Women in Biochemistry
by Benjamin Palmer

Introduction 1
Interviews 4
Biographies 31

© Copyright Biochemical Society
Introduction and background

This document details the second half of a 2-part research project commissioned by the Biochemical Society. Biochemistry, as a research discipline, has a rich history, much of which is filled with exemplary women. At the turn of the 20th Century, biochemistry was a relatively new and rapidly expanding field. Later the discovery of DNA added to the excitement of the field.

Why was biochemistry such a fruitful field for women? Perhaps, as it was a new discipline, it was more open, and less entrenched in gender bias than other subjects. Within biochemistry, several research areas were considered, at the time, to be ‘gender appropriate’. Research in so-called ‘domestic’ topics was considered to be more acceptable than others. Many of the women highlighted in this booklet worked in nutrition, endocrinology and reproduction, plants and agriculture.

Additionally, the two World Wars undoubtedly played a role in facilitating the careers of female biochemists. In the UK, during the Second World War, women were required to complete mandatory service, and many of the women featured here began their careers in laboratories during the war. Additionally, with many men away at war, there was more opportunity for women to establish themselves in research.

The first phase of this project was conducted in 2011, in celebration of the Society’s centenary. The Biochemical Society was formed in 1911, but women were not accepted as members until 1913. The second phase was conducted as part of the Society’s ‘Celebrating Women in Biochemistry’ campaign in 2013; marking the 100-year anniversary of the acceptance of women into the Society.
The initial phase of the project was undertaken by Professor Robert B. Freedman, Dr Vicky Long and Professor Hilary Marland at the University of Warwick. Together they produced a website and database of the results of an extensive survey of Biochemical Journal and archive materials.

Available resources include an Access database of all papers from the Biochemical Journal authored by women from the inception of the journal in 1906 until the outbreak of World War II, a guide to archival resources and bibliography.

This second phase of the project summarises the data collected from 35 years of Biochemical Journal archives, published books, institutional archives and obituary and biographical databases. In total, 1757 unique papers, authored by 911 female authors, publishing from over 60 institutions were identified in the time period. Questionnaires were sent to 34 women who conducted research in the UK in that time period, and further in-depth interviews were conducted with 6 women.

There were several barriers encountered along the way. Most notably was the practice of women changing their names after marriage. Furthermore, women authors were identifiable by the fact that their full given names were used in credits on research papers, whilst their male counterparts were identified only by initials. Whilst this was helpful in identifying which papers were authored by women, it is a glaring example of the societal sexism of the time.

The stories told in these pages highlight some of the most exemplary female scientists of the last century. Hopefully their lives will inspire the next century of exceptional female scientists.
What was it like?

The following are first-hand accounts of 9 women who began their careers in biochemistry before 1975. Their stories offer insight into the day-to-day happenings, motivations, hurdles and successes of women working in molecular biology at the time. Each woman’s story is different, and these interviews show the wide range of experiences.

Some stayed in science for their entire careers, some left to do other things; some stayed in the UK, whilst others went overseas. Several had families, and a few did not. Some said their gender impacted negatively on their career, whilst others thought quite the opposite.

The one thing they all have in common, however, is that they persevered in an environment where it wasn’t easy, or expected, for women to climb the ranks in science. They carved their own paths in a male-dominated domain and etched out a spot where they could succeed and do what they loved.

Each one is truly inspirational, and hopefully their stories can shed some light on the issues facing current women in science and perhaps inspire a new generation of women biochemists.

NB: Opinions expressed in these interviews are those of the interviewee, and do not reflect those of the Biochemical Society.
An interview with
Anne Soutar

- **1971** PhD, University of Leeds, UK
- **1972 – 1973** ICI Postdoctoral fellow, Department of Biological Sciences, University of Leicester, UK
- **1973 – 1975** Postdoctoral Research Assistant, Department of Biochemistry, Baylor College of Medicine, Houston, Texas
- **1975 – 1979** MRC Training Fellow, Medical Research Council Lipid Metabolism Unit, Hammersmith Hospital, London.
- **July 1979 – 1993** MRC Scientific Staff, MRC Lipoprotein Team
- **1993 – 2010** MRC programme leader, Lipoprotein Group, MRC Clinical Sciences Centre, Honorary Professor of Molecular Genetics, Imperial College London Faculty of Medicine
- **2010 –** Director of Postgraduate studies (part-time) MRC Clinical Sciences Centre, Imperial College London

**Research area(s):** Lipoprotein regulation and metabolism, Genetics and molecular genetics of lipoprotein disorders.

**What motivated you to go into scientific research?**
“I had a long-standing interest in how things worked in biology.”

**What motivated you to choose your specific field?**
“Bacterial metabolism was a major topic at Leeds, and I moved to Leicester to work with Hans Kornberg on a similar topic. I planned to move to Texas with my husband who had a postdoc position there, and had to find a postdoc position myself - Hans Kornberg organised a position for me with Tony Gotto (his first PhD student) on the enzymology of human lipoprotein metabolism.”
Did you feel you were encouraged, or discouraged to go into science? How so?
“I was encouraged at first at my school which was an excellent academic all-girls school. I was the first university entrant in my family, and was encouraged by my (non-working) mother. My father was worried that I would become a “blue-stocking” and wanted me to follow a secretarial course. After school, entering the gender-mixed environment of my undergraduate degree was a shock when I discovered that I was supposed to be (a) not only inferior, but (b) only playing at science until I got married.”

When you started your PhD, what (roughly) was the ratio of women to men in your laboratory? “Surprisingly during my undergraduate degree at Leeds, 4/12 biochemistry students were women, but only I stayed on for a PhD. In the medical school, numbers of female entrants were still limited to a certain percentage. After that the ratio was much worse, especially in the more medical field I entered - in the early days I was frequently the only woman present at meetings.”

How did you find work after completing your PhD? “I wrote to a major scientist in the field asking for a postdoc position - he applied for an ICI fellowship on my behalf.”

What do you feel was your biggest achievement in your career? “Surviving without an academic mentor”

Who is/was your inspiration or champion for your career? “I don’t really feel I have a champion. My inspiration was my interest in science, my love of doing experiments and my desire to do ‘good research’. I should probably acknowledge Hans Kornberg’s role in my career, although I was only with him for a short time and his support was strictly time-limited. I quote, on asking him for a reference when I was returning to the UK in 1975, he said “Anne, you must remember that references, like fish, do not keep well”.”

At any point do you feel that you were excluded, or denied opportunities because of your gender? “Attending scientific meetings has always been a challenge for me as I never felt part of the ‘club’, especially in the early days when my colleagues were never comfortable with me. When I had young children, it was at a critical time when I should have been attending more international meetings, particularly in the US, but I was unable (or maybe unwilling) to leave the children for more than a day or so.”
How did your career affect your decision to have or not have a family and how did you find a balance? “I waited until I had obtained my first tenured post (at age 37) before having two children. I was established by then, so it was easier to work shorter hours. I took 6 months maternity leave each time and when I returned I always left the lab by 4.30pm. This meant I missed out on the “sitting around and chatting” part of science as I worked very hard while I was in the lab and kept my head down.”

How do you feel attitudes have changed since you first started out? “Women are taken seriously now as scientists - to the point where they forget what it was like for us! I think attitudes towards working women (and men) with children have changed for the better. My husband (also a scientist) used to feel incredibly guilty if he had to leave the lab early for child care duties in the working week - so rarely did them. In my Institute now, this is accepted.”

Do you think there are any other actions that need to be taken to increase participation of women: “I still think that there is a persistent attitude that what counts is the hours you spend in the lab/office rather than what you achieve, which counts against people (men and women) with young families.”

Do you have any interesting anecdotes or stories to tell us about your experience? “I was most angry when Hans Kornberg visited Houston as a distinguished lecturer (because I was there) to give a seminar in my department. One of the senior scientists in the department who was my colleague said to me “Your husband (who worked in a quite separate department) should take this opportunity to talk to Hans about getting a job back in the UK”. No thought that I might want a job.....

I returned to the UK to a small MRC unit that was entirely male except for the secretary, one technician and the person who made the tea. Shortly after my arrival the Director of the Unit arranged a meeting and his secretary produced the programme. All names were shown as initials plus surname except for mine, which had my first name in full. When I asked her why, she said “Oh well, it’s important for the audience to know you are a woman because some people don’t like the sound of a woman’s voice.””
An interview with

Belinda Bullard

1954 – 1957  Natural Sciences, Girton College, Cambridge. BA 1957
1957 – 1958  Harvard University, Biochemistry Program
1958 – 1962  Research Assistant, MRC Biophysics Unit, King’s College, London
             1962  MSc Biophysics, London
1963 – 1965  Departmental Research Assistant, Nuffield Lab Ophthalmology,
             University of Oxford
1970 – 1979  AFRC Unit of Muscle Mechanisms and Insect Physiology,
             Department of Zoology, University of Oxford
             (1978: Principal Scientific Officer)
1978       1978  PhD, Cambridge
             (Principal Scientific Officer)
             1980  EMBO member
             1986  Visitor Dept. of Biology, UCSD, San Diego
1987 – 1988  Fellow, European Molecular Biology Laboratory, Heidelberg
1988 – 2004  Staff scientist, European Molecular Biology Laboratory, Heidelberg
             2004 –  Honorary Visiting Professor, Dept. of Biology, University of York

Research area(s): Biochemistry of muscle contraction

What motivated you to go into scientific research? “I was successful in scientific subjects at school, and the example of my father who was a geophysicist.”

What motivated you to choose your specific field? “An interest in the sliding filament model of muscle contraction which appeared in 1954.”
Did you feel you were encouraged, or discouraged to go into science? How so?
“Encouraged - My headmistress at school wanted me to read classics at university, but my father was against this and encouraged me to read sciences.”

When you started your PhD, what (roughly) was the ratio of women to men in your laboratory? “I already had a tenured position when I got my PhD. The ratio of women to men in the AFRC Unit in Oxford was about 3:7. I was the only female AFRC staff member, the other women were technicians. All the men were staff members.”

How did you find work after completing your PhD? “I wrote to Professor Pringle at the Zoology Department at Oxford. The job was not advertised.”

What do you feel was your biggest achievement in your career? “My discovery that the rapid contractions of insect flight muscle work through a regulatory protein that senses stretch, not changes in calcium concentration.”

Who is/was your inspiration or champion for your career? “Edwin Norris - who taught an evening class in physiology at Kingston Technical College, which I attended before university and Professor Pringle in the Dept. Zoology, Oxford - whose enthusiasm for insect flight muscle was an inspiration. His particular interest in my work led me to make the subject the focus of my career.”

At any point do you feel that you were excluded or denied opportunities because of your gender? “As a woman, I could not be an undergraduate at any of the older colleges in Cambridge. Men in these colleges had many advantages not available at the three women’s colleges. While at Oxford, I had two MSc students. I suggested the subjects and supervised the students, who were in my lab. However, in both cases another person was appointed to be official supervisor. This was nominally because the Board of Studies might not approve me as supervisor, though I think the professor preferred to have men supervising students.”

How did your career affect your decision to have or not have a family and how did you find a balance? “I got married and had one son late in my career. For me, work came first. There was no flexibility in working hours, or possibility of taking long periods of leave and returning to the same job. I hired a nanny for child care.”
How do you feel attitudes have changed since you first started out? “Hugely - Women even have an advantage over men in the job market. Employers allow more flexibility in working hours to fit in with women’s needs. I see no discrimination against women in science now.”

Do you think there are any other actions that need to be taken to increase participation of women? “I think the problem of low numbers of women in the higher positions in science starts in schools. Girls need to be encouraged to study scientific subjects at university. There is still a perception that the arts are more suitable for women, and that is where the bright ones end up.”

Do you have any interesting anecdotes or stories to tell us about your experience? “Men (and some women) tended to assign women a domestic role, even in the lab. I have mopped the floor in the lab when told to by a fellow male graduate student. Before going on a scientific visit to the Zoological lab in Naples, I was asked (by a woman) if I would make curtains for the lab van to hide the equipment. Also, on a lab outing to a restaurant in London, a senior member of staff told me he thought women in science was a bad thing - tactless. I think that when I was young, we women hardly realised how differently men and women were treated professionally.”
An interview with
Gillian Murphy

1964 – 1971  BSc, PhD, post doc Birmingham University Dept of Biochemistry
1971 – 1973  NATO Royal Soc Fellow Max Planck Institute Munich
1973 – 1975  PDRF Strangeways research lab Cambridge

Research area(s): Enzymology

What motivated you to go into scientific research? “I attended a British Association for Advancement of Science meeting for school children, and the discovery of the significance of DNA at about that time.”

