Dr. Antoinette Pirie (1905–1991)

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Oxford

Antoinette Pirie, former Reader in Ophthalmology at the University of Oxford and head of the Nuffield Laboratory of Ophthalmology died on October 11, 1991, aged 86, in Oxford.

She was best known to most eye researchers for her pioneering studies of the lens and cataract but her earlier research included studies of tissues from the cornea to the vitreous, and after retiring in 1973, as a reader, she returned to the effects of vitamin A deficiency on the cornea and put her findings into practice in India and elsewhere.

Her research on the lens and cataract formation started after she became Reader in Ophthalmology in 1949 and after Ruth van Heyningen joined her as a research assistant. They formed a remarkable partnership lasting for 20 years. They explored biochemical changes in X-ray cataract in rabbits: the loss of glutathione, protein thiol and glutathione reductase (1953, 1957), the slow growth and loss of other enzymes (1954, 1957), the effects of partially shielding the lens (1957, 1959), radiation resistance of the hen lens (1959, 1961) and cysteine protection (1959, 1960). They studied the formation of galactose cataract (1955). They also explored normal lens metabolism: the maintenance of glutathione levels (1953), barium and strontium levels (1958), the presence of a variety of organophosphate compounds (1958). Tony Pirie reported on the metabolism of glycerophosphate (1962, 1963), on glucose 6-phosphate dehydrogenase and 6-phosphogluconate dehydrogenase (1964) and on glutathione peroxidase and the formation of hydrogen peroxide (1965).

By 1956, Tony and Ruth wrote 'Biochemistry of the Eye' to share their knowledge with biochemists and ophthalmologists. The book is written in the clear, simple style that characterized their original papers, and provided the background information for a generation of ocular scientists. In the early sixties, she had a second storey put on to the laboratory more than doubling the space to allow for an expansion of activities. In May 1962, Tony Pirie organized a Lens Symposium in Oxford which was published as a special issue of Experimental Eye Research. The symposium photograph still hangs in the lab and shows many great lens experts of the day.

Tony set up the International Committee for Eye Research, chairing it from 1968 to 1972. It developed into the flourishing International Society for Eye Research. When Davson edited 'The Eye' (1962 and 1969), Tony Pirie wrote the chapters on the vitreous body. In 1968, Tony wrote the book 'Diabetes and the Eye' with Francis Caird and Terry Ramsell. Also in the sixties, Tony and Ruth investigated naphthalene-induced cataract exploring the metabolism of naphthalene and reactions of

59

the metabolites dihydroxynaphthalene and naphthaquinone with lens proteins (1966). Ascorbic acid was lost from aqueous humour and vitreous body, and calcium oxalate crystals formed in the retina (1967). The coloration of the lens in naphthalene cataract was due to naphthaquinone-

protein adducts. Tony showed how naphthalene interfered with mitosis in lens epithelium (1968). She became fascinated by the yellow-brown colour of cataracts and by their fluorescence and started to investigate them by analyses of human cataract lenses and by studies of model systems such as tyrosine oxidation products (1968).

She won the Proctor Medal of the Association for Research into Vision and Ophthalmology, an honour which had rarely gone outside the United States. In her Proctor Lecture, she compared the brown fluorescent proteins of human nuclear cataract with those of naphthalene cataract in rabbits (1968). She introduced the simple classification of human cataract based on nuclear colour and showed progressive changes in lens protein associated with these four classes. The Department had prospered during the sixties with many other studies published independently by her colleagues.

Tony Pirie continued her work on experimental cataract with the exploration of diquat cataract and the associated free radical reactions (1969, 1970, 1971). The investigation of one possible cause

of cataract, sunlight, led her to show that tryptophan in lens proteins is converted to N-formylkynurenine by sunlight causing crosslinking (1971, 1972). Other changes to proteins were explored with a succession of postdoctoral fellows (Buckingham, Harding, Dilley). Tony continued to explore the sunlight hypothesis, by comparing proteins photo-oxidized in the laboratory with proteins of human cataractous lenses finding similarities in colour and fluorescence (1972), but in the end after careful analysis of protein from human cataracts with Dilley they could not support the hypothesis principally because there was no loss of tryptophan from human cataracts to compare with the early drastic loss in proteins exposed to sunlight (1974). In 1973, she inspired and chaired the Ciba Symposium on human cataract. If the symposium did not provide all the answers to cataract at least it clarified many of the questions.

She retired as head of the Nuffield Laboratory of Ophthalmology in 1973, to be succeeded by Tony Bron, an ophthalmologist. She did not give up laboratory work at this point but continued with vitamin A deficiency in rats first in Cambridge and then back in the Nuffield Lab for 2 years, showing increased proteolytic activity in the cornea of deficient rats (1975, 1980, 1981), and showing that topical retinoic acid cleared the lesion in deficient rats (1977).

Her interest in vitamin A deficiency took her beyond the laboratory. The Royal Commonwealth Society for the Blind asked her to help set up a Nutrition Rehabilitation Centre in Tamil Nadu to deal especially with vitamin A deficiency and the resultant xerophthalmia, a major cause of infant blindness in South-eastern Asia, South America and parts of Africa. The philosophy behind the Nutrition Rehabilitation Centre was outlined in a paper by Venkataswamy, Pirie et al. in *Lancet* in 1976. In 1977, it was demonstrated that children at the Nutrition Rehabilitation Centre needed dietary protein to allow synthesis of retinol-binding protein before dietary vitamin A or carotene could be fully beneficial.

The Xerophthalmia Club promoted these ideas and Tony Pirie produced a news sheet, the *Xerophthalmia Bulletin*, full of sound practical advice on the prevention of xerophthalmia. Its circulation increased to over 1,000 during her time as an editor which ended in 1985 when she also had to give up the foreign travel demanded of her in her role as roving advisor in nutritional problems and participant in nutritional meetings.

In the laboratory, her forte was in the design of simple experiments to provide clear answers to important questions. In the world outside it was to devise simple, appropriate and acceptable methods to prevent blinding malnutrition.

60

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Obituary