have recently described in some detail ("Life is an N of 1"), I had some behavioral issues throughout school – probably throughout life. In hindsight, it is likely I had ADHD or some variant thereof, but the worlds of education and psychology were too naïve to treat these kinds of problems in the 50s. Perhaps this was a good thing, at least for the kids who were problematic but not too disruptive. Meds today may be given too liberally and too quickly, perhaps as much to help teachers and parents as to help the troubled kids. Certainly, I turned out OK without any meds or treatment.

My dad died of a heart attack in the fall of 1954 at the age of 42. He died in the synagogue on Yom Kippur eve, shortly after singing Kol Nidre, the liturgical chant which is sung by the cantor at the beginning of this most sacred holiday. It is said that only the holiest of men die on Yom Kippur; I would like to believe this is true. I should avoid any confusion at this point and state unequivocally that I am a devout atheist and quite anti-religion. Nonetheless, I do have an irrational connection to this event and to my family history, which is now obvious even to the most casual reader. Emotional issues are not easily dismissed, and my own health history is not unrelated. I had a heart attack at the age of 38 and am still here and in decent shape at the age of 74.

My father had had an initial heart attack a few weeks prior, for which he had been hospitalized. There was apparently a big family brouhaha that ensued over whether he should return to singing, which is physically quite stressful. My mother told him that he had to decide himself, and so with his physician's OK, he went back to his normal job. If hindsight is 20:20, foresight in this case was blind.

Our small nuclear family was destroyed by my father's death. My fragile mother, just 40 years old, never fully recovered; my brother and I – ten and six at the time – were left to fend for ourselves, at least emotionally. In this case perhaps and in contrast to my possible childhood behavioral issue mentioned above (ADHD), some professional intervention might have been a good thing, for my mother as well as for me and my brother.

My father's death was an additional blow for my mother in an entirely different way. She had matriculated at BU Medical School and was slated to begin classes in the fall of 1954. This was when my brother began first grade, when both of us would

finally be in school full-time. This was therefore the first opportunity in more than 20 years that she had to fulfill her dream of becoming a physician, the path she had been on in 1933 when the Nazis had forced her to leave university. BU had even fast tracked her path by giving her two years of credit for her time in a German university studying medicine. However, we had no financial resources and so my mother had to go to work to support her two children. She took a six-month course at the Massachusetts General Hospital (MGH) and then went to work at the Beth Israel (BI) Hospital as a cytologist. Within a few years, she became the head of this new subdivision of the BI Pathology Department. She supervised a team of cytologists and ran this well-known and profitable department for many years. After being a widow and working at the BI for 20 years, she married another German Jew, a widower from Pittsburgh. She moved there in 1974, at about the same time I came to Brandeis, and lived in Pittsburgh for the last 34 years of her life, until she died in 2008 at the age of 94.

Although painful, this history still does not do justice to the difficult life my mother had. I have already described the extent to which her education and secure world as a comfortable Berliner were destroyed by the Nazis. She then had to begin life anew in the United States at the age of 24. In addition, however, her own Sonntag family was divided by thousands of miles; her parents and brothers went to Brazil in the late 30s when my mother and father emigrated to the US. My mother only saw her parents once after 1938, a visit she made alone to Brazil fourteen years later in 1952. Thank goodness she made that trip, because my grandparents both died one year later in 1953, a year before the death of my father. They never managed to see their daughter's children, and my brother and I never met our maternal grandparents. In addition to all this history, can you imagine losing both your parents and your husband within one year at the age of 40, and then having to go to work to support your two young children?

This short ode therefore serves to put into perspective some less than admirable personality features of my mother: she was emotionally distant, not very empathetic and also quite selfish. I do prefer nature (hard-wiring) over nurture (environment) as the principal explanation for personality, but the hard road my mother had to travel has made her family more forgiving about her shortcomings. Lastly, she was unbelievably proud of her children, including my academic accomplishments. She would always ask my wife, "Do you think he will win the big one?" What a shame that she died 9 years too early and did not live to see my Nobel Prize.