What motivated you to choose your specific field? “Chance; it seemed like a healthy mix of my interests in biology and chemistry”

Did you feel you were encouraged, or discouraged to go into science? How so? “No, I think I was just self-motivated”

When you started your PhD, what (roughly) was the ratio of women to men in your laboratory? 1:4

How did you find work after completing your PhD? “I obtained a NATO/Royal Society fellowship in Munich.”

What do you feel was your biggest achievement in your career? “Being an Arthritis Research UK senior Fellow for 10 years and subsequently a Chair at Cambridge University.”

Who is/was your inspiration or champion for your career? “Dr Zena Werb (University of California, San Francisco, USA) and Dr Andrew Docherty (Celltech)”
At any point do you feel that you were excluded or denied opportunities because of your gender? “No, never.”

How did your career affect your decision to have or not have a family and how did you find a balance? “It had a substantial effect; I have no children.”

How do you feel attitudes have changed since you first started out? “Raising children is much more supported now, also there are many more opportunities to return to work after having a family.”

Do you think there are any other actions that need to be taken to increase participation of women? “I think there needs to be more support for child care and provision for the involvement of partners.”
An interview with
Janet Oliver

1965 University of Adelaide, Australia BSc Biochemistry/Zoology
1966 Flinders University of South Australia BSc Hons Biochemistry
1968 University of Alberta, Edmonton, Canada MSc Biochemistry
1971 London University, London, UK PhD Biochemistry
1971 – 1973 Harvard Medical School, Boston, MA Post Doc Cell Physiology
1973 – 1983 Assistant to Full Professor, Departments of Physiology & Pathology,
     University of Connecticut Health Center
1983 – 2013 Professor, Department of Pathology,
     University of New Mexico Health Sciences Center
    July 1 1983 – Professor Emerita

Research area(s):
Mechanisms by which cells receive and transmit signals that enable dynamic and
coordinated responses to external events.

What motivated you to go into scientific research?
“I had an early love of biology, a suspicion of “arts” subjects that seemed too easy, and
a strong desire to avoid ending up in teachers' college. At the end of high school, I had
no experience or counselling that would have led me to think about a career in research.
At the end of my three-year undergraduate degree, it simply seemed logical to take one
more step, the Honour’s year, and after that the next two, the MSc and PhD. The ability
to travel between Commonwealth countries made Canada and England desirable
destinations where I could learn new science while indulging my desire to see the
world. After circling the Commonwealth, I went with some trepidation to the USA to
take the next obvious step, the postdoc. There, I was immediately immersed in the new
field of cell biology. The excitement of being a pioneer in an emerging discipline that
integrated my own field of biochemistry with physiology and imaging, and my early
success in publication and grants, were the main events that opened my eyes to the possibility of an academic career. I had always had contemporaries – all men – who seemed born to be Professors. For me, the possibility emerged from the process of just putting one foot in front of the other through the PhD and then finding my area of passionate interest as a postdoc.”

**What motivated you to choose your specific field?** “I believe that I became a cell biologist and later a systems biologist because these were the emerging and exciting fields and I was present, equipped with the right toolbox, at the beginning of both. I was one of the first to demonstrate that proteins are not distributed at random in cell membranes as then-modern models predicted, but instead occupy specific domains for specific functions. The evidence came from cell fractionation studies that showed that some proteins are selectively included, and others selectively excluded, from the membrane that is internalized during phagocytosis (cell eating), and from fluorescence and electron microscopy studies that showed that specific proteins are predictably redistributed to the front or back (or the centre during cell division) when cells change shape. Pharmacological experiments implicated cytoskeleton–membrane interactions in maintaining both shape and molecular order in the complex membrane. Later work focused on the mechanisms of this heterogeneity and on the roles of membrane reorganization in triggering the responses of immune and cancer cells to external stimuli. As microscopy came of age, I spent more and more time on high resolution and fluorescence electron microscopy, complemented with biochemistry, to understand spatial relationships between receptors and their partners during the activation of cell signalling networks. Much of this work required advanced imaging probes, instruments and analysis tools, leading to productive collaborations with engineers, physicists and mathematicians and, ultimately, to competing successfully to become the first woman Director of a NIH National Center for Systems Biology. I would say I began as a Biochemist, participated fully in the emergence of Cell Biology as its own discipline and had the incredibly good luck to spend my last decade in the still emerging discipline now called Systems Biology.”

**Did you feel you were encouraged, or discouraged to go into science? How so?** “My father was an engineer and encouraged my interest in science. My mother was a school teacher and encouraged any kind of higher education on the basis that educating a woman would educate a family. I attended an all-girls high school, where science teaching was undistinguished but perhaps I benefited from the absence of competition with boys. I took pride in being one of only 3 female undergraduate biochemistry majors
in my year (there had been one in the previous year and none 2 years earlier). Perhaps because of our vanishingly small numbers, we were treated particularly well by the all-male (except for one lecturer) faculty and by the male students. We were not, however, encouraged to become academics. Of the other two girls in my class, one became a teacher, and the other became a lab technician and I took the first step towards a research career by taking an Honour’s year (that serves in Australia essentially as the qualifying year to enter a PhD program) in enzymology.

Outside of the university, there was indeed a great deal of prejudice among the general public in Australia, typically expressed as “why are you occupying a man’s place in the university” and “aren’t there easier ways to get your MRS degree”. I was thus quite amazed by the absence of overt criticism of my choice of biochemistry once I moved first to Canada (MSc in Biochemistry, where I was fortunate to discover the red cell nucleoside transport pathway in a cancer-focused lab) and then to the UK (PhD in Biochemistry where I worked on oestrogen action in the uterus). I encountered no discrimination in Canada (remember I had just come from Australia, so subtlety was lost on me). At the Courtauld Institute, the only overt discrimination was caused by my nationality (Australian – how uncouth!) and not my gender.

I arrived in the USA as a postdoctoral fellow and joined a welcoming lab that included one other woman postdoc and 2 female graduate students. The lab wanted a biochemist to complement existing expertise in immunology and physiology for a project on the cytoskeletal regulation of membrane transport processes and I fit the bill. My mentor at Harvard was perhaps the first to clearly talk to me about my potential to make the next step, to faculty status. His encouragement occurred in the very early 1970s, just as the absence of women in science was becoming a political issue. As a result, I may have been more sought out for interviews and possibly offers than my male colleagues. Once on faculty at the University of Connecticut, I was strongly encouraged to move through the ranks through early grant awards, invitations to give platform talks, study section memberships and other profile-lifting events where organizers suddenly needed a representative woman.

Through these various steps, the question of seeking a position in science in Australia was one I continually deferred. The reason was largely the fear of the old boys’ system. Although this had not been an issue as a student, I was well aware that the sole woman faculty member in my original department was the subject of much gossip and that most of the employed PhD women had soft positions. My own few friends who entered
academia in Australia had to fight for decades to be respected, heard and funded. They deserve far more credit than I do for staying the course!"

**When you started your PhD, what (roughly) was the ratio of women to men in your laboratory?** “My PhD lab in the Courtauld Institute for Biochemistry in the Middlesex Hospital Medical School was all men except for myself and fellow student Patricia Feherty (Dr. Patricia Smith). There were perhaps 10 of us, so 1:5.”

**How did you find work after completing your PhD?** “US medical schools were expanding in the early 1970s and both Physiology and Anatomy departments were moving away from classical whole animal and whole organ structure–function studies into my new field of cell biology. Not many recent PhDs, especially women, were equipped with experience in biochemistry, physiology and imaging, the basis units of cell biology. As a result, I had several job offers at the end of my Harvard postdoc and it was relatively straightforward to move to a tenure-track Assistant Professor position in the Department of Physiology at the University of Connecticut Health Center.”

**What do you feel was your biggest achievement in your career?** “At this late stage, I am proudest of the accomplishments of the last 10 years, where long-nurtured ideas about membrane organization and cell signalling were taken up as the theme of a $15 million National Centre for Systems Biology (NCSB). I took enormous pleasure in positioning the University of New Mexico with Harvard, MIT, Princeton and other top institutions as host to the 10th NIH (National Institutes of Health) National Centre for Systems Biology and I am incredibly proud of the young faculty we hired and the interdisciplinary teams we created. Being the first woman PI (Principal Investigator) of a NCSB was an amazing honour and seeing our young female faculty members succeed and our young female PhD students, moving to strong academic positions has been a joy. My scientific vision from 40 years ago is now being extended beyond my imagination by teams of wonderful young scientists. Not many academics have this much luck!”

**Who is/was your inspiration or champion for your career?** “I was never discouraged from a career in science, but neither was I particularly well-mentored. My postdoc advisor (male) encouraged me to apply for faculty positions, which led to multiple interviews and several job offers. After I moved to the University of Connecticut, a wonderful and eminent senior faculty member at Yale (female) invited my participation in the exciting cell biology community at Yale and provided advice about priorities for young faculty members (especially to focus on my research goals and to realize that...”
my many flattering invitations to committees and study sections were more likely related to new gender representation requirements than my native brilliance). I suspect it was just good fortune that I was not derailed during my student years. I am strongly committed to supporting trainees and young faculty members so that career success is not such a random affair."

At any point do you feel that you were excluded or denied opportunities because of your gender? Women in science need the ability to turn lemons into lemonade. As an undergraduate, I worked each summer in a different lab in the School of Agricultural and Veterinary Sciences in South Australia. Summer positions were highly competitive, but I succeeded three years in a row by reminding the hiring faculty that I would cost only six pounds a week, a great bargain for them compared with hiring a boy at nine pounds a week. Clearly pragmatism trumped feminism in South Australia in 1963.

My only life-altering experience of discrimination occurred at the end of my Harvard postdoc when I became engaged to a Canadian mathematician, then working in Boston, who had a faculty offer at the University of Toronto. This led me to apply for a faculty position at a prestigious biomedical research institute in Toronto. I was initially offered a junior faculty appointment, but was told at the last minute that I should come as a postdoc because my future husband had committed to the University of Toronto. My postdoctoral fellowship from the Leukaemia Society was transferable to Canada and I, by implication, was in no position to negotiate. With the support of my fiancée, I instead took a tenure track position as Assistant Professor of Physiology in the USA. Sadly, he and I ultimately parted ways, but I continue to remember and value his support to confront this blatant discrimination.

How did your career affect your decision to have or not have a family and how did you find a balance? “I have two children, one born immediately after gaining tenure and promotion to Associate Professor in Connecticut (1977) and one following my move to the University of New Mexico (1988). I also have five step children. I learned early that mixing career and children required committing most of my salary to gain excellent day care and household help. In the early years, I focused most of my energy on work and made little attempt to “balance”. I recall spending 4 weeks at home over Christmas with my son and only one week with my daughter. I was not a good PTA (Parent–Teacher Association) mother and still owe multiple schools many hours of parental volunteering. It was long ago, and my children and step-children (and my husband) have forgiven me for neglect!”
How do you feel attitudes have changed since you first started out? “When I began, an anarchic culture reigned where ideas flowed, risks were taken, grants were imperfect and publication was easy. The community of Harvard postdocs in 1971 were convinced that they would not get jobs, but in fact most were in academic positions within 3 years of the first postdoc. As a junior faculty member, I recall little stress over issues of promotion and tenure, of compliance for human and animal research, of safety and monitoring committees. It was fun!

Young faculty members now need much more sophisticated portfolios and presentations to gain interviews and job offers. Many become trapped in multiple postdocs, losing momentum towards independence. Once on faculty, they must follow more rules, reach more milestones, present more preliminary data in grant applications and include as “on-line supplements” to publications, work that would have been a separate paper in my generation. I recall showing my first Nature paper to a young faculty member, who looked at my two-sided report and said “That can’t be a Nature paper!”. I think science is more of a business now, and that more creative fun and fewer compliance committees would be enormously helpful for our trainees and young faculty members.”

Do you think there are any other actions that need to be taken to increase participation of women? “There are many initiatives in the USA and other countries to increase the numbers of women in STEM professions. In biology, over 50% of graduate students are now women, yet the proportion of women faculty member remains low. I believe that senior women must take a deliberate role to address this. It is my observation that any time a woman organizes a meeting or conference, more women are on the programme. When a woman heads a hiring committee, women are more likely to be invited to interview and to receive job offers. Over the years, I have led 10 hiring committees, resulting in 7 female appointments because these were the best applicants. My male colleagues are highly sensitive to the need for more women at all levels, yet they tend to find men to be the best applicants. Women must step up to the plate.”
An interview with

Lynne Jones

1969 – 1972: BSc Biochemistry, University of Birmingham
1972 – 1981: Research Technician, University of Birmingham
1979: PhD, University of Birmingham
1981 – 1987: Research Fellow, Department of Cancer Studies, University of Birmingham
1992: MP, Birmingham Selly Oak

Research area(s):
Inositol phospholipids

What motivated you to go into scientific research?
“My father suffered from mental ill-health and I wanted to contribute towards research that would help to find a ‘cure’ (as I saw it then!) for schizophrenia."

