Isabella Leitch's contributions to the development of systematic reviews of research evidence

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Frank Hytten

Blossoms, Cobblers Hill, Gt Missenden, Bucks HP16 9PW, UK

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Personal background

Isabella Leitch was born in 1890 in the Aberdeenshire fishing town of Peterhead; her father was the local postmaster. The family must have been reasonably well-off because Isabella and her three sisters were all well-educated at a time when relatively few women reached university. Partly because she had seen Peterhead children having to go barefoot in winter, she grew up with a passionate hostility to social inequality and was an active suffragette. She was apparently sufficiently similar in appearance to Christabel Pankhurst to take her place as a decoy on the stage of the Albert Hall, allowing Miss Pankhurst to escape a riotous situation through a back door.

Following her graduation in science from Aberdeen University, Isabella Leitch spent time during World War I studying a variety of haemoglobins in Copenhagen with Professor A Krogh, and it was during that time that her lifelong interest in genetics began. She was even interested in aircraft design, and I remember seeing a collection of slides illustrating various aircraft which she had used for lectures at about that time.

Despite being an experienced research worker with a Doctorate of Science awarded by Aberdeen University in 1919, Isabella Leitch was unable to find a research post in Aberdeen. In 1923, however, she found a job as a temporary librarian at the Rowett Research Institute,[1] and this was to provide the foundation for her encyclopaedic knowledge of the field of nutrition, which, in turn, led to her appointment as personal assistant to the director of the Rowett Research Institute, John Boyd Orr.[2] She told me that, when she began working with him, his Calvinist upbringing had led him to believe that the poor were poor because they deserved to be. She changed his mind, and it was her influence that led to Orr's landmark book *Food, Health and Income*,[3] and from that, his founding directorship of the UN Food and Agriculture Organization.

Working with Dr Leitch

I came to know Dr Leitch (that is how everyone always addressed her) in the early 1950s, when I was on the staff of the MRC Obstetric Medicine Research Unit in Aberdeen. She was interested in and encouraged my studies of breast milk and lactation. On the basis of seeing only three of my papers, she persuaded Hugh Clegg – a friend and editor of the *British Medical Journal* at that time – to accept a series of 10 papers for publication. I moved on to study other aspects of maternal physiology, again with her encouraging interest. Our main work together was to compile, one evening a week for several years, the first comprehensive review of the physiology of pregnancy.[4,5] Pregnancy was, after all, a nutritional exercise: the acquisition of chemical building blocks to make a fetus; their carriage to the building site; and the removal of waste products. The range of metabolic modifications constituted a very intricate and complex undertaking. The first edition of the book was translated into Spanish and I remember Dr Leitch refusing to allow its publication until she had read it; she found several serious errors of translation.

Among the many aspects in which the MRC Obstetric Medicine Research Unit was involved, birthweight, and the influences which might modify it, was of special interest. I can offer one example of how, in our search for birthweight data, chance clues could lead Dr Leitch in unexpected directions. My attention had been drawn to a paper in *Nature* by Laws,[6] which made the point that aquatic mammals, supported by water, were able to have relatively large fetuses (4–5% of maternal weight) compared to large terrestrial mammals, such as bears and lions (under 1%). This was obvious nonsense since the human fetus

weighs 5% or 6% of its mother's weight. This stimulated a hunt for the weights of newborn young of many species of mammal. Dr Leitch knew where to look, who to ask and how to collate the data from the 114 species for which we eventually obtained information. Rather than using the weight of a single fetus, we used the more rational weight of the whole litter where there was more than one fetus. Our analysis demonstrated an important natural law for the first time: the logarithms of the fetal weight and maternal weight have a straight line relation, from a 6 g bat to a 70,000 kg whale.[7]

Dr Leitch had a profound influence on several generations of scientists, particularly in the field of nutrition. She founded and edited the journal *Nutrition Abstracts and Reviews*, which had offices embedded in the agricultural milieu of the Rowett Research Institute. The success of the journal reflected her links to many scientists worldwide who made their expertise available to her usually through compiling abstracts of papers, her command of several languages, and her critical mind. Although she was a loyal and generous friend to those 'on her wavelength', she could be contemptuous and dismissive of any workers in science who failed to meet her standards of integrity and intellectual honesty.

Conceptualizing systematic research reviews

Isabella Leitch will be remembered mainly for her contributions to the scientific quality of research reviews. These covered a remarkably wide range of topics, and not all the facts came from research studies. She took particular pleasure in tracing an idea back to its earliest discoverable record. Her reports and reviews were always expressed in simple, lucid, unambiguous prose.

