

## THE WOMAN WE HONOR



DR. ELIZABETH N. MARKS

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## Biography of Elizabeth Nesta Marks

Elizabeth Marks was born in Dublin, Ireland, on 28th April 1918 and was christened in St. Patrick's Cathedral (with which a parson ancestor had been associated), hence her nick-name Patricia or Pat. Her father, an engineering graduate of Trinity College, Dublin, had worked as a geologist in Queensland before returning to Dublin to complete his medical course. In 1920 her parents took her to their home town, Brisbane, where her father practiced as an eye specialist. Although an only child, she grew up in a closely knit family of uncles, aunts and cousins. Her grandfather retired in 1920 in Camp Mountain near Samford, 14 miles west of Brisbane, to a property known as "the farm" though most of it was under natural forest. She early developed a love of and interest in the bush. Saturday afternoons often involved outings with the Queensland Naturalists' Club (QNC), Easters were spent at QNC camps, Sundays and long holidays at the farm. Her mother was a keen horsewoman and Pat was given her first pony when she was five. She saved up five pounds to buy her second pony, whose sixth generation descendant is her present mount. In 1971 she inherited part of the farm, with an old holiday house, and has lived there since 1982.

Primary schooling at St. John's Cathedral Day School, close to home, was followed by four years boarding at the Glennie Memorial School, Toowoomba, of which she was Dux in 1934. It was there that her interest in zoology began to crystallize. Entering the University of Queensland (UQ) in 1935, she graduated B. Sc. in 1938, with Second Class Honors in Zoology in 1939, and M. Sc. in 1940. She also earned a Full Blue for swimming and a Half Blue for hockey. (Later, in 1950, she swam for Cambridge against Oxford). The undergraduate courses then available to Science students included only one term of Entomology, taught by F. Athol Perkins, a stimulating teacher in class and field. For honors Pat specialized in parasitology, with a strong bias to insects of medical and veterinary importance. She continued her contacts with Perkins, but was supervised by a lecturer in Zoology, Dr. Ronald Hamlyn-Harris, who, as Brisbane's City Entomologist 1928-33, had been a pioneer of biological control of mosquitoes in Australia. His enthusiasm was infectious, he took her out collecting mosquitoes, and one of her projects (and her first publication) was the description of an anopheline larva. In August 1939 she began work as Assistant Curator of the Pathology Museum in the newly completed UQ Medical School, but kept her primary interests alive by demonstrating to medical students taking Perkins' practical classes in Medical Entomology.

The years 1942-44 saw intensive activity in Australia concerning mosquito-borne diseases. The war moved to New Guinea early in 1942, bringing Australia's troops into highly malarious areas. Beginning at the end of 1941, a major epidemic of dengue fever extended as far south as Brisbane and late in 1942 a serious malaria epidemic erupted in Cairns. The Australian Army formed over 20 Malaria Control Units, whose officers received instruction in Sydney. Perkins was appointed O. C., Land Headquarters School of Malaria Control, to give basic entomological training to other ranks. Courses were based in his department, with J. Leatham Wassell instructing in field work and line surveys.

Following the Cairns malaria epidemic, the Queensland Government, in February 1943, appointed a Mosquito Control Committee (MCC) with the Director of Health as Chairman and Perkins as Secretary. Its functions included mosquito control, education and research. On 1 April 1943 Pat moved to UQ Department of Entomology as the MCC's Graduate Research Assistant, supported by a government grant through the State Health Department to UQ. This continued until she obtained 10 months leave without pay to visit Europe in February 1949. The MCC gave her the remaining 100 pounds from its original lump-sum grant to enable her to study for 6 weeks in the British Museum (Natural History) (BMNH), and said that it would ask for a further grant when she was due to return. When, in August 1949, she advised the committee that she had decided to study for two years at Cambridge, but hoped to return to mosquito research in Queensland, the MCC said it would defer asking for another grant until it heard that she was returning. The committee then negotiated an annual grant, and she came back in October 1951 to the same project at UQ. In the interim Perkins had undertaken whatever identifications and advisory work were requested. This job, with various changes in title to, finally, Senior Research Officer, continued until 30 June 1973 when the government dissolved the MCC and transferred her on 1 July to the staff of the Queensland Institute of Medical Research (QIMR) as Principal Entomologist. However, QIMR had no space for her and she continued her work at UQ until 30 December 1976, when she moved to QIMR's new building. At her retirement on 28 April 1983, QIMR appointed her an Honorary Research Fellow and it continues to provide her with research facilities.