What motivated you to choose your specific field? “I got my first job with Bob Michell, who had MRC funding for a research technician. In reality I was a post-grad researcher.”

Did you feel you were encouraged, or discouraged to go into science? How so?
“Neither. I chose science and maths because I thought it would be good for me rather than because I liked these subjects best.”

When you started your PhD, what (roughly) was the ratio of women to men in your laboratory? 1:3

How did you find work after completing your PhD? “This was no delineation for me. I carried on working with Bob on ‘soft money’ till 1981, by which time I was a Councillor. I then worked part time for 6 years funded by Cancer Research UK.”
What do you feel was your biggest achievement in your career? “Getting the opposite results to those expected which led to progress in understanding the role of inositol phospholipids in the cell membrane.”

Who is/was your inspiration or champion for your career? Dr. Robert Michell, FRS

At any point do you feel that you were excluded, or denied opportunities because of your gender? “Not in science.”

How did your career affect your decision to have or not have a family and how did you find a balance? “It didn’t. I had a good mother!”

How do you feel attitudes have changed since you first started out? “I have not been in science for 26 years, but I think there is greater realization that women are able to take up more senior positions within the scientific community and that science suffers when they don’t.”

Do you think there are any other actions that need to be taken to increase participation of women? “Exposing more female scientists in the media.”

Do you have any interesting anecdotes or stories to tell us about your experience? “Only how blasé we were about radioactivity (it was thought amusing when a rat that had been injected with $^{32}$P escaped and peed all over the lab). Until one student managed to contaminate her film badge so badly that everyone else’s film badge was also contaminated. Fortunately it was only $^{32}$P and her body scan was normal!”
An interview with

Pauline Harrison

1943 – 1944:  Chemistry, Physics, Maths, Edinburgh University
1944 – 1948:  Chemistry, Somerville College, Oxford
1948 – 1952:  Research Assistant and PhD, Oxford
1952 – 1955:  Nuffield fellow, King’s College, London
1955 – 1991:  Independent researcher and lecturer

Research area(s): Protein structure and iron metabolism

What motivated you to go into scientific research? “I was interested in chemistry and biochemistry from the age of 12. My parents were both botanists, but my mother did not pursue a career after marriage, which I thought was a pity. I had the shining example of Dorothy Hodgkin, my tutor at Somerville, of a woman who successfully combined academic work and family. I just wanted to investigate proteins.”

What motivated you to choose your specific field? “I started work on ferritin structure as part of my doctoral work. At King’s I worked on poly-proline and collagen, but wanted to return to ferritin.

After moving with my husband to Sheffield in 1955, I managed to get research grants for work on ferritin (MRC and later the Wellcome Trust). Ferritin provided both an interesting structural study and a challenge to understand its mechanism of iron storage, which involved knowledge of inorganic chemistry.”

Did you feel you were encouraged, or discouraged to go into science? How so? “My father thought that chemistry was not a suitable subject for a girl (it would lead only to school teaching), but my mother supported me and I was determined.”
When you started your PhD, what (roughly) was the ratio of women to men in your laboratory? “About 1:2, perhaps more, but I was in a female-led lab with Dorothy Hodgkin. When I worked in the Dyson Perrins laboratory in Oxford, I was one of a very small number of women working on organic chemistry.”

How did you find work after completing your PhD? “I got a Nuffield Fellowship, which essentially was arranged between my supervisor, Dorothy Hodgkin, and John Randall at King’s.

What do you feel was your biggest achievement in your career? “Determining the structure of ferritin and going a long way towards understanding its iron storage mechanisms. Much of this achievement is thanks to a great deal of support from PhD students, post-doctoral fellows and collaborators.

Who is/was your inspiration or champion for your career? “Dorothy Hodgkin, University of Oxford (for protein structure) and Sam Granick, Rockefeller Institute for Medical Research (for iron metabolism).”

At any point do you feel that you were excluded, or denied opportunities because of your gender? “My husband got an appointment at Sheffield University in 1955 and I had to move, giving up the opportunity to work with Bragg at the Royal Institute. There was no protein crystallography at Sheffield and very little crystallography of any sort, so no group I could join and no academic posts available. Luckily I managed to get my own research support (salary and equipment etc.) and a place in the biochemistry department to pursue it. Some members of staff were hostile but most were supportive.”

How did your career affect your decision to have or not have a family and how did you find a balance? “I always wanted to combine career and family. When I had my 2 babies I was being supported by the MRC who gave me 2 months leave of absence each time. I lived near the university so could come home to breast feed etc. I could do some of my research in the evenings but it was a struggle.”

How do you feel attitudes have changed since you first started out? “Combing family and career has become more acceptable, although it is not easy. Some male prejudice still exists - and some female.”
Do you think there are any other actions that need to be taken to increase participation of women? "Organizations like AWISE (Women in Science, Technology, Engineering, Mathematics and Medicine Network) are helpful. Women themselves must be quietly determined (not aggressive) and not take “no” for an answer! Also, recognised periods of leave are important."

Do you have any interesting anecdotes or stories to tell us about your experience?
“Looking for a position in Sheffield after 3 years as a post-doctoral fellow in London, I approached the head of the Chemistry Department. He said “There might be a studentship. I suppose you are looking for pocket money?” I said “No, that’s not my idea”. Later in the Biochemistry Department when I became pregnant, the head told the MRC that I would not need my grant anymore. I told them I intended to continue and luckily the MRC supported me.”
An interview with

Ruth Itzhaki

BSc Physics, London University
MSc Biophysics, London University
PhD Biophysics, London University
Postdoc Radiotherapeutics, Cambridge University
Holder of Beit Memorial Fellowship in Medical Research and
Wheldale Onslow Memorial Fellowship, Newnham College Cambridge
Patterson Laboratories (Cancer Research), Christie Hospital, Manchester,
Molecular Neurobiology Laboratory,
Department of Optometry and Neuroscience, UMIST
Faculty of Life Sciences, University of Manchester

Research area(s): Role of viruses in Alzheimer’s Disease

What motivated you to go into scientific research? Extreme interest in seeking and finding answers to interesting and totally original questions - and the great excitement of making the occasional discovery. (What other reasons could there be?)

What motivated you to choose your specific field? “I chose it because nothing whatsoever was known about the causes of the disease and there were and are several strong arguments that support a role for a certain virus. At Paterson Labs, topics (for all the researchers there, not just me) were to some extent selected according to the whims of the then Director, who based his decisions on the funding bodies’ current fashions.”

Did you feel you were encouraged, or discouraged to go into science? How so?
“T was greatly encouraged by my school (St Paul’s Girls’ School, London) which was highly academic, and by my parents, who wanted me to have as good an education as possible - and wanted me to be happy in my work.”
When you started your PhD, what (roughly) was the ratio of women to men in your laboratory? “Probably very roughly 1:3 or 4.”

How did you find work after completing your PhD? “I moved to Cambridge (after I got married to a researcher working there) and my PhD supervisor recommended me to the professor of a relevant department in Cambridge.”

What do you feel was your biggest achievement in your career? “Finding very good evidence for a role for the virus HSV1 (in conjunction with a genetic factor) in Alzheimer’s disease and, much earlier, helping to elucidate the structure of chromatin (though, alas, the latter has never been acknowledged, and the former is regarded as heresy by some in the field!).

Who is/was your inspiration or champion for your career? “Marie Curie”

At any point do you feel that you were excluded, or denied opportunities because of your gender? “I think that women on the whole are less confident than men and so they and their work are sometimes taken less seriously or are ignored by some men.”

How did your career affect your decision to have or not have a family and how did you find a balance? “Luckily, the cost of a nanny in Manchester was less than in other areas so we were able to afford a full-time one while our children were of preschool age, and so I was able to continue my work full-time. Nonetheless, it was extremely difficult to manage, with no decent nursery schools, and even more difficult when the children (twins) went to school, as there were always crises, and there were then no after-school activities, let alone mobile phones and other aids! One needed the constitution of an ox to do two jobs.”

How do you feel attitudes have changed since you first started out? “There are far more facilities for helping and encouraging mothers to work if they wish, and a far greater likelihood of support - and of promotion. The concept of a woman leading a research group is now totally accepted; then it seemed strange or unlikely to some people.”

Do you think there are any other actions that need to be taken to increase participation of women? “The main problem is for both partners to find a job in the same town, and unfortunately, I can’t see how that can be overcome for those who are doing practical/lab research work.”
An interview with
Susan Manley

1969 – 1971:  Foundation Scholar Queens University, Belfast
1971:  BSc (Hons) Queens University, Belfast
1974:  PhD, Bristol University with Professor Sir Philip Randle
1986 – 1999:  Biochemist Diabetes Research Laboratories, Nuffield Department of Clinical Medicine, University of Oxford with Professor Robert Turner
1997:  University Research Lecturer Diabetes Research Laboratories, Nuffield Department of Clinical Medicine, University of Oxford
1999 – 2002:  Biochemist, Diabetes Trials Unit, Nuffield Dept of Clinical Medicine, University of Oxford with Professor Rury Holman
2002:  MRCPath Member of Royal College of Pathologists by submission of published works, awarded retrospectively from 1999
2002:  HPC state registration Clinical Scientist, Council for Professions Supplementary to Medicine (CB Clinical Biochemistry CS3443)
2003:  Clinical scientist Department of Clinical Biochemistry, University Hospitals Birmingham NHS Trust
2004:  Honorary senior lecturer University of Warwick
2007:  Honorary senior research fellow University of Birmingham
2007:  FRCPath Fellow of Royal College of Pathologists

Research area(s): Diabetes

What motivated you to go into scientific research? “A brilliant, motivated, up-to-date biology teacher and chemistry department who left me to my own devices for an A-level chemistry project on chromatography at a girls only grammar school. Subsequently working with two stellar professors — Prof Sir Philip Randle at Bristol University during my PhD on insulin secretion from islets of Langerhans and Professor
Robert Turner at Oxford University when biochemist in a multi-disciplinary team for UK Prospective Diabetes Study.”

What motivated you to choose your specific field? “On looking for a PhD post, Clifton in Bristol was more appealing than other places after living in troubled Belfast.”

Did you feel you were encouraged, or discouraged to go into science? How so? “Encouraged as science was fashionable and exciting in the 70s.”

When you started your PhD, what (roughly) was the ratio of women to men in your laboratory? “About 1:2”

How did you find work after completing your PhD? “I worked as a research assistant for 1 year in the laboratory in Bristol, and then had 7 years off looking after our 2 children in Bristol and Cheltenham. There were no opportunities for research in Cheltenham so I did a PGCE. I taught for 18 months in a girls’ school which I enjoyed and which was most valuable for my career as I gained skills not available in the laboratory. We then moved to Oxford because of my husband’s career and I found a part-time laboratory position in the Biochemistry department at Oxford University with Prof Eric Newsholme who had also been a PhD student of Prof Sir Philip Randle.”

What do you feel was your biggest achievement in your career? “Being biochemist for the UK Prospective Diabetes Study, the leading clinical trial on treatment of Type 2 diabetes and internationally renowned. It was subsequently awarded the Banting and Best medal by the American Diabetes Association. Also, being the author of one of most cited papers on diabetes in the British Medical Journal which contains a figure relating HbA1c, a marker of glycaemic control, to the complications of diabetes that regularly appears in presentations on diabetes.”

Who is/was your inspiration or champion for your career? “Myself, plus encouragement from my husband, who was a publisher of scientific journals and text books in the various places where we lived and now works for the media.”

At any point do you feel that you were excluded or denied opportunities because of your gender? “Yes because the higher echelons of science and academic positions are difficult to access especially if you work across different disciplines.”
How did your career affect your decision to have or not have a family and how did you find a balance? “I was lucky to be able to juggle 2 children and 3 grandchildren plus a career and am still getting academic work accepted for our flagship NHS hospital in Birmingham by international diabetes journals and academic meetings plus research grants.”

How do you feel attitudes have changed since you first started out? “There are many more highly paid managers and less recognition of the need for scientific skills, though the balance may be changing now.”