High school and college (Caltech)

I was a rather indifferent high school student and went to Caltech to escape the unhappy home life briefly described above. Caltech was a good school and also as far away as I could get from Boston in the early 1960s. Going to college there was a stroke of good fortune, because it was academically very challenging. My fellow undergraduates were really smart, and most of them were also hard-working – a combination of diligence and fear of failure. I in contrast had no study habits from high school, a combination of the likely ADHD I referred to above and the fact that I could succeed reasonably well without any effort. This was impossible at Caltech, and after a year or 18 months of trying to succeed without working like in high school, I finally succumbed to the old adage, "If you can't beat 'em, join 'em." So I buckled down, started to study and did well academically.

I remember that the Caltech Dean of Students Paul Eaton told me at graduation in 1965 that I had the very lowest projected GPA of all the students in my class. (In those days before computers, Caltech had some primitive system for projecting the academic performance of their applicants.) He told me this to emphasize how proud he was of my performance, which had dramatically exceeded expectations. In hindsight, I had been accepted to Caltech almost certainly because of "geographical distribution;" west coast schools wanted east coast students as well as west coast students. My good academic performance at Caltech is an important lesson I try to remember: statistics are important, especially for making policy, but there are always individual outliers.

Not only did I do well academically, but the course material had also become MUCH more interesting. Skating along the surface, studying only just before exams, doesn't provide the positive feedback that comes with real learning, with thinking often about academic material. Once the old habits were broken, they were replaced by the positive feedback loops of understanding.

I was aided in this transition by a wonderful advisor and mentor, Norman Davidson. ND as he was called was a fantastic chemist, who was just transitioning in the early 60s from physical chemistry and statistical mechanics to nucleic acids. He was a no-nonsense guy, who challenged me to do well. He was also a fantastic role model with his complete joy in doing research and running a lab. I had never met a grown-up who loved his work so thoroughly. I remember the day I decided to do research for a living. ND was walking down the hall away from me and was wearing a t-shirt. On the back it said on top, "I'd rather be in the lab," and then on the bottom, "Or maybe playing tennis." (He really liked sports, skiing as well as tennis, and had been a basketball player as an undergraduate at the University of Chicago.). I didn't know what it was really like to run a lab, but I said to myself, "this has to be a good thing if it can bring such unbridled joy."

Paris

I went to Paris for year after Caltech. It was highly unusual in the 60s to take time off, to not go directly to graduate or professional school, but I had a desire to see the world. (My mother was an inveterate traveler, so perhaps my wanderlust was inherited or perhaps culturally transmitted.) I had been working and saving money during my junior and senior years of college to travel for a year, when I decided on a lark to apply for a Fulbright Scholarship. I knew some French from high school and even one semester in college, and Paris was a romantic destination. I also had learned in a Caltech class about Jacob and Monod (the lac operon, gene regulation and allostery), and so Paris even seemed like a good scientific destination. My choice was prescient, because these two gentlemen – along with their French/Pasteur colleague André Lwoff – won the 1965 Nobel Prize in Physiology or Medicine, which was awarded a month or so after I arrived in Paris.

To my surprise, I was awarded that Fulbright Scholarship and was off to Paris by boat from New York together with the rest of my fellow Scholars in the late summer of 1965. The Fulbright organization used that trip and the first two weeks of our time in Paris for group bonding and orientation. My recollection is that I was the only scientist in the group, which was great for my general education. Most of my colleagues were Ph.D. students in French literature, from prestigious US universities. They were therefore not only older but also wiser than I was, especially in matters that concerned France, French language and French culture; my fellow Scholars therefore helped me acclimate to my new circumstances.

