OBITUARY

Herbert Macgregor (1933–2018)

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Anyone familiar with the spectacular lampbrush chromosomes (LBCs) found in oocytes of frogs, salamanders, birds, and other vertebrates will think immediately of Herbert Macgregor, who made seminal contributions to our understanding of these wonderful chromosomes and to many other areas of chromosome research.

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Herbert was introduced to LBCs by H. G. “Mick” Callan in 1958. At that time, Herbert was a final year Honors student in the Zoology Department at St. Andrews University, Scotland, where Callan was Professor. Callan suggested that Herbert treat LBCs with various enzymes to determine whether the patterns of digestion would reveal anything about the molecular organization of the chromosomes. Pepsin, trypsin, and RNase caused generalized digestion of the chromosomes, but nothing very exciting. However, DNase was different. It caused clean “breaks” in the lateral loops and along the main axis of the chromosomes, with little or no overall loss of

mass. The simplest interpretation was immediately obvious: DNA extended as a continuous backbone from one end of the chromosome to the other. Losing no time, Callan and Macgregor prepared a short note for *Nature*, which was published a mere 6 weeks later. Students today are taught, well before University, that chromosomes are basically long strands of DNA. It is difficult now to appreciate how revolutionary that idea was in 1958.

From this auspicious beginning, Herbert went on to establish himself as a leader in the field of chromosome research and a major spokesperson for LBCs. His formal academic career is quite straightforward. He remained at St. Andrews and completed his Ph.D. with Callan, after which he became Lecturer, a position he held until 1970. He then obtained an appointment as Professor of Zoology and Head of the Department of Zoology at the University of Leicester, England. He remained at Leicester until his retirement in 1996, when he moved to Topsham near Exeter. There he was Visiting Professor at the School of Biosciences of the University of Exeter.

Even before moving to Leicester, Herbert was one of a handful of investigators who more or less simultaneously rediscovered amplification of the genes coding for ribosomal RNA (rRNA). I say “rediscovered” because the phenomenon had, in fact, been accurately described many years earlier, but for all practical purposes had been forgotten. The details of gene amplification are too extensive to describe here, but in short, the ribosomal genes (rDNA) somehow get out of the chromosomes during early meiosis and replicate independently inside the oocyte nucleus. As a result, most of the DNA in the oocyte nucleus is actually rDNA, a small fraction of which is associated with each of the 1000 or so extrachromosomal nucleoli. During an enjoyable sabbatical that I spent in St. Andrews in 1968, Herbert and I reinvestigated one of the classical accounts of rDNA amplification, which takes place in oocytes of the giant water beetle *Dytiscus*.

If one were to characterize the essence of Herbert’s original research at Leicester, it would be that he used giant chromosomes from a variety of organisms—frogs, salamanders, birds, and insects—to study a wide range of phenomena. Included were gene amplification, the nature and chromosomal distribution of highly repetitive sequences, as well as the organization of telomeres and centromeres. Space does not permit a description here of each of his contributions to

these aspects of chromosome structure. But throughout, he never lost interest in the LBCs and their remarkable loops. Time and again he came back to these chromosomes and to the still poorly understood relationship between their structure and the massive synthesis of RNA during oogenesis. His last two formal publications in 2012 are entitled “So what’s so special about these things called lampbrush chromosomes?” and “Chromomeres revisited.” Both were published in *Chromosome Research*, the journal he conceived and founded in 1992 and then edited for 20 years. From its inception, *Chromosome Research* has provided an important addition to the relatively few journals devoted specifically to chromosomes. It remains a forum for wide-ranging contributions on all aspects of chromosome structure and function, especially important now when studies of chromatin are so often couched in purely molecular terms.

In addition to his research and teaching, Herbert found time to write two very useful books: Macgregor HC and Varley JM (1983) *Working with Animal Chromosomes*, John Wiley and Sons; and Macgregor HC (1993) *An Introduction to Animal Cytogenetics*, Chapman and Hall.

Well known to all who work on LBCs, but perhaps not to those outside this sub-specialty, is the website “Lampbrush Chromosomes” (<http://projects.exeter.ac.uk/lampbrush/>), which Herbert founded and maintained. Here, one can find short biographies of nearly all “lampbrushologists” as well as an exhaustive bibliography of papers published on LBCs since the original description by Flemming in 1882.

Herbert Macgregor will be remembered for his many contributions to chromosome research as investigator, mentor, author, editor, and above all as enthusiastic cheerleader for his beloved lampbrush chromosomes.

For more information on the influence and life of Herbert Macgregor, please see the link below to Dr. Pat Heslop-Harrison’s website which contains his personal tribute to Herbert: <https://molcyt.org/2018/08/13/herbert-macgregor-1933-2018-a-personal-tribute/>

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