Do you think there are any other actions that need to be taken to increase participation of women? “Yes, but I am not sure what. You need to ask younger scientists! Perhaps my strategy has been to carve out a pathway and enjoy my work. Out of myself and my 4 sisters, I am the most highly qualified, but the worst paid! I think that it would be easier for more scientists in this country, men and women, to get recognition at the highest level based on their achievements if different measures were used to assess their careers. So, you have to be very good at science and immerse yourself in it. Otherwise, you might end up unhappy. However, I would not have changed my career pathway, which has developed in a way that I could not have imagined when I started out! Ideas matter most in research - also in my case a multidisciplinary approach with epidemiology, medicine, statistics and people skills required.”

Do you have any interesting anecdotes or stories to tell us about your experience? “I feel quite sad that people who give top international lectures or such like may have had to immerse themselves so much in science that other areas of their lives have suffered.”
An interview with
Valerie Galton

1955: BSc in Physiology, University of London (Bedford College)
1958: PhD in Biochemistry, University of London
1959–1961: Milton Research Fellow in Medicine, Harvard University
1961–1963: Instructor in Physiology, Dartmouth Medical School, New Hampshire, USA
1963–1967: Assistant Professor in Physiology, Dartmouth Medical School
1967–1975: Associate Professor in Physiology, Dartmouth Medical School
1975: Professor in Physiology, Dartmouth Medical School

Research area(s): Thyroid endocrinology

What motivated you to go into scientific research? “An innate love of science and investigation, and the encouragement of my College professors and especially my PhD advisor, Dr Rosalind Pitt-Rivers, PhD, FRS.”

What motivated you to choose your specific field? “As an undergraduate, endocrinology was always my favourite area of physiology. Then I was invited to do a PhD with Dr Pitt-Rivers and she had just discovered 3,5,3’-triiodothyronine, which is now recognized to be the active form of thyroid hormone. But we did not know that then and we also knew very little about the mechanism(s) of action of the hormones, so it was a very exciting area of research to me and I was determined to continue with it.”

Did you feel you were encouraged, or discouraged to go into science? How so? “My father was a lawyer and was happy for me to do whatever I wanted until I married. He retained the view that married women should not work! My mother had the same view. However, once out of that environment I felt nothing but encouragement, especially from the man who became my husband, and my two main mentors.”
When you started your PhD, what (roughly) was the ratio of women to men in your laboratory? “It was not a big lab. The leader, Dr Rosalind Pitt-Rivers was obviously a woman and she had both a female and a male research assistant. I was the only other woman in the group. However, we had many visitors who came for varying lengths of time to do research and learn techniques. A rough guess would be a 2:1 male:female ratio.”

How did you find work after completing your PhD? “During 1957, I became acquainted with Dr Sidney Ingbar, who was on sabbatical leave from Harvard Medical School and spending it doing a thyroid project at the National Institute for Medical Research in London where I was based. He and I spent a lot of time discussing research and came up with an exciting project. He asked me to come to the US to carry out the project, which I did.”

What do you feel was your biggest achievement in your career? “Probably determining the critical importance to normal development of the three deiodinase enzymes (D1,D2,D3) that metabolize the thyroid hormones. We then went on to clone the three enzymes and make mice deficient in one, two or all three of these enzymes (knock-out mice), in order to define their roles in thyroid hormone action.”

Who is/was your inspiration or champion for your career? “Dr Rosalind Pitt-Rivers and Dr Sidney Ingbar”

At any point do you feel that you were excluded, or denied opportunities because of your gender? “Never. To the contrary, a number of opportunities were offered to me most likely because I was a woman. If I felt that this was the case, I would invariably decline.”

How did your career affect your decision to have or not have a family and how did you find a balance? “It didn’t. In fact I became a widow when my two boys were 6 and 4. It becomes a question of being efficient, and prioritizing. When home I was focussed totally on the boys and when in the lab I focussed on my research and teaching. I think living in a safe, relatively rural environment where I was only 5 minutes from home and my kids could walk to school helped a great deal. Nevertheless my kids’ welfare came first.”
How do you feel attitudes have changed since you first started out? “I happen to be in an institution that has always done well by women. When I came in 1961 there were three women in the department’s faculty of ten. Although there is a lot of pressure to hire women faculty members, in my view hiring the best possible recruit available should be the goal; if that is a woman, all the better. Otherwise, so be it. The American Thyroid Association has increased the percentage of female members from 5% in the late 80s to more than 35% now. When I came to Dartmouth, the College was all male and there was one female medical student in a class of twenty. As of now, both the College and the Medical School has roughly equal numbers of male and female students.”

Do you think there are any other actions that need to be taken to increase participation of women? “Probably, but I cannot think of them. In many respects I think there is too much pressure on the issue right now. At least some of us are not interested in being recognized solely on the basis of gender. I also think that time is and will continue to take care of the gender issue; at least in the US. I look at my three granddaughters, currently 22, 8 and 6. It is quite evident that they do not look at the future, worrying that females are somehow going to find it more difficult than males to have a career. Lack of self-confidence in their gender is clearly not something that is in the forefront of their minds. In fact, my grandson has commented that it could end up being harder for him than for the girls!”

Do you have any interesting anecdotes or stories to tell us about your experience? “A few years ago, in an article written about a female faculty member in Dartmouth’s College of Arts and Sciences, a comment was made that she was the first women to be made a full professor at Dartmouth. Clearly in their research, they had not included the Medical School as it had three women promoted to full professor before this one.”
Antoinette Pirie 1905–1991
(née Patey)

Antoinette was born in London to William and Florence Patey, who owned a pharmacists shop on Bond Street. She went to school at Wycombe Abbey School, where she credits her chemistry teacher for inspiring her to pursue a career in chemistry, before studying natural sciences at Newnham College at Cambridge, achieving a first-class honours degree in 1938. She stayed at Cambridge and studied for a PhD, researching vitamins, under Sir Frederick Gowland Hopkins; which she was awarded in 1933. She married Norman Wingate Pirie, himself a biochemical graduate student at the time (they both received their PhD on the same day) and had two children.

Tony (as she was known) began her career in New York with Dr. Karl Mayer. At the break of World War II, she returned to the UK and joined the Imperial Cancer Research Fund's Mill Hill laboratories, researching the effect of poison gases on the cornea and how to protect it from injury. She worked under Ida Mann, whom she accompanied to Oxford in 1942 as her assistant. Together they published The Science of Seeing in 1946, reportedly to refute Aldous Huxley’s book The Art of Seeing. In 1947 she succeeded Ida and became a reader in ophthalmology at the Nuffield Laboratory of Ophthalmology at Oxford Medical School, a controversial appointment as it usually went to a clinician. She researched the biochemistry of diseases of the eye, working closely with Ruth van Heyningen. The two authored a book, Biochemistry of the Eye, in 1956 – a text which stimulated much research in the field.

In 1962 she hosted a symposium at Oxford; “Lens Metabolism in Relation to Cataract”. This spurred the founding of the International Society for Eye Research, the committee of which she was chair from 1968–1972. She also edited the Xerophthalmia Bulletin until 1985, an effort which took a great deal of her time.
Tony's main area of interests was cataract, a major cause of blindness. A common thread through her research was vitamin A, a greatly important vitamin in eye health. One of her most notable achievements was the discovery that damage to the cornea brought about by a deficiency of vitamin A, was swiftly reversed by its restoration. She became increasingly concerned about blindness, and how easily it could be prevented with vitamin A. After her retirement from Oxford in 1971, she was approached by the Commonwealth Society for the Blind to consult on a project in India, which aimed to prevent Xerophthalmia (blindness due to nutrition). In this vein, she made several long trips to India, and set up a nutritional centre where she would teach mothers how to include enough vitamin A into their food.

She was also an ardent supporter of the Campaign for Nuclear Disarmament, and spent a great deal of her spare time educating herself on the radioactive hazards of nuclear explosions. In 1957, she, along with eight other scientists, published the book Fallout; Radiation hazards from nuclear explosions in the aim of publicizing the dangers which the government had been trying to conceal.

In 1968, Tony was the first woman to be awarded the Proctor Award (for excellence in the field of ophthalmology), and in 1990, she received an award from the International Association for the Prevention of Blindness for her work in India.

Her work often aligned itself well with that of her husband, also a biochemist, both of who's research often focused on furthering the welfare of mankind. N. W. Pirie worked tirelessly for years on the extraction of a protein from otherwise unused leaves which could serve as a cheap and beneficial source of nutrition in the developing world. This extract turned out to be an excellent source of beta-carotene, a precursor to vitamin A.

Tony was described as a caring and strong woman, with conviction, determination and the dedication to further the causes she believed in.

References


University of Oxford Medical Sciences Division (2014) *A Brief History of the Nuffield Laboratory of Ophthalmology* [Online]. Available at http://www.eye.ox.ac.uk/nlo-about/nlo-history (accessed 9 September 2014)

Barbara was born in Lancashire, eldest daughter of Thomas and Gladys. Her father was a schoolmaster. She attended Blackburn High School for Girls and Queen Mary School. Barbara knew from the young age of 10 that she wanted to be a chemist, after visiting a chemistry laboratory with her father.

She attained a BSc in biochemistry from Edinburgh University in 1957, the same year she married George Mawer, a clinical pharmacologist. She stayed at Edinburgh to complete a PhD under the supervision of Guy Marrian, which she completed in 1961, studying the metabolism of cholesterol. She worked as assistant lecturer in biochemistry at Edinburgh from 1958–1963, after which she took a few years off to care for her children.

In 1967, she began to pursue a career in research in earnest; starting as a Research Associate to William Stanbury at University of Manchester. Here she studied vitamin D metabolism, and metabolic bone disease. Together, they were the first to link renal disease with disorders of the bone by showing that those with renal disease were unable to make the hormonal form of vitamin D, which controlled the absorption of calcium.

Barbara was well-respected and acknowledged accordingly. She became senior research fellow at Manchester in 1974 and then north-west regional health authority senior research fellow in 1983. This was followed by a readership in 1993 and professorship of bone and mineral metabolism in 1995. After Stanbury’s retirement, she applied for funding from the MRC, but was denied as they had no record of her (all the previous funding had gone to Stanbury directly). She overcame this obstacle with grit and determination, and later received much success in funding. She went on to do remarkable research with her colleague Mike Davies. Together they were the first in the UK to show discernible differences in the macrophages of patients with pseudovitamin D deficiency rickets, and created an assay for vitamin D metabolites.
She served as secretary and then president of the Bone and Tooth Society and was deputy-director of the Bone Disease Research Centre at Manchester. Her efforts were recognised by a career achievement award at the 11th International Vitamin D Workshop in Nashville in 2000. Outside of the laboratory, Barbara was very active in local politics, concerned with education, the environment and personal rights. She was also a leader and role-model for women scientists. She was described as elegant, quiet and unassuming. Her firm, no-nonsense style was feared, but balanced by an excellent sense of humour, and unconditional support.

References

Women in Biochemistry 1945–1975

Brigitte ‘Ita’ Askonas 1923–2013

Born in Vienna to Czech parents, Ita (as she was known) and her family left Austria after the Nazi occupation and annexing, eventually ending up in New York and settling in Canada in 1940. Her father and uncle owned knitting mills and her mother studied fine art.

She studied for two years at Wellesley College in Massachusetts before doing a degree in Biochemistry at McGill University in Montreal, Canada where she also later gained an MSc.

Brigitte had a wide-range of interests and found it difficult to decide which area of science to study. She attributes her decision to study biochemistry to the influence of a single person, David Lansborough Thomson. He was a Professor of Biochemistry and the Dean of Sciences at McGill, and Brigitte was enamoured with his teaching style and sense of humour.

Her first post was also at McGill, researching the biochemistry of dementia at the Allan Memorial Institute of Psychiatry (an appointment which she claims was given based on her unrestrained laughter at a comic on Dean Thomson’s desk). In 1949 she moved to Cambridge to do a PhD in muscle enzymes under Malcolm Dixon. After being awarded her PhD, she moved to the National Institute of Medical Research, where she remained until retirement in 1988.

At Cambridge, she described Margaret Stephenson and Dorothy Needham as her role models and personal influences, teaching her “good science gets recognition regardless of the sex of the scientist”. Having begun her PhD in muscle enzymes, she moved to immunology through the desire to find a new way to simulate protein synthesis, via antibodies. It was then that she met her long-time mentor, John Humphrey. He was encouraging, supportive and scientifically generous. Brigitte became utterly fascinated by immunology, but credited her biochemical training for influencing her experimentation and critical analysis of results.
At the NIMR, she worked with John H. Humphrey to develop the immunology departments and became head of the division of immunology in 1976. She spent most of her career studying antibodies and B-cell triggering. In 1976, she changed direction and began studying pathogens. She encouraged such a shift at some stage of a career, saying that it was ‘refreshing and intellectually stimulating’. She published over 200 papers in her career, one as recently as 2012. Her research laid the groundwork for international research efforts into a great many infectious diseases including HIV, TB and influenza.