The original research program of the MCC in 1943 placed emphasis on "species sanitation" and its dependence on accurate studies of a taxonomic, biological and ecological nature. The MCC's function regarding control was one chiefly of advice and stimulation and was undertaken in response to requests from the Health Department or Local Authorities. In June 1952, the MCC revised its research program: "The long term aim is a knowledge of the complete life histories of all species of mosquitoes found in Queensland, and as much information as can be obtained on their distribution, biology, habits and relationship to man and domestic animals" with eventual production of a monograph of Queensland mosquitoes on the lines of those on Ethiopian mosquitoes by Hopkins, Evans and Edwards. "Since there are 128 Australian species that occur in Queensland and only 25 that do not," it would be better for the projected publication to include all Australian species. The immediate objective was discovery of stages still unknown, and publication of descriptions and figures of undescribed species and stages, which required more detail than needed in the monograph. Taxonomic studies should concern groups of related species. The program would also include any advisory investigations or participation in researches concerning mosquitoes or mosquito-borne disease, that might be requested. This program was followed except that the monograph did not eventuate, at least partly because no assistance was provided, John Belkin in 1962 set a new standard for descriptions and figures of larvae and pupae, the number of known species escalated, reaching 210 from Queensland, 272 from Australia by 1985, and the researcher had many diversions.

Personalities and current events influenced the research programs, which were directed by Perkins until his retirement in 1965. His own pre-war research on fruit flies had evolved from field studies on seasonal distribution to the

taxonomy of Australian and Oriental Tephritidae. In 1951, in south-eastern Australia, there was an epidemic of Murray Valley encephalitis (MVE) and a widespread enzootic of myxomatosis. Potential vectors became of special interest and suddenly it was widely realized how little was known about the total Australian mosquito fauna. It was at this time that N. V. Dobrotworsky was appointed to the University of Melbourne to study the mosquitoes of Victoria. Dr. I. M. Mackerras, who had been the Australian Army's war-time Director of Entomology, was appointed the first Director of QIMR in 1947 and became a member of the MCC. In 1952, QIMR was on the threshold of its extensive arbovirus researches. Probably too, by 1952 Pat's bent for systematics influenced the MCC's choice of program.

In 1943 the UQ Entomology Department was an exciting place to begin research on mosquitoes. Although not involved with the Army classes, Pat had permission to accompany Wassell on field trips to collect class and other material. He had a natural genius for biological collecting and was a stimulating mentor. Any unusual larvae were given to her for rearing and identification. Some of the NCO's who had passed through the courses sent Perkins culicines from north Queensland, New Guinea and the Solomons. Men from other services who came for instruction included USN Ensigns George Bick and George Penn who later sent collections from New Guinea. In August 1943, Perkins ran two one-week courses for school inspectors and during 1943-45, collecting outfits were railed to schools throughout the state. These various contributions laid the foundation for the UQ mosquito collection and provided Pat's introduction to the fauna of the Australian region and her basic training in identification of a wide range of genera and species. Perkins suggested that she should aim towards papers on *Aedes* but he did not hurry her.