Despite my genuine praise above for Caltech, it was at the time an institution with no female undergraduates and more generally a rather narrow cultural bandwidth. It turned out that I was desperate for a different experience and so fully embraced what Paris had to offer. This was just about everything: in addition to the obvious – women, cuisine and wine – about which I knew virtually nothing at the age of 21, there was the remarkable cultural and political heterogeneity of mid 1960s Paris. I was stunned by all the refugees and students from all over the world, which reflected the genuinely cosmopolitan nature of the city as well as the influence of colonial France and the French language in the Middle East, Africa and Asia. It also reflected the parochial nature of my life in the US in the 50s and 60s; I don't think I had ever met an Arab before Paris, and I didn't know where the Maghreb was or what the word meant. (It is a major region of North Africa, including Morocco, Algeria, Tunisia and Libya; I also just learned from Wikipedia that it includes Mauritania.) There were also tons of Lebanese in Paris; I did know where Beirut and Lebanon were only because – like most Jews at the time – I knew they were just north of Israel.

1965 was at the end of France's colonial era, 9 years after Dien Bien Phu and only 3 years after the end of the Algerian war. This recent history explained many of the refugees and the left-wing politics that were thriving in the Paris streets. However, I also met charming and generous rightwing people. Most memorable were the Pieds-Noirs. (The term refers to Europeans, mostly French people like Albert Camus, who had lived in Algeria for generations and had now "returned" to France.) Their politics was understandably colored by their experience of having been uprooted from their homes and adopted land by revolution. I learned a lot from all of these people, from their politics, their languages, their experiences, their stories, their families, and even their home-made couscous.

You might be wondering: how did a young scientist have time for this cultural accretion? The short answer is that I didn't work much that year. The longer answer is as follows: I was assigned by the Fulbright organization to the lab of Marianne Grunberg Manago at the Institut de Biologie Physico Chimique. Marianne was a very famous 44-year-old scientist in 1965. She had been a post-doc of Severo Ochoa at NYU and famous for having done the work for which he won the Nobel Prize in

1959. In fact Marianne's enzyme, polynucleotide phosphorylase, won two Nobel Prizes as it was used to synthesize the oligonucleotides used by Marshall Nirenberg to crack the genetic code (1968 Nobel Prize).

Marianne was a very nice but somewhat imperious European professor and totally dumfounded by the assignment of a very assertive 21-year-old Caltech undergraduate to her laboratory. She put me to work with her wonderful technician Jacques Dondon to help make the stock of charged tRNAs for the lab. This preparative work took a full week and was interesting the first week, tolerable for the second but quite boring by the third. Every week I would ask Marianne to give me a proper research project, and she kept responding by saying she would do it "next week." So after 4-5 weeks of this back and forth, I changed my tack. I said, "Marianne, I am going back to graduate school in the United States without question, but I am now having the time of my life here in Paris in other ways. I am seeing and learning things I never imagined existed. I like the lab here and will work if I have a research project but not without one. So if you still don't give me a research project next week as I have been asking, I will stop coming to the lab except once a week to collect my paycheck and to peruse the journals." She never gave me a project, and I stopped working in the lab as previewed. I spent the year doing all these other things in Paris, including learning to speak French well, and I also traveled all across Europe. In the decades that passed, Marianne never mentioned this conflict to me – if I can call it that. She followed my career and proudly saw me as one of her scientific progeny.

In the immortal words of Edith Piaf, "I regret nothing" about my year in Paris. I made dear friends and acquired a life-long appreciation for French culture and the French language. I even benefited professionally because I had a long string of outstanding French students and post-docs who came to Brandeis years later and had a huge, positive impact on my career; it all began I believe with that year in France at the tender age of 21 and with my subsequent quite fluent facility with French. Moreover, I was offered big director jobs 20–25 years later. The offers were flattering and I was tempted, but I was recently married with my current wife, a Chilean who adored the States and was reluctant to change countries once again. Moreover, she convinced me – correctly in hindsight – that I would never be able to navigate institutional politics in a foreign culture like France. There is too much important that is left unsaid, in conversation and negotiation, that only a native can glean, despite excellent language skills. My wife said, "Let me put it this way; if you have had trouble at Brandeis, imagine what this would be like in France."