She was vice-president of the Royal Society from 1989–1990 and became a visiting professor in the Department of Medicine and Immunology at St Marys Hospital Medical School from 1989–1994 and Immunology at Imperial College London in 1995.

She was awarded the Feldberg Foundation Prize in 1973, giving a lecture in Antibody Diversity and Clonal Dominance. She was a founding Fellow of the Academy of Medical Sciences; and an honorary member of the American Society of Immunology, of the Société Française d’Immunologie and of the Deutsche Gesellschaft für Immunologie. In 2007 she was made a foreign associate of the United States National Academy of Sciences and awarded the Koch Foundation’s Robert Koch Gold Medal.

Brigitte was most known for her ability to inspire and profoundly influence. Many of her students moved on to become leading professors in immunology, and she is credited as influencing several Nobel Prize winners. In addition to her contributions to the field of immunology, her legacy is noted as having mentored so many scientists who went on to become leaders themselves. Her influence, and the degree to which she was beloved in the scientific community, was exemplified by the droves of her scientific ‘offspring’ who could be found around her home in the last months of her life, preparing meals and working in the garden before she passed away at the beginning of 2013.

References


Daphne was born in India, where her father was a colonial administrator. As a young child in India, she developed an interest in plants and fauna and a love for travel. She returned to the UK to board at Perse School in Cambridge, and then attended Kings College, London where she read for a BSc in chemistry and an MSc in botany. She went on to complete a PhD in botany at University of London’s Wye College, researching plant growth regulators. She was married briefly in her youth, but dedicated herself to her career. After her PhD, she was awarded a Fulbright Scholarship and travelled to California Institute of Technology (Caltech) to join their biology department. There she worked with Frits Went, the pioneer of plant hormone research. This trip was the first of many during Daphne’s career, which included posts and fellowships in USA, Argentina, Nigeria and Israel, amongst many others.

Daphne returned to the UK in 1952 and joined the Agricultural Research Council (ARC) Unit of Experimental Agronomy at the Department of Agricultural Science at Oxford University. At this time, the majority of Daphne’s work focused on selective herbicides, especially auxin, but she also conducted research on chemical promoters of the seasonal abscission of leaves.

When the unit closed in 1970, she was offered the position of deputy director at the new ARC Unit of Developmental Botany at the University of Cambridge. At Cambridge, she became the first female fellow of Churchill College, and also supervised the first female PhD student at the college. When this unit closed in 1978, she moved to the AFRC (the ARC changed their name to Agriculture and Food Research Council) Weed Research Organization at Begbroke. She remained there until 1985, and gained a senior position in the British Civil Service, deputy chief scientific officer.

She retired from civil service in 1985 as was obligatory at aged 60, but a ‘restful’ retirement was not an option for someone so driven and passionate. She went on to become a visiting professor at Oxford, as well as joining the Open University as an honorary...
research fellow. In 1988, she organised the NATO Advanced Research Workshop in Turin, Italy on cell separation processes in plants. She travelled extensively and received many visitors, as she did throughout her career, and in 1991, she moved to the Open University’s Oxford research laboratory, and remained there until her death in 2006. Here she began working on an interesting 2-stage abscission process in the fruits of oil palms. Working on tropical plants in England was no small feat, but Daphne received regular air shipments of materials through her sponsor, Unilever.

Daphne was known to diversify her research interests and used collaboration as an opportunity to learn new skills. Across her over 50-plus years of research, she worked on a wide variety of areas in botany. She helped promote ethylene as a natural regulator in plants, dispelling the commonly held view that it was a pollutant, or by-product. Further work focused on seed viability in relation to DNA degradation and repair. She even developed a project for the European Space Agency’s Spacelab programme on the effects of gravity on cell elongation. She was perhaps best known for what was called the ‘Osborne concept of target cells’, cells in specific positions in plants that were particularly sensitive to endogenous regulators. She published a book on this topic with Michael McManus in 2005; *Hormones, Signals and Target Cells in Plant Development*.

Daphne published over 200 papers during her career, and her outstanding work was acknowledged with several awards and accolades. She received an honorary professorship at Kiev University, an honorary research fellowship from Somerville College, Oxford; doctorates from the Open University and the University of Natal (in South Africa) and the Sircar Memorial Gold Medal for Research in Physiology from the University of Calcutta. She was elected a corresponding member of the Botanical Society of America and in 2008, the Annals of Botany published a commemorative issue in her honour. Daphne was described as having a “wonderful intellectual style” and a “proclivity for remarkable and perceptive experimental findings”. Her career can only be described as legendary. On her deathbed, she was still editing papers and discussing on-going projects. She was an excellent teacher and supervisor and her expertise was sought out world-wide, owing to her seemingly never-ending source of inventive experiments and ever-curious mind.

**References**


Dorothy Mary Needham 1896–1987
(née Moyle)

Dorothy was born in London; one of 4 children of John Thomas, a patent clerk, and Ellen Daves Moyle. She was educated privately at Claremont College, Stockport; a school which was run by her aunt. In 1915 she attended Girton College at Cambridge, receiving her bachelors degree in 1919. It was here that she became interested in chemistry and biochemistry after attending lectures by Frederick Gowland Hopkins. Upon graduating, she received a grant from the Department of Scientific and Industrial Research, and began research in Hopkins’ lab at the Sir William Dunn Institute of Biochemistry, Cambridge. This was fortunate because Hopkins’ was a man she admired greatly, and one of the few at the time who would accept women for research positions. Hopkins encouraged her research in the biochemistry of muscle contraction and she excelled in it. In 1924 she received the Gamble prize for an essay on the structure, function, and chemical constitution of different types of striated muscle. From 1925–8 she was a Beit memorial medical research fellow and she gained her PhD in 1926.

In 1924 she married Joseph T. M. Needham, also a biochemist. They rarely collaborated on their research, but their relationship was very close.

From 1928–1940, Dorothy lectured extensively not only at Cambridge, but all over the world, including America, France and Belgium. Her most important research work dates from this period when O. Meyerhof, O. Warburg and she independently elucidated the chemical changes in the breakdown of glucose to ATP.

Like many other scientists of the era, her research was disrupted during World War II, and she worked at the Ministry of Supply in the chemical defence group from 1940–1943. Here she worked on the effect of mustard gas and other chemical weapons on skin and bone marrow metabolism. During this time she was also a member of the committee of the Biochemical Society (1941–1943). In 1944 she travelled to China to accompany her husband who was appointed as the scientific councillor at the British Embassy. Here she served as
the vice-president of the Sino-British co-operation office. During her time in China, Dorothy contracted tuberculosis, and suffered a slow and protracted recovery. She had barely recovered when she returned to the Sir William Dunn Institute at Cambridge in 1945. Upon her return she was awarded her ScD degree from Cambridge. In 1948 she was elected a Fellow of the Royal Society, making the Needhams the first married couple of Fellows (Joseph had been appointed in 1941) since Queen Victoria and Prince Albert.

Dorothy held excellent academic distinction at Cambridge, but she never held a pensionable post. She was very successful in getting research grants, however. The Medical Research Council gave her a grant for work on enzyme biochemistry from 1946–1952. From 1952–1955 she received a grant from Cambridge’s Broodbank Fund. When that ran out, she tried to get funding from the Royal Society, but despite being a Fellow, she was declined, apparently because President at the time didn’t believe that married women needed a salary. From 1955–1962 she received a grant from the Agricultural Research Council for research in smooth muscle and also a Foulerton gift donation. In 1963 she received a Leverhulme award, after which she retired.

After her retirement, Dorothy barely slowed down. She spent several years working on her book _Machina carnis: The Biochemistry of Muscular Contraction in its Historical Development_ which was published in 1971. This book formed an authoritative history of the research in muscular contraction from as far back as 1600. It was reissued in 2009, and is still considered a formative text on the topic. She also collaborated with the Royal Society to organise the first symposium on the chemistry and physiology of smooth muscle. Before her death, she was working on co-authoring _Sourcebook in the History of Biochemistry: 1740–1940_ with Mikuláš Teich, which went on to be published in 1991.

Dorothy held a number of fellowships at Cambridge. She first became fellow of Lucy Cavendish College (which she helped establish) in 1965, followed by an honorary fellowship at her alma mater, Girton College, in 1976. She also had the distinction of being the first woman to be admitted to Gonville and Caius College where her husband was master.

Dorothy was loved by all those around her. She had a love for painting and travelling, and it was said that she was kind, warm and patient, with a keen intelligence and a strong mind. She was highly influential in the Cambridge laboratory she spent most of her career in, and many of her students went on to become distinguished professors and researchers themselves.

References


Haines, C.M.C. (2001) _International Women in Science: A Biographical Dictionary to 1950_, Santa Barbara, ABC-CLIO. Available at [http://books.google.co.uk/books?id=HftdjMNDwvlC&pg=PA222&lpg=PA222&dq=Dorothy%20Needham%20Prince%20Albert&source=bl&ots=c7gXtnFH0QYj&sig=brSf_y8FHA1TnzwDx441NTCvKVA&hl=en&sa=X&ei=f500JVIkJm144n6h4n6gMAC&ved=0CCMQ6AEwAQ#v=onepage&q=Dorothy%20Needham%20Prince%20Albert&f=false](http://books.google.co.uk/books?id=HftdjMNDwvlC&pg=PA222&lpg=PA222&dq=Dorothy%20Needham%20Prince%20Albert&source=bl&ots=c7gXtnFH0QYj&sig=brSf_y8FHA1TnzwDx441NTCvKVA&hl=en&sa=X&ei=f500JVIkJm144n6h4n6gMAC&ved=0CCMQ6AEwAQ#v=onepage&q=Dorothy%20Needham%20Prince%20Albert&f=false) (accessed 9 September 2014)
Elizabeth was born in Marylebone, London. She was an only child, her father owned a zinc and plumbing business, and her mother had been a ladies maid before marrying. Little is known about Elizabeth’s early days. She joined the Women’s Royal Naval Service (Wrens) at 19, when World War II broke out. After her service she attended Queen Mary’s College, and received a BSc in chemistry. In autumn of 1955, Betty (as she was known) joined the National Institute for Medical Research at Mill Hill in Rod Porter’s laboratory. It was a new group, consisting only of Betty, Porter and two technicians. They were joined, for a time, by American immunochemist and protein biochemist John Cebra. Betty worked with Porter for the entire duration of her career and they had an excellent working relationship. She moved with Porter to St Mary’s Hospital Medical School in 1960. In 1967 they moved again to the MRC immunochemistry unit in the Biochemistry Department at Oxford. Here Betty took up a senior MRC scientific post, and Porter was appointed to the Whitley Chair of Biochemistry.

Betty was an outstanding protein biochemist, and contributed greatly to Porter’s Nobel Prize win in 1972. Their work focused on structural immunochemistry. At the time, it was thought that antibody molecules were too large to study intact. Together Betty and Porter broke down the structures into fragments and chains and conducted studies on them. They determined the 4-chain structure of the immunoglobulin G molecule, amongst several other important discoveries in the field. Near the end of her career, Betty also studied the structure of plasma complement protein C4.

Betty never went for a PhD, the lack of which she felt did not affect her work or ability. She even supervised a PhD student, without ever having done one herself. It did, however, mean that she did not get the full acknowledgement she should have received for her ground-breaking work. She was never made a
Fellow of the Royal society, awarded any fellowships, and receives little mention in reviews of Porter’s life (despite co-authoring nearly 2 dozen papers with him). Betty was described as straight-forward, without pretence, and with a keen sense of humour. She was decisive and practical; quickly figuring out what needed to be done, and getting on with it. She was especially well-known for her capacity to put rambling debates to a quick halt. She was generous with her time and knowledge, especially to students, and despite not being overtly emotional, she cared greatly about those around her.

References

Elsie was born and raised in south-east London. As a schoolgirl, she had a great interest in zoology, but her chemistry mistress encouraged her to do a degree in chemistry instead. She attended Imperial College, as one of three girls in a class of 100. She finished her BSc exams in 2 years, and spent the remaining year before she was awarded her BSc in the biochemistry laboratory of Professor S.B. Schryver.

