

# FETAL PHYSIOLOGY

Dedication to the Work of Geoffrey S. Dawes, FRS,  
*David M. Olson,*  
*Professor of Obstetrics and Gynaecology,*  
*Paediatrics and Physiology,*  
*Director, Perinatal Research Centre,*  
*University of Alberta*

Can Fetal Heart Rate Monitoring Ultimately Become a Useful  
Tool in Obstetrical Practice?

*Robert Gagnon, MD,*  
*Departments of Obstetrics and Gynaecology and Physiology,*  
*University of Western Ontario,*  
*MRC Group in Fetal and Neonatal Health and Development,*  
*Lawson Research Institute,*  
*Associate Professor,*  
*St. Joseph's Health Centre,*  
*London, Ontario*

Nutrition and Fetal Growth  
*Jane E. Harding, MB, ChB, DPhil, FRACP,*  
*Professor of Neonatology,*  
*Research Centre for Developmental Medicine and Biology,*  
*Department of Paediatrics,*  
*University of Auckland,*  
*Auckland, New Zealand*

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# INTERNATIONAL SYMPOSIUM ON FETAL PHYSIOLOGY— DEDICATION TO THE WORK OF GEOFFREY S. DAWES, FRS

*David M. Olson,  
Professor of Obstetrics and Gynaecology,  
Paediatrics and Physiology,  
Director, Perinatal Research Centre,  
University of Alberta*

The Canadian Investigators in Reproduction are pleased to have sponsored an international symposium in fetal physiology at the Annual Clinical Meeting in Halifax dedicated to the work of a true pioneer in science, Geoffrey Dawes. Geoffrey Dawes, who died in May of 1996, will be remembered for more than his seminal studies in fetal physiology. He inspired an entire generation of fetal physiologists from around the world. This was ingrained forever in my memory when, as a young scientist in 1984, I travelled to St. Catherine's College, Oxford to attend my first international fetal physiology symposium. The meeting was timed to coincide with the retirement of Professor Dawes from his directorship of the Nuffield Institute. I was amazed as I looked around at all the well-known fetal physiologists from the United Kingdom, United States, Australia, New Zealand, The Netherlands, Canada, and elsewhere who were in attendance. Why, I asked, were all these people here? Simple, I was told. Most of these individuals either trained or spent a sabbatical with Dawes at the Nuffield. Indeed, virtually an entire generation of fetal physiologists at

one time or another performed research in Oxford, many with Dawes. And from these scientists a second generation of fetal physiologists were being trained or established in their careers. Many were still investigating important questions explored by Dawes. Others had moved into new fields of inquiry. All carried the legacy of Dawes.

The articles in this volume are condensed versions of presentations made by two leading fetal physiologists in the world today at the Halifax symposium. The symposium was chaired by Knox Ritchie of Toronto. An article, by Canadian Robert Gagnon, explores a theme championed by Geoffrey Dawes, but gives modern interpretations and application to clinical practice. This is fetal heart rate monitoring in the assessment of fetal well-being. The second lecture, by Professor Jane Harding of New Zealand, is exciting new work on the role of nutrition in fetal growth. I am certain you will thoroughly enjoy each of these articles, and will gain a large appreciation for the important contributions made by fetal physiologists to our understanding of development and to modern clinical obstetrics.

In closing this introduction, I have reproduced by kind permission of the London *Times* the obituary of Geoffrey Dawes written by Professor Chris Redman of Oxford. It details with eloquence and respect the life of Professor Dawes.

*Geoffrey Sharman Dawes, Physiologist; born Mackworth, Derbyshire, 21 January, 1918; married 1941 Margaret Monk (two sons, two daughters); Fellow, Worcester College, Oxford 1946–85 (Emeritus); Director, Nuffield Institute for Medical Research, Oxford 1948–85; FRS 1971; Member, Medical Research Council 1978–82; CBE 1981; Director, Charing Cross Medical Research Centre 1984–89; died Oxford, 6 May, 1996.*

Geoffrey Dawes, Director of the Nuffield Institute for Medical Research in Oxford for nearly 40 years, was a dominant international figure in fetal physiology.

Born in the last year of the First World War, he was the youngest offspring of the vicar of Mackworth in Derbyshire, where he grew up in the huge house, Thurlaston Grange, which was then the vicarage. After school at Repton, he went up to Oxford where he gained a First Class degree in physiology just as the Second World War began.

He completed his clinical medical training in Oxford in 1943, but was rejected for military service because of the asthma that plagued him throughout his life. Instead he joined the department of pharmacology under Professor J.H. Burns, and helped to develop drugs for treating gas gangrene and for countering nerve gas exposure.