MIT

I went to graduate school at MIT, which was a great place for me. I decided to work on eukaryotic gene expression in the lab of Sheldon Penman. He was very smart, committed to the lab and a caring mentor. There was also a wonderful collection of students and post-docs in his lab. Notable from that period of time were Bob Weinberg, Hung Fang and Rob Singer. My work went well. I gained confidence and experience, and generated first-rate publications.

MIT was a much bigger, more cosmopolitan place than Caltech, and the late 60s was a more interesting period of time in the United States than the early 60s. Vietnam had polarized the country, MIT was a center of political activity, and marijuana had gone mainstream. I was very engaged in the anti-war movement and considered devoting more time to this political work. I spoke to Sheldon about it, and he told me I would have to change advisors if I wanted to do politics in a way that would interfere with my lab work. Moreover, he said that there were MIT faculty members who would be OK with a less than complete effort to the lab, who were themselves committing considerable time to anti-war activities. Because Sheldon was quite right-wing and in favor of the US military effort in Vietnam, I thought this might have contributed to his inflexibility. So I went to Sheldon's younger colleague David Baltimore for advice. David was anti-war and only six years older than I was, i.e., in some ways my peer. To my surprise at the time, he endorsed Sheldon's viewpoint by agreeing that a PI can insist on the effort that a graduate student should make in his/her lab. And he too suggested I switch labs or agree to pare down my political activities if I wanted to stay working for Sheldon. I respected and was grateful for David's candid opinion, which had a big influence on my decision to remain in Sheldon's lab. My scientific career has almost certainly had more influence than any political contribution I might have made, and I would not be writing this Nobel biography had I not made the decision to remain with Sheldon.

Two anecdotes stick in my mind from my 5 years at MIT; they are both illuminating I suspect. Sheldon and I had the identical old car. When he decided to upgrade and buy a new car, he generously offered me his old one for parts. He knew I

had some experience fixing cars from my Caltech years and so might make use of the gift. I accepted but had another idea in mind. I spent an entire Sunday trying to remove intact his faculty parking sticker so I could affix it to my driver's side window. Failing that, I tried removing his window to replace mine, but that too was problematic. I finally settled on removing my driver's door and replacing it with his door. The only minor problem was that his car was blue and mine was white, so I drove for the next year a two tone car, white with a blue door. (No way was I going to pay to have my car painted to address this minor issue.) To my delight, the parking garage guards at MIT paid no attention to my new two-tone car, and so I parked in the close and prestigious faculty lot for a year. As a testament to habituation, I became more and more bold over the next year and was eventually caught by the police for parking illegally in that lot. Sheldon was ticketed because the sticker was registered to him. He read me the riot act but was secretly amused, I always thought, admiring perhaps of my chutzpa.

The second anecdote was when I – a graduate student – fired one of the technicians in Sheldon's lab while he was out of town. I was working at the hood (fume cupboard) and jostling for space with a technician, who had admittedly been there first. I was in a rush and told her in a rude way that my work was more important. She took offense, not unreasonably, and said something like "I can't work here any longer," to which I responded with an even more offensive remark. She then stormed out and did not return for the rest of the day. It took an hour or two for the reality to hit me, including the fact that Sheldon was due back at MIT the next morning. I had to drive to the technician's apartment that evening and beg forgiveness. She wouldn't open her door for me, and it took 30 minutes of pleading and throwing pebbles against her window to get her to let me in, finally accept my apology and promise not to tell Sheldon the next morning.

A simple, polite summary of both anecdotes is that I had a difficult character. Thank goodness for the permissive, tolerant environments of Caltech and MIT.