She spent her time separating amino acids, no small task in the era before chromatography. Near the end of the year, someone from the Plant Physiology department approached her about a job that was available. She got the job, and spent the next 3 years working with Helen Archbold (later Porter) on a project exploring the chemistry and physiology of apples. Elsie specifically looked at the changes in carbohydrates from blossom through ripening and storage. This involved weekly trips to an apple orchard in Kent to pick samples at various stages of growth.

Elsie published her first paper in 1931 in the *Biochemical Journal* on the determination of reducing sugars in apples. She gained a great deal from working under Helen, but wanted experience in working in animals and humans, so when her grant ran out, she went to the Courtauld Institute at the Middlesex Hospital to work with Professor E.C. Dodds. Here she investigated urine and serum proteins in nephritis, publishing a paper which would later be referred to as ‘pioneering work on the subject’.

After working with Dodds, Elsie needed to find a job. Under his recommendation to explore dietetics, she enrolled in a postgraduate diploma course in dietetics at King’s College of Household and Social Science. It was here that she met Dr Robert McCance, who was doing work on composition of meat and fish, and the effects of cooking on them. He had also done some work on carbohydrates, and upon reading his paper on this, she noticed his figures seemed too low (based on her previous work with apples). Impressed by this, McCance offered Elsie a position, attaining an MRC grant for her, studying the composition of fruits, vegetables and nuts. During her year-long dietetics course, Elsie had the opportunity to work at St Bartholomew’s Hospital (Bart’s). She noticed that the nutrient tables for patients at the hospitals were being based on the American tables, which
contained values for raw foods, not cooked. She also noticed that the carbohydrate values were
based on what was left after water, protein and fats were subtracted; leaving essentially,
what we call ‘dietary fibre’ today. This spurred Elsie to believe that there needed to be
British tables created. McCance agreed, and together they began writing The Chemical
Composition of Foods, which was first published in 1940, containing about 15,000
values.
McCance was busy exploring salt deficiency in diabetic coma patients, and sometimes
rope Elsie in to help. The procedure for this study was difficult, requiring subjects to
eat a salt-free diet and measuring the sodium in their sweat. These studies were
instrumental in helping doctors understand the importance of sodium, the principles of
which, are still considered today in the treatment of patients with diabetic coma,
heart disease and kidney disease. Later they were given beds in King’s College
Hospital, and this led to their studies of iron excretion. This gave rise to the
suggestion that iron in the body was not regulated by excretion, but by
absorption. This theory was later proven to be true.
Elsie kept in touch with Margery Abrahams, with whom she worked at Bart’s,
and together they wrote a book, Modern Dietary Treatment, which was published
in 1937. In 1936, Elsie travelled to America to work with the scientists at the
Department of Agriculture who had been responsible for publishing the food tables. A
notable experience there, was when Elsie tried to (unsuccessfully) convince a senior
scientist that the values should be based on studies, like her own, that were current, as
opposed to the works of Atwater, which dated from 1900.
In 1938, Elsie went to Cambridge with McCance, where he had been offered a
Readership in Medicine. Their work there included a study on the absorption and excretion of
strontium by the body. They conducted this by injecting each other with doses of the
substance. This happened to be slightly foolhardy, as ‘a slight accident’ resulted in them both
suffering a pyrogen infection from bacterial contamination in one of the batches they injected! None-
the-less, they determined that the body rids itself of strontium slowly, and via the kidney, not the bowel.
When World War II began, McCance and Elsie began studying rationing, again using themselves (and
other people in the lab) as subjects. They gave themselves what was considered absurdly low rations,
and completed feats of physical endurance to test them. It turned out that they were indeed fit and able.
They concluded however, that the subjects were not getting enough calcium. This lead to another
experiment, in which they and the other volunteers had a carefully measured diet and all excretions
were measured and analysed as well. It was a cumbersome and sometimes embarrassing process,
but they were able to determine that something in the wholemeal bread
(which replaced white bread during rationing) interfered with the
absorption of calcium. Their recommendations to add calcium to the
flours used in bread was made law, and the practice is still with us today.

References
2000’, Biographical Memoirs of Fellows of the Royal Society vol. 48 [Online],
royalsocietypublishing.org/content/48/483.full.pdf (accessed 5 September
2014)
Helen was born in Surrey to George and Caroline; her father was a well-respected school master, and her mother, for the most part, a housewife. Her upbringing was what could be called typically Victorian middle-class and very conservative. She was initially educated at home and had wide access to books, though none of them science-based. From age 6–17, she attended the Clifton High School for Girls. After the outbreak of WWI, her previously idyllic life became quite disrupted, and their finances became very constricted. She remained at Clifton as a boarder with the assistance of two generous school Governors. She was a high achiever in school, both academically and athletically.

In 1917, she entered Bedford College for Women, at London University, reading chemistry, physics and mathematics. After graduating, she secured a research position at Imperial College, researching barbiturate derivatives under Dr Martha Whiteley, who instilled very high standards of work in Helen. In 1922, she was sent to V.H. Blackman’s laboratory to work on respiration of apples (where she worked alongside Elsie Widdowson). Helen had not studied biology in some time, so she attended night classes at Birkbeck College to brush up on her knowledge.

Her work on apples involved frequent trips to Cambridge to collect frozen samples. Her trips resulted in contact with Cambridge’s Biochemistry Department, especially Sir Gowland Hopkins. Slowly, Helen’s interest in biochemistry grew, and she attended courses in biochemistry at Chelsea Polytechnic College. Her work with apples initially had begun as a direct chemical analysis but developed into a more broad analysis of development in plant matter. In 1931, financial support for this project dried up, and she was transferred to Professor F. G. Gregory’s plant physiology group, Imperial College of Science and Technology. She joined in on his research of mineral nutrition, and its effect on sugar metabolism, and switched from work on apples to barley. She also became a visiting lecturer at Swanley Horticultural College. She obtained her DSc in 1932 from University of London.
It was here that Helen disproved the previous hypothesis that starch in the grain originated from sugar that was stored in the stem. Helen and her colleagues proved through very careful analysis that the starch in barley actually originated directly from fixed carbon dioxide and that the sugar in the stem was used in respiration during senescence. At the outbreak of World War II, once again, her life was disrupted by war. Imperial College had been commandeered for defence purposes, and Helen was transferred to the research station in Rothamstead.

She married physician William George Porter in 1937, and whilst he tragically died after only a few years of marriage, she kept his name professionally. After the war, in 1947, Helen went for a year to the Crobi Laboratory in St Louis, USA. It was during that year that the husband and wife team won the Nobel Prize, which no doubt made it a very exciting trip for her. Upon her return to the UK, she continued her work on starch metabolism at Imperial, before spending some time in Bangor in 1949 with Professor Peat. It was in Bangor that she proved the presence of starch phosphorylase in barley. By now, Helen had gained a very favourable reputation in the scientific community, and in 1953, she was given a large grant from the Nuffield Foundation. This money allowed her to set up her own research group at Imperial. Here Helen became one of the first to utilize the new techniques of chromatography and radioactive tracers to further study the intermediate metabolism of plants. With these novel techniques, she wrote several innovative papers on formation of starch from sugars and the movement of photosynthetic materials in plants.

Helen’s outstanding reputation was well-recognised. She was elected fellow of the Royal Society in 1956, and became a Reader in Enzymology at Imperial College in 1957. She maintained an active interest in the Biochemical Society throughout her career, and was elected onto its committee in 1962, and became chairman in 1965. Helen’s influence here saw several changes to the society, including the formation of smaller specialists groups in 1964, the move to a new premises and the Society becoming incorporated in 1966. She was also Second Secretary and then advisor to the Secretary of the Agricultural Research Council. It is also notable that she was the first female lecturer at Imperial College. In 1962, she married a second time to physiologist George Huggett, who once again, died after only 6 years of marriage. She had no children, but gained two teenaged daughters from her second marriage, with whom she had a very close relationship. Helen was an excellent administrator, and was said to be firm and direct, but always fair. She was skilled in needlework and well-travelled. She was a very private person, but generous with her time, finances, and expertise.

Upon her death in 1987, she left a large sum to the Royal Society.

References

Isabella Helen Mary Muir 1920–2005

Born in India to Basil Muir, a member of the Indian Civil Service and Gladys Helen Mary Muir, Helen was home-schooled by her mother until age 10, after which she went to boarding schools in both Switzerland and England. She was inspired by her father’s interest in natural history, and despite receiving very little scientific education as a child, she took courses at a London college so as to attain entry to Oxford. She attended Sommerville College at Oxford to study medicine in 1940, but switched to chemistry under the influence of her tutor, Dorothy Hodgkin. She attained her degree in 1943 and her DPhil in 1947, studying under Sir Robert Robinson, researching the chemical synthesis of penicillin.

She began her career, at the Dunn School of Pathology at Oxford, before joining the biochemistry lab at the National Institute of Medical Research. There she worked under Albert Neuberger, where under his influence her research interest began to skew towards biology. It was here with Albert that she published her first paper in 1949. In 1954, she was awarded the Empire Rheumatism Fellowship and moved to the medicine department at St Mary’s Hospital in Paddington, to explore her growing interest in connective tissues and arthritis. Compared to previous laboratories, the hospital was ill-equipped, but she received a great deal of support for her research from Professor of Medicine, Stanley Peart. This led her to the research in which she focused most of her career, arthritis; specifically chondroitin sulphate and protein polysaccharides. She moved on to work at the newly-founded Kennedy Institute of Rheumatology. Here her career blossomed, and she was appointed head of the biochemistry department in 1966 and became director of the institute in 1977, a position she held until she retired in 1990.

Her research had a profound effect in the field, showing that cartilage degeneration was not simply a matter of old-age and ‘wear-and-tear’, but an ‘active disease process’. As such her work was notable for moving the field from the observation of pathology,
to a chemical and cellular investigation of disease. Her research was ground-breaking, and often bordering on heretical, but Helen’s rigorous testing provided data that has stood the test of time. Her work resulted in a much greater understanding of the proteins and proteoglycans involved in cartilage degeneration as well as a range of lysosomal storage diseases, leading to better treatments for many chronic and debilitating diseases.

Her work was widely recognised, both in the UK and internationally. It earned her much acclaim in the scientific community. She became the first woman member of the Medical Research Council in 1973, was elected fellow of the Royal Society in 1977, a foreign member of the Swedish Academy of Science in 1989 and a CBE in 1989. She was a trustee of the Wellcome Trust from 1982–1990, and opened the Wellcome Trust Centre for Cell-Matrix Research at the University of Manchester in 1995. She was a prolific author, having published over 150 papers during her career.

She also received many awards for her research:

- Heberden medal of the British Society for Rheumatology (1976)
- Feldberg Foundation award (1977)
- Bunim medal of the American Rheumatism Association (1978)
- Ciba medal of the Biochemical Society (1981)

The high-regard in which she was held did not come by chance. To be a woman scientist in this era was difficult. She had to not only be exceptional, but also determined. She enjoyed the many benefits of her high status, especially the occasions in which she was invited to hunt. She was an avid hunts-woman with a passion for horse-riding, fast cars (especially her green Mark 2 Jaguar) and ballet (she attended classes for much of her life). She was a vibrant woman, passionate and beautiful.

Despite many male admirers, she never married. She had a great sense of humour and whilst being forceful and direct, only ever judged people on their merits. The degree to which she was beloved by her peers and friends was demonstrated by the many (and often extensive) celebrations that marked her later birthdays and retirement. Helen retired in Yorkshire, where she held on to her passion for science right to the end of her life. She was an ardent supporter of ecological and environmental causes, donating her time to conservation efforts and even fitting her home with solar panels. Late in life, she suffered from spinal stenosis which limited her mobility and eventually succumbed, most stoically, to breast cancer in 2005.

References


Honor was born in Yorkshire to Colonel William and Alice Fell; one of 9 children. Her father made his living procuring horses for the army. He had a keen interest in animals and it is thought Honor inherited her interest in biology from him.

Her early education was at the Wychford School in Oxford. It encouraged not only classics and literature, but science, especially biology. Honor was intensely interested in animals and was well-known for her pet ferrets. In 1916, she went to Madras College, St Andrews, and then to Edinburgh University in 1918. Unsurprisingly, she read for a degree in Zoology.

Her research began under Francis Crew at the Institute for Animal Breeding, exploring sexual development of fowl. When Crew heard of the work on tissue culturing being done at the Strangeways Research Laboratory in Cambridge, he sent Honor down for a few months to learn the technique. Here she was deeply impressed by watching a cell divide in culture. Thomas Strangeways, in turn, was deeply impressed with her, and offered her a job. As there was no position available for her back at Edinburgh, she joined the Strangeways lab in 1923 on an MRC grant, where she spent the remainder of her career. Whilst at Cambridge, she received her PhD in 1924 and a DSc in 1932; which was notable, due to how uncommon it was for someone under 40 to receive a DSc.