In 1959, she was invited to contribute to an International Conference on Scientific Information which had been organized by the US National Academies of Sciences, in Washington, DC. Her paper was entitled 'The place of analytical and critical reviews in any growing biological science and the service they may render to research',[8] and it is this paper that has been used within *The James Lind Library* to mark her contribution to the development of systematic reviews. She begins by explaining that a 'research review' deals 'directly with facts and findings, seldom with the opinions of authors of papers from which data are taken', and that 'it is both a review of research and an inquiry into the deductions that may be drawn from an accumulation of results treated as a new whole'. Indeed, she refers to James Lind's *Treatise of the Scurvy*[9] as an example of a 'noble fore-runner' in the genre.

Her paper goes on to describe characteristics of the research review:

> *'The technique can be used for any quantitative problem as soon as enough bits of information are available to provide a worth-while array of data. It may or may not require, or be suitable for, complex statistical treatment. There are two main points to be noticed: the difficulties of assembly because of the scatter of publications, and the complexity of the subject matter itself which, by its nature, accounts for a large part of the scatter and, at the same time, makes assembly and analysis of the composite a necessity.'*

She considers the conditions under which assembly and analysis are profitable, and refers to the waste of research material that results from faults in research technique and inadequate reporting:

> *'… some of the work and unfortunately an increasing proportion of it, is lost for purposes of resynthesis, because of the mode of presentation. There is, for instance, the paper in which the results of a diet survey are presented, not in absolute terms but as percentages of attainment of some arbitrarily chosen standard. Nothing further can be done with such data … The entry of statistical experts into the biological world, to be welcomed in other ways, has had this effect that results may be given only as a few equations, coefficients, and measures of probability. That is possible because the statisticians have already made sure that the experiments are properly planned to give a statistically satisfactory answer to a defined question. However satisfactory that may be for the solution of the problem set, it is not wholly satisfactory because the work is potentially a small part of a much larger whole. Devices exist by which such results may be combined with similar and similarly planned work, but the data cannot be rebuilt piecemeal into a larger array to serve a different analysis … That being so, it is much to be desired that the individual results of biologically important experiments should be*

tabulated and made available to those who could make further use of them …'

Dr Leitch's paper then gives examples to illustrate 'The statistical review', 'The review of concepts', 'The service or interpretive review' and 'The creative review' – the last being 'the highest manifestation of such endeavour because it deliberately sets out to effect a synthesis between phenomena previously unrelated'.

Readers may be impressed and amused by her account of one of her 'service reviews':

'The Technical Communication on the feeding of camels[10] arose from a request from an officer of the Somaliland Camel Corps for advice about certain disorders in camels which, he thought, might be due to faulty feeding. Since little had been written about the feeding of camels, an enquiry was sent to correspondents in those parts of the Commonwealth in which camels were still used. From the replies received and what publications could be found on the diet and physiology of camels, a summary was made and a comparison of diets on which camels were said to do well, or not to do well. On analogy with the feed requirements of cattle, about which there was plenty of information, it was at once clear that camels were often underfed, or ill fed, or both. It was then a simple matter to draw up plans for diets adequate by standards for cattle, made up of the feeds commonly given to camels. It was also clear that the camel has a peculiar requirement for salt, which is related to its capacity to withstand deprivation of water; deprivation of salt may cause serious disorder … This report was received with gratitude by the officer who asked for advice, and, he said, with amusement by his camelmen who thought it funny that advice should come from a remote armchair in a country where camels exist only in zoological gardens.'

The paper contains a section on the facilities needed for research reviews:

'In order that research reviews may be produced there must, of course, be access to libraries, adequate in their holdings and liberal in the privileges they grant, so that the literature required may be found and borrowed. It must be possible to command a team of skilled or semi-skilled labour to collect and transcribe. There must be expertise in many languages. There must be someone in charge.'

Dr Leitch retired before computers revolutionized data retrieval, but she saw them coming and would undoubtedly have valued their help if she were persuaded that they retrieved information efficiently. In a prescient paper,[11] however, she remarked that 'there is no virtue in a computer for its own sake', and I suspect that she would have deplored the current trend to quote only literature retrievable electronically.

Isabella Leitch's 1959 paper concludes as follows:

'Most of the examples chosen to illustrate the argument have arisen in response to a need, more or less urgent, for information that could not be reliably obtained from a superficial survey of the literature. Needs and applications have been in political, social, medical, nutritional, and agricultural fields. Each review can claim to have retrieved and made use of knowledge in danger of disappearance and loss, or to have clarified issues and cleared the way to further research. Indeed, the technique of the research review, by virtue of the assembly and use of scattered records, appears to be unequalled as an instrument for retrieval of buried work. It gives a new value to the small experiment and the single biological observation, and in the analysis may reveal truths which might not be reached in a lifetime of direct investigation.'

Isabella Leitch died in 1980. She was a remarkable woman who had a profound and lasting influence, not just in her main field of nutrition, but in demonstrating the value of critical, scientific research reviews. In some ways, her approach echoed the remarkable flowering of science in the 8th and 9th centuries, when scientific scholars in the Islamic world brought together ideas and information from many cultures and translated documents and books from many languages to form a synthesis, thus giving a huge push to scientific understanding.

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