At the end of the war, he continued in the field of pharmacology with a Rockefeller Travelling Fellowship in Harvard and Philadelphia before returning to a Foulerton Royal Society Research Fellowship in Oxford. But in 1948, the youthful Dawes became the first, and as it transpired the only, director of the newly-formed Nuffield Institute for Medical Research. This was one of the many direct results of Lord Nuffield's benefactions to the Oxford Medical School. The Institute's first home was in the beautiful old Radcliffe Observatory, designed by Christopher Wren and at that time recently vacated, with the removal of the entire staff and equipment of the Observatory to the brighter and clearer skies of South Africa. Although unsuitable in nearly every way in its new purpose, the building housed an energetic and fruitful team of physiologists, pharmacologists, and clinicians. The far-thinking Dawes had decided that they should turn their attentions to the hitherto poorly explored field

of fetal physiology, in the first instance to focus on what mechanisms controlled the fetal circulation.

There followed many investigations of the distribution and control of the fetal circulation, predominantly in the unborn lamb, at first in acute experiments and later, after the Institute moved to its new site in Headington, with chronically catheterized preparations that allowed longer-term observation and experimentation. The influence of chemoreceptors, the mechanisms that trigger the dramatic changes of birth, in particular the control of the onset of breathing, were analysed in detail with constant attention to the implications for human physiology and disorders. Dawes was one of the first to observe that the fetal lamb had sleep cycles as well as breathing movements *in utero*, and within a short time could confirm that so did the human fetus. This led naturally to considerations of central nervous control, not only in relation to sleep state, but also heart rate variability and responses to stimulation of chemoreceptors.

A long-serving Fellow of Worcester College, Dawes became a Fellow of the Royal Society in 1971 and received many awards that recognized the breadth and importance of his contributions. His retirement in 1985 saddened his many friends, because no successor could be found to continue his work, so that the Nuffield Institute was closed. Nevertheless, Dawes did not in any sense "retire." His mind continued to buzz with original ideas and concepts, and with delight in the unfolding of new knowledge and understanding. He was a skilled mathematician (a trait inherited from his father) and now grappled with numerical methods to describe the complexities of human fetal heart rate patterns.

His interest had been sparked by earlier work with fetal lambs, at which time he had mastered the principles of computing, then at a relatively primitive stage of development. His studies of the human fetus were made possible by the technology of non-invasive, Doppler ultrasound recording, by now a well-established part of clinical practice. He was fascinated by the need to understand the physiological mechanisms underlying the still unexplained short and long-term variations in the heart rate of the healthy human fetus, and the ability to use changes induced by spontaneous hypoxaemia (a deficiency of oxygenation of the blood) to detect fetal distress *in utero* and so devise a clinically useful diagnostic technique.



He delighted in the new potency of desktop computing, harnessed the technology to his purpose, and produced a system of measurement now used at the bedside around the obstetric departments of the world as the most precise, non-invasive way of assessing the well-being of the human fetus. He was a familiar figure in the Department of Obstetrics at the John Radcliffe Hospital in Oxford, participated in clinical case conferences, and continued to goad his clinical colleagues for their mindless preference for subjective impressions rather than objective numerical measurements of fetal heart rate patterns. Papers, letters, and reviews flowed from his pen—more than 20 since 1990 alone. He had a terse, synoptic style of writing, clear and economical; sometimes he had to be reminded that his readers' minds were not as quick and logical as his own, and so be persuaded to insert what he considered to be unnecessary elaboration and explanation.

He retained astonishing vigour, openness to new ideas, a precise and detailed memory, and an unremitting dislike for thoughtlessness and ignorance. His encounters with the latter stimulated his asthmatic wheeziness, so it was a familiar signal of his mood when he angrily had to use his inhaler. He enjoyed attending international meetings, was sought as a good speaker until his final year, and cheerily coped with the punishment of modern air travel.

He continued his hobby of fly fishing, and spent many hours developing and caring for his beautiful large garden at his home in north Oxford. There, visitors were always welcomed from every part of the world to stay, to drop in for a glass of sherry or be entertained for dinner. They found a unique ambience arising from his long and happy marriage to Margaret whom he met in his first year as an Oxford undergraduate. He was proud of his large family—two sons and two daughters—and enjoyed nothing better than the occasions that drew them together. Of formidable intellect, great integrity, and questing spirit, he was also a kind and humorous man.

Geoffrey Dawes was a foremost international authority on neonatal physiology, writes Dr. John Walker. He was educated at Repton, a school which showed unusual wisdom by making him first a member and later, in 1971, chairman of its Governing Body.

During his time at Oxford he was involved in important work in connection with his subject; he was Secretary of the British Pharmacological Society and Editor

of the British Journal of Pharmacology. He was also a popular member of his old college, Worcester.

Dawes' combination of a rosy-cheeked face from behind which came apparent sounds of wisdom led some to suppose that there was an element of pomposity in his make-up, but you had only to observe the way the family enjoyed itself together, and the care that Geoffrey took of his wife after blindness overcame her, to see that this was an unusually happy family, and that Geoffrey was an important element in it.

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