Her relationship with Strangeways was productive and friendly. After Strangeways died in 1926, Honor went on to become temporary director of the laboratory, officially heading up the department at only 29 years-old. Despite the added administrative work, she never let that keep her from the lab.

Most of Honor’s research centred on what Crew had termed ‘organ culture’, which was distinct from tissue culturing, in that the specimens maintained their functionality. With this technique, she was the first to study skeletal tissue, biochemically. She was also credited as being the first to apply biochemical techniques to the study of pathology.
Honor’s reputation grew rapidly, and in 1931, the Royal Society awarded her a 5-year grant to support her work. Most of Honor’s early work focused on biochemical development of bone and cartilage tissues. During the war, her research deviated slightly to ‘war efforts’, namely enzyme healing of wounds. After the war, she returned to her work on bones and cartilage, including research on the influence of vitamin A on skeletal tissue and later on skin.

When she retired, she went to the pathology department at Cambridge to study immunological degradation of cartilage. At the end of her career, she returned to the Strangeways Research Laboratory, and her final research continued in a similar vein, exploring porcine cartilage destruction.

Honor had a most prolific career. She published 145 papers between 1922 and 1989. She received many awards and accolades, including being made a Fellow of the Royal Society in 1953. She also became a Fellow of Girton College, Cambridge in 1955 and a Foreign Honorary Member of the American Academy of Arts and Sciences in 1957. She became a Dame of the British Empire in 1963. In addition, she was awarded numerous honorary doctorates from such institutions as Harvard, Cambridge and Edinburgh. Her awards and honours are too numerous to list, but the total list, in combination with the glowing reminiscences from her friends and colleagues shine a light on how outstanding she really was.

Honor worked in the laboratory up until the final two weeks of her life. After her passing, several colleagues and friends spoke incredibly highly of her. A colleague accredited her success in a largely male-dominated field to the “sheer force of her excellence as a scientist and as a person”. She was known for her precision and care, sharp mind and as a never-ending source of inspiration.

References

Jennifer was born in Norwich to parents S. H. Leonard Moyle (son of a farmer) and Olive M. Dakin. She had one sister, Vivian, who was also a biochemist. Jennifer’s parents were avid musicians, and she sang in choirs throughout her life. She attended Norwich High School, a day school for girls, before entering Girton College at Cambridge in 1939. She read for the natural science tripos, studying chemistry, biochemistry, botany and zoology. She was awarded the equivalent of a bachelor’s degree in 1942, but at the time, women were not given actual degrees at Cambridge. She also attended many lectures on philosophy, a great interest of hers. She credited the lectures she attended from Ernest Baldwin as her inspiration to pursue biochemistry.

After her BSc, Jennifer faced the same options as everyone did in war-time, but unlike many women who chose to work in a laboratory, Jennifer joined the Auxiliary Territorial Service in intelligence. She soon became an intelligence officer at MI8, a British ‘signals intelligence’ department during World War II. She was promoted quickly, and was soon 2nd in charge of a group obtaining ciphers from breaking German codes. She remained in service for a year after the war, working on helping servicemen return to civilian life.

In 1947 Jennifer joined the biochemistry laboratory at Cambridge as Marjory Stevensons’ assistant, after being tipped off about the position by her sister, who was Earnest Baldwin’s assistant at the time. In 1949, after Marjory’s death, she became Peter Mitchell’s assistant, a move facilitated by Marjory. It seemed Marjory had a great deal of insight into her and Mitchell’s personality, and thought they would work well together. She remained Mitchell’s scientific collaborator until her retirement, with the exception of 2 years in which she worked with Malcolm Dixon, becoming his assistant in 1952. Her work with Dixon focused on the purification of isocitric enzyme.
In 1955, Jennifer followed Mitchell to the University of Edinburgh, where he had been asked to set up a biochemistry research unit in the department of zoology. With the move she began her PhD work and was awarded a PhD in zoology in 1958. That same year, she and Mitchell began publishing work on the group translocation hypothesis.

In 1964, she, along with Mitchell, formed Glynn Research Ltd., a charitable research company which promoted biological work. It was based in a vacation house in Cornwall that Mitchell bought in 1961. Jennifer moved to Glynn in 1963, overseeing the restoration and renovation, and began laboratory work there in 1965.

Her work with Mitchell was very fruitful. Together they determined that Gram-positive bacteria contained phosphate derivatives. Later, Jennifer designed many of the experiments to help prove Mitchell’s Chemiosmotic Theory; a theory which earned him a Nobel Prize in 1978.

Jennifer is described as a superb, precise and orderly experimentalist with a keen analytical mind. Jennifer retired in Norwich in 1983.

References

June was born and raised in Sydney. She attended the University of Sydney, and received a BSc in Biochemistry in 1944. She stayed at Sydney, working as a research scholar and teaching fellow, and then a Linnean Maceay fellow, receiving her MSc in 1947. She began her research in microbiology, a field in which she remained for her entire career. Her initial research was focused on the metabolism of molecular hydrogen in Escherichia coli. Her work was so outstanding, that in 1947 she was awarded the prestigious Royal Exhibition of 1851 Overseas Research Fellowship. She chose to come to the UK, joining the microbiology unit of the biochemistry lab at Oxford. Here June made several important contributions to the field of microbiology, especially in the metabolism and synthesis of enzymes in bacteria. She was awarded her PhD in 1952, and continued her work at Oxford. In 1956 she was awarded a Rockefeller Foundation Fellowship, and went to Stanford for a year to work C. B. van Niel at the Hopkins Marine Station. Van Niel was legendary in his knowledge of micro-organism biology, and this experience afforded June a great many experiences; especially the ability to study more exotic bacterial organisms. The work she did during this period contributed to several impressive discoveries such as dispelling the previously-thought rule that anaerobes do not have cytochromes, and the existance of a soluble β-hydroxybutyrate dehydrogenase, which allowed Kreb’s group to devise a now widely-used assay for ketone bodies.

From 1960 to 1965 she was appointed University Lecturer in Microbiology at Oxford. In 1964, while on a year’s leave, she became a visiting Professor of Bacteriology at UCLA; a role which was made permanent in 1965. These years were some of the most productive in her career, and her work provided the basis of understanding of tetrpyrrole synthesis in photosynthetic bacteria which holds true even today.
June was a member of the Biochemical Society from 1947 to 2002 and served on the *Biochemical Journal* editorial board from 1959 to 1966. She also served on the editorial boards of the *Journal of Bacteriology*, the *Journal of General Microbiology* and the *Archives of Microbiology*. Additionally, she was one of the editors in the 1973 book *Microbial Photosynthesis*.

June retired in 1989, but continued to work daily until 2 years before her death. She was a private and modest woman, but always forthright and plain speaking. She is best remembered for her generosity to young scientists, being approachable and giving wise council. Upon her passing, she was described by a colleague as “an accomplished scholar, dedicated learner, highly respected experimentalist, unique role model and rare friend”.

**References**

June Olley was born in a bungalow on the back of Croydon aerodrome, where her father was a flyer. Her father didn’t believe in education for girls, but her mother insisted that she receive the best education possible. Neither of her parents had any interest in science, but a copy of Zoo magazine, given to her as a young girl, sparked curiosity in June. In primary school she studied chemistry and physics, where she became interested in practical experiments. She then went to Wycombe Abbey, one of the most expensive boarding schools in the country. The cost of fees was an on-going concern for her family during World War II, but somehow they managed, and she finished secondary school having studied chemistry, physics, botany and zoology. She was supported in her interest in science by her teachers, who, even blacked out the science library for her during the Blitz so that she could study late into the night.

After secondary school, June attended University College London. She had wanted to study biochemistry, but the laboratory was relocated when the University was evacuated from London, so she studied chemistry instead; achieving her BSc in 1944. For the Honours portion of her degree, she went to the Human Nutrition Research Unit of the Medical Research Council, where she developed a method of estimating the elemental sulphur in rats’ skin, working with B. S. Platt. After her BSc, she wanted to continue studying with him and do her PhD in biochemistry, but was disallowed due to not having the correct prerequisites. June was persistent, however, and eventually a new degree was invented, called Chemistry of Nutrition. Platt was appointed the Chair of Nutrition at the London School of Hygiene and Tropical Medicine, and it was there that she was awarded the first-ever PhD in Chemistry of Nutrition in 1950; her research focused on fatty liver. June credits Platt as being her mentor, and he gave her a great many opportunities as a young scientist.
After her PhD, she went to Aberdeen to join the Torry Research Station, where she worked around the handling and preservation of fish as food. She remained there from 1951 to 1968, however during this time; she travelled extensively. She was awarded a Fulbright Scholarship to visit University of Washington in 1956, where she began working on phospholipids. In 1961 she visited Israel for 3 months, where she worked on synthesising phospholipids from fish tissues. Finally, in 1962 she went to Rome for 3 months to work for the Food and Agriculture Organisation of the United Nations. In 1968, she received her DSc from University of London. Later that year, June was visited by two senior fisheries scientists from Australia who asked her to go to Hobart to offer advice on the idea of introducing a fishmeal industry there. This resulted in her relocation to Tasmania, where she became engaged to barrister Frank Cumbrae-Stewart. She remained there, and began work on abalone at the CSIRO Tasmanian Food Research Unit. She got this job, almost by accident. A typist at the Torry Research Station had misplaced part of June’s CV, omitting her DSc, which was a blessing in disguise, as if it had not been omitted, she would have had to have been director of the unit. At CSIRO in 1971, she continued working on the handling and preservation of food, leading to being involved in the discovery of a method of predicting food safety, known as predictive microbiology with David Ratkowsky, with whom she worked closely with for another 30 years. From 1973 to 1974, she took another sabbatical to travel around the world with her husband, and stopped to work in South Africa, England, Sweden, Spain and Poland. Throughout her career, June published around 160 papers, and edited or contributed to several books. In 1972 she was elected junior vice-president of the Tasmanian Royal Society, and senior vice-president in 1973. In 1976 she became one of two female Foundation Fellows of the Australian Academy of Technological Sciences and Engineering. In 1986 the Australian Institute of Food Science and Technology gave her their Award of Merit and then in 1988 she was given an Order of Australia and also an honorary DSc from the University of Tasmania. She retired in 1989. Throughout her career, June was asked to assist or comment on several projects around the world. She was known as a “trouble-shooter”, and her opinion was greatly valued. She spoke of the value of having a large network. Even after retirement, June would still read postgraduate theses, and guide and inspire young researchers. She was well-respected and loved in the fish science industry, aptly demonstrated by a retirement card she received from the International Association of Fishmeal Manufacturers – some 23 years after she had been their secretary — signed by people from all over the world.

References


Mary was born in Derby, the youngest daughter of Hugh and Ethel. Her father was a physician. She was educated at Alice Ottley School in Worcester, after which she attended the London School of Medicine for Women. She obtained a conjoint diploma in 1934 and her MB BS (Bachelors of Medicine and Surgery) in 1936. After graduating, she became an A. M. Bird scholar and pathologist at London’s Royal Free Hospital. Two years later, she became assistant pathologist at the Archway Group Laboratory. She obtained her MD in 1940, and moved to Hammersmith Hospital. In 1947, she was made a lecturer in bacteriology there. At Hammersmith, Mary began the research which would be the focus of the rest of her career – antibiotic resistance and hospital cross-infections. In 1947 after noticing an increase of infections resistant to penicillin, Mary identified a selection of cells which produced an enzyme that destroyed the antibiotic. The next year, she became a reader in bacteriology at St Thomas hospital, where she proposed a series of preventative measures to halt the spread of antibiotic-resistant infections. She returned to Hammersmith in 1958, and by sheer force of personality, enthusiasm, and good science she got her colleagues to abide by her preventative recommendations. These newly implemented protocols resulted in a substantial decline in resistant infections. In 1963, she was awarded the title of Professor, and in 1965 she became a member of the Royal College of Physicians. Although a lot of Mary’s work focused on the ward, she was an avid experimentalist and an accomplished microbial biochemist. She was often the first to be offered new antibiotics for independent testing. Considered to be quite the expert in the field, she was invited to co-author a book with L. P. Garrod, and together they published *Antibiotics and Chemotherapy* in 1963. She was a good teacher, but the bench is where she devoted
most of her attention. She had a sharp tongue and strong views, with a forceful manner to accompany it, but she balanced these with a kind and loyal heart and sense of humour. She was an idealist with a strong interest in politics and religion and, in fact, was on her way to a meeting of the Coalition for Nuclear Disarmament when her life was prematurely ended in a car crash.