Post-doc and Edinburgh

I had planned to go for my post-doc to the wonderful Hogness lab at Stanford, to study *Drosophila* chromosomes, and I wrote and received a Helen Hay Whitney Fellowship to do that. A few short months before leaving MIT however, I had a change of heart. It was catalyzed by meeting a couple of chromosome-nucleic acid researchers from Scotland, Mick Callan and John Bishop, both of whom spent some time in 1970–1971 in Boston. There was also my wanderlust; I thought this might be the last time I would be able to live in Europe, an opportunity I should not pass up. So I inquired about going to Callan's lab in St. Andrews and planned to collaborate with Bishop in Edinburgh at the same time. I wrote the Whitney foundation, which gave me permission to switch. I then wrote to Hogness and honestly explained my decision, including my desire to live for a while in Europe. He wrote me back a handwritten note and was a complete gentleman about the situation. After I became a PI myself, I appreciated even more his graciousness. Not going to his lab had multiple layers of irony: Mike Young went there a few years later, and many of my colleagues and friends were trained in the Hogness lab at the same time as I would have been there, e.g., Ray White, Gerry Rubin and Michael Grunstein to name just a few.

I was not very happy in St. Andrews. It was a lovely town but a bit sleepy after Boston and MIT, culturally as well as scientifically. Callan was an excellent scientist but not very communicative; he did his own work and kept to himself. So, I transferred to the Bishop lab in Edinburgh, which was a more dynamic city and scientific environment. John's lab was an excellent place, and I learned a lot from him as well as from my colleagues in his lab, for example Nick Hastie, Saveria Campo, and Stanley Perlman. There was the Birnstiel lab next door, which had Peter Ford as a post-doc and Adrian Bird and Michael Grunstein as students. I collaborated with Ford during my time in Edinburgh. A couple of hundred meters or so down the road was the Zoology Department with Ed Southern and his laboratory.

Edinburgh and the UK will always have a special place in my heart, and I have life-long friends from my time there, especially Michael Grunstein and his family. The Brits also have a special place in my head. Their educational system and general approach to science was not identical to the way things were done in the US. Simply put, the UK approach was more cerebral whereas Americans are more pragmatic. I would like to think my exposure to the UK way of doing science complemented my American education and natural instincts, which are almost pathologically pragmatic.

Recruitment to Brandeis

I was only about 15 months into my post-doc when Brandeis called me up and asked me to apply for a faculty position. I said it was too early and I wasn't interested, but Harlyn Halvorson, the Director of the Rosenstiel Center at Brandeis persisted. "Just come give us a seminar." Since my mother lived only a few miles from Brandeis, it was an opportunity to visit her too, so I left Edinburgh for a long weekend. I gave a seminar, met with faculty, and they ended up offering me the job I had said I didn't want. It turned out that they had a blue ribbon committee to recommend people for the two molecular biologists they wanted to hire. The chair of that committee was Jim Darnell. He was the mentor of my MIT mentor Sheldon, had known me since the beginning of my Ph.D. there and had kept his eye on me.

The upshot was that Brandeis leaned over backwards to get me to accept the job. They let me stay in Edinburgh for more than 18 months to complete my post-doc. The space, set-up money and teaching conditions were generous. And then to top it off, they offered to pay me my Brandeis salary for the year before I would arrive on campus. Although this turned out to be complicated (I couldn't keep my fellowship while keeping my salary), Brandeis supplemented my salary to bring my total compensation to match an assistant professor salary. This effectively doubled my 1973 salary, from about \$10K to \$20K. My post-doc salary of 10K was already extraordinarily generous by UK standards, especially with the then current dollar to pound exchange rate. To put my 1973 salary in perspective, it was considerably higher than that of my PI Bishop. Moreover, he was a Reader, the equivalent of an Associate Professor, with a mortgage and 3 children, and I was single. One important outcome of all this was that I banked the extra 10K, which was exactly the 25% down payment for the house I purchased in 1975–76 more than 40 years ago. We raised our children in that house and still live there. I therefore owe Brandeis the roof over my head in addition to the shirt off my back and a good fraction of my Nobel Prize.

There is of course more to say, but I am ending this brief biography to coincide with my arrival at Brandeis, when the Brandeis circadian rhythm story began.

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