References

Naomi was born in London to Alexander and Ellen. Her father was the secretary of the Chartered Surveyor’s Institution, though he retired when she was 10. They then moved to Gloucestershire, where she attended St Mary’s School in Wantage. Her father had a great deal of knowledge of the countryside, which he passed down. She originally attended the University of Paris (Sorbonne), but returned to London in 1939 at the outbreak of World War II. Her older sister had married George P. Wright, a well-established pathologist, and it was likely his influence which generated her interest in medicine. Upon her return to the UK, she enrolled in pre-medicine at University College London and then medicine at West London Hospital medical school. While on her pre-medical course, she met Prakash Datta, whom she married in 1943. Prakash later became a professor of medical biochemistry at UCL. After qualifying in medicine in 1946, she worked as a senior bacteriologist from 1947 to 1957 at the Public Health Service, simultaneously studying part-time for a diploma in bacteriology from University of London. She gained her diploma in 1950 and then qualified as an MD in 1952. In 1957 she returned again to Hammersmith, where she was appointed assistant lecturer in bacteriology at the royal Postgraduate Medical School. Her research focused on antibiotic resistance in bacteria, using samples from staff and patients in the hospital that had contracted salmonella infections. Initially, she intended to explore changes in the bacterium as it travelled within the host, but she discovered that some of the cultures were resistant to three antibiotics. This was curious, as none of those infected had been given all three. She was the first to describe transfer of antibiotic resistance in bacteria. She went on to show how this happened and describe the properties of the plasmids involved. Naomi received many honours and accolades for her groundbreaking work. She became a Fellow of the Royal College of
Pathologists in 1973 and of UCL in 1981. After her retirement in 1984, she was made emeritus professor at UCL. She was elected Fellow of the Royal Society in 1985, and an honorary member of the Society for General Microbiology in 1989. She wrote over 80 papers, and contributed chapters to several books. She was described as creative, caring and an excellent leader. She was devoted to her family and loved to travel. She was a proponent of life-long learning, aptly demonstrated by the fact that in 1966, she did a part-time MSc in human evolution, purely out of personal interest.

References


Rosalind Venetia Pitt Rivers
1907–1990

Rosalind was born in London, one of 4 daughters of Hon. Anthony Morton Henley (captain of the 5th Lancers) and Hon. Sylvia Laura Stanley. She came from an aristocratic background (though her family was not of particular wealth), and was incredibly well-educated. Her family was not particularly academic or scientific, but her father’s youngest brother was a chemist and a Fellow of the Royal Society. It was this very uncle who gave her a chemistry set when she was 12, an action which spurred her interest in Chemistry. Ros (as she was known) and her cousin were given use of a stable to use as a laboratory. In childhood, she was educated by a French governess, before attending Notting Hill High School. It was at this high school that her chemistry teacher remarked, quite ironically, that she would “never make a chemist”. Her sister remarked that as a teenager, she was always diligently working, and seemed indifferent to the fact that it was a ‘man’s world’. This anecdote seems to be a particularly accurate insight into her prolific career. After WWI, she attended Bedford College at University College London and in 1930 she was awarded a first-class BSc, top of the university. She had her eyes set on a career in chemistry, and completed an MSc under the supervision of E.E. Turner and Margaret M. Murray. The results of her Master’s thesis formed the bases of her first two published papers in 1931 and 1932. Ros married in 1931, and then had a son. As a result of this, she put a hold on her career in research until she and her husband separated in 1937. She returned to science that year by joining the Chemical Pathology laboratory run by Sir Charles Harington at UCL and completed her PhD under Albert Neruberger. After achieving her PhD, she joined Harington’s laboratory researching the thyroid hormone L-thyroxine. In 1941, Harington left UCL to join the MRC’s laboratory at the National Institute of Medical Research and Ros went with him, remaining there until her retirement in 1972. She was well on the way to several remarkable discoveries in relation to thyroid hormones when her research was disrupted by World War II. During the war she
worked in several posts related to war-time efforts including projects to increase milk yield in cows, and nutritional studies. Towards the end of the war, she worked in Belgium studying the nutrition of concentration camp prisoners, and was profoundly affected by what she saw there. After the war, she returned to the NIMR in Hampstead with Harington, who became increasingly involved in administration of the institute. In 1950 he became director of the newly built biochemistry laboratory in Mill Hill, a position which afforded Ros nearly complete independence in her research. She relished this independence, but still assisted Harington in his research, showing her immense dedication to him. Around this time, Dr Jack Gross, a Canadian endocrinologist, joined the Mill Hill lab to work with Ros on the chemistry of thyroid hormones. This began the most fruitful part of her career, where she, alongside Gross, discovered the thyroid hormone T3. This discovery launched Ros’ career, and she was quickly inundated with awards and recognition and invitations to lecture. She won the William Julius Mickle prize in 1952 and was elected Fellow of the Royal Society in 1954. Additionally around this time, she spent several sabbatical periods in the United States working on thyroid biochemistry. She went on to publish two books: *The Thyroid Hormones* (1959) and *The Chemistry of Thyroid Diseases* (1960) and collaborated with Avrion Mitchison to develop a new approach for the production of specific antibodies. At the end of her career, she spent 3 years as head of the division of chemistry at NIMR, facilitating its disbanding. It was not an easy task, but she handled it with tact and grace, masterfully preventing any unpleasantness in the uprooting and relations of scientists and their families. After retirement, she spent a few years back at UCL in the pharmacology and zoology departments before settling in her family home in Dorset, where she died of pneumonia in 1990.

The end of her career was littered with several accolades including (but not limited to) being made fellow of Bedford College in 1973, an honorary fellow of the Royal Society of Medicine in 1983 and an honorary fellow of the Royal College of Physicians in 1986. There is no way to pinpoint exactly what made Rosalind such an outstanding scientist, but it was certainly her relationship with Harington that formed the greatest inspiration in her career. She was self-confident, at ease communicating with other scientists and passionate about her work. She was an excellent bench scientist and while rigorous in her testing, she thoroughly enjoyed it. She was described as generous and of great wit, and was beloved by many until the very last days of her life.

References


Sylvia was born in 1917 in Russia where her father worked as an agronomist and trader. Her mother, who was Russian, gained a degree in mathematics from Moscow University. Their family left Russia in 1920, during the revolution, and settled in West London. She attended Ealing County School for Girls. She studied mostly languages (Russian and German, as well as studying Latin and French). She initially studied German at King’s college, but then transferred to University College London to study science. She received a second-class honours degree in zoology in 1939. Sylvia was married in 1940 to Anthony Simpson, taking his name professionally. He died in combat in 1941, and Sylvia remarried in 1956, this time to J. F. Tait.

After her bachelors degree, she spent 3 years at Oxford in the anatomy department as assistant to Assistant to Professor J. Z. Young before joining the Courtauld Institute of Biochemistry at Middlesex Hospital Medical School. She began as an assistant to P. C. Williams, testing synthetic analgesics as alternatives to opiates. She also conducted work on oestrogens, and soon became proficient in oestrogen bioassays. She wanted to expand beyond working with oestrogens, and in 1948 it was suggested she collaborate with James Tait, who was working on radioactive isotopes. Together, they tackled the onerous task of developing a bioassay to measure the effect of adrenal steroids on sodium and potassium excretion. This lead to a number of collaborative and in-tandem experiments, all culminating in the discovery of a new hormone – electrocortin. A series of further investigations and collaborations commenced, and after Tadeus Reichstein established the correct structure of this hormone, the hormone was renamed aldosterone. Sylvia and J. Tait’s biggest contribution to this discovery was the radioactive acetic anhydride method to measure aldosterone.
In 1958, the Taits moved to the Worcester Foundation for Experimental Biology laboratory in Massachusetts, USA, joining Gregory Pincus. There they continued their work on aldosterone metabolism, concluding that when there was a peripheral interconversion of steroids, measurement of plasma production was more effective than interpreting values from urinary excretion. They also contributed to refining the contraceptive pill to reduce harmful side-effects from increased release of aldosterone.

In 1960, the Taits moved on to study the biosynthesis of aldosterone in vivo in sheep at the University of Melbourne. The group there made important advances in the understanding of aldosterone synthesis in states of sodium deficiency. The trip was rewarding and exhausting, and generated life-long friendships and collaborations for the Taits. After Australia, the Tait’s returned to the WFEB laboratory to begin what was to become Sylvia’s main passion in research: the study of isolated adrenal cells.

In 1970, Sylvia and her husband returned to the Middlesex Hospital Medical School, mainly due to family issues, and the death of Pincus at WFEB. James was appointed Head of the Department of Physics as Applied to Medicine and created a Biophysical Endocrinology Unit, which he ran with Sylvia. Here their work focused on Sylvia’s main interest, isolated adrenal cells.

In 1982, Sylvia and James retired from Middlesex. Their home had excellent facilities, so they remained in touch with their former lab, and helped interpret data and design experiments. They continued to publish papers from home, using computer simulation conducted on two Apple Ile personal computers operating in parallel. Additionally, they published reviews and historical accounts of the discovery of electrolytina (aldosterone).

Sylvia passed away in 2003 from renal and heart failure following a heart condition, shortly before the 50th anniversary of the discovery and identification of aldosterone. Sylvia was described as enthusiastic, and direct, outspoken and objective in her analysis of data. She had a remarkable ability to emotionally distance herself from her own hypotheses, resulting in her being an excellent person to debate with.

References

Winifred May Watkins 1924–2003

Winifred was born in London in 1924; her father was an engraver in the newspaper industry. Her family had no scientific connections. She went to St Stephen’s parish elementary school in Shepherd’s Bush, after which she was awarded a London county scholarship to go to Godolphin and Latymer Girls’ School in Hammersmith. The school was evacuated during the war, but she was able to finish later and received her higher school certificate in 1942. During the war, after secondary school, Winifred had two choices: to either serve in the military, or to do a job approved by the Ministry of Labour. Being a lab technician was an approved job, so Winifred chose that and, quite fortunately, she was sent to the biochemistry department at the Lister Institute (the only department which remained in Chelsea during the war).

At the Lister Institute she met Walter Morgan. Morgan saw potential in Winifred very quickly and went on to be her lifelong friend and mentor. Winifred’s name appeared on papers published by Morgan as early as 1944. Winifred enjoyed her experience in the lab greatly, especially the opportunity to be in contact with eminent scientists of the time. She began taking evening classes at Chelsea Polytechnic and received an honours degree in chemistry from London University in 1947.

She left Lister for 3 years to complete her PhD in the action of nitrogenic mustards (used in the treatment of leukemia) at St Bartholomew’s Hospital medical school with the immunoochemist Arthur Wormall. After she was awarded her PhD, she returned to Lister to continue working with Morgan on the chemical structure of red cell antigens in the ABO blood group.

Winifred and Morgan made an important discovery, early on, that the A and B antigenic determinants were carbohydrates, and not themselves gene products. They showed that the A and B genes code for the enzymic precursors to antigens. Winifred came up
with several theories during her research, and nearly all of them were proven correct. One of her most brilliant contributions was the proposal of genetic pathways in which the genes involved in the blood group antigen system acted sequentially. In 1960–61, Winifred took a sabbatical to go to University of California at Berkeley to research glycosyltransferases; work which greatly influenced her research upon her return to the Lister Institute. In 1965 she was made a reader in biochemistry at University of London, and in 1968 she was made professor.

The Lister Institute closed in 1975, and Winifred moved to the newly-created MRC division of immunochemical genetics at Northwick Park, where she was appointed head. She made several important discoveries while at Northwick Park, including that A and B transferases have overlapping specificities and that unexpected antigenic determinants appear on malignant cells due to the lack of normal transferases. She suffered a stroke in the 1970’s, but was still able to continue working. When the division closed in 1989, she went on to continue her research at the haematology department at Hammersmith Hospital until she retired in 2000.

In 1969 she was elected Fellow of the Royal Society, and served as member of the council at the Royal Society from 1984 to1986. She also received the Society’s royal medal in 1988. She was awarded the Landsteiner memorial award (jointly) in 1967, the Ehrlich-Ludwig Darmstädter prize (jointly) in 1969 and was given an honorary DSc from Utrecht University in 1990.

Winifred was described as shy, but friendly and cheerful. Her scientific career was of utmost importance to her. She died in 2003 after contracting pneumonia following a second stroke.

References