Australian research in mosquito systematics in 1943 was centered in the University of Sydney, at the School of Public Health and Tropical Medicine (SPHTM) where F. H. Taylor had been entomologist since 1930, and in the Zoology Department, where A. R. Woodhill (then in the Army) and D. J. Lee were revising the anophelines of the region and Lee, working as a taxonomist for the Army, was preparing an atlas of mosquito larvae and identifying many collections. In April, 1944 Pat worked for several weeks with Lee from whom she learned much about anophelines and about the significance of systematics. Colonel Willard V. King, a mosquito taxonomist attached to the US Army Medical Corps, who was working there on New Guinea collections, also taught her a great deal. She had taken to Sydney most of UQ's New Guinea culicines and the collections were compared and a division of labor planned that would obviate duplication of descriptions. Lee undertook to revise *Tripteroides*, Pat the *Aedes kochi* group, and King and his colleagues most of the other New Guinea culicines. She also had her only meeting with F. H. Taylor. The SPHTM type material had been removed for safety, but was studied on another visit in May, 1945.

Hamlyn-Harris had exchanged reprints and specimens with Johanna Bonne-Mepster in Java and her papers were much in use at UQ. Early in 1946 she and her husband were in Brisbane recuperating from their years in Japanese prison camps, while waiting to return to Java. She joint Pat on two field outings and demonstrated how to collect *Mansonia* larvae from a hyacinth swamp - an excitement for both of them.

In May 1946 Pat was sent to make an anopheline survey at Lucinda Point, an isolated community in the Ingham district of north Queensland where there had been a malaria outbreak. This collecting trip was extended to Cairns, and in 1947 she investigated *Culicoides* pests at Gladstone and mosquito problems at Mackay. Between June 1946 and June 1948 she identified most of the 5000 samples from the Brisbane City Council's anopheline survey of the Greater Brisbane area.

She went on leave to Europe in February 1949. This was to mainly holiday, but she visited Mrs. Bonne-Wepster and examined type specimens in Amsterdam. At the London School of Hygiene and Tropical Medicine she was shown around the laboratories by D. S. Bertram, noting there a colony of *Aedes pseudoscutellaris* from Fiji being maintained for Sir Philip Manson-Bahr. She spent six weeks at the BMNH studying specimens from the Australian region and enjoying exchange of ideas with Peter Mattingly. In September 1949 she enrolled as a ph.D. student in the Zoology Department at Cambridge University, with John Smart as her supervisor. Seeking a project with relevance to the Australian region, she obtained Manson-Bahr's permission to have eggs and larvae from his *Ae pseudoscutellaris* colony. Sir Rickard Christophers, who had a room in the Zoology Department, demonstrated how he maintained his colony of *Ae aegypti* and helped solve her problems - so began a happy friendship. Her thesis, presented in 1951, was titled "A review of the *Aedes scutellaris* subgroup with a study of variation in *Aedes pseudoscutellaris* (Theobald)." Her examiners were P. A. Buxton and W. H. Thorpe.

Mattingly found a box of unidentified mosquitoes from south-eastern Polynesia, sent by E. C. Zimmerman to F. W. Edwards at the beginning of the war. He suggested that Pat might borrow and identify them. Differences between Zimmerman's series and specimens from her colony led to recognition that two species were being identified as *Ae pseudoscutellaris*, the second she described as *Ae polynesiensis*. At the IX Congress of Entomology in Amsterdam in August 1951 she met many well known mosquito workers, including K. L. Knight with whom she had already co-authored a manuscript on *Finlaya* after he had stimulated her interest in species groups.

On return to Australia she was plunged into field work, going in January 1952 to Mildura to assist in the Hall Institute's study of the epidemiology of MVE, and to work with W. C. Reeves, who came from California to lead the field team with techniques not seen before in Australia. In May she assisted QIMR in a similar exercise at Townsville (there was another in November 1954), then collected further west before receiving instructions in June to meet Josephine Mackerras (QIMR's parasitologist) at Horn I. and proceed to Murray and Darnley, eastern Torres Strait islands, to investigate an epidemic of malaria. On return they collected at Bamaga near the tip of Cape York Peninsula. In April 1953 she joined a QIMR team for a malaria and mosquito survey of the western islands of the Strait and stayed longer at Bamaga (where she collected again in 1979 and 1985). She then joined Wassell at Coen for further collecting. Other visits to

the Peninsula were to the remote Lockhart River Mission on the east coast with Jo Mackerras in 1956 and with R. L. Doherty in 1961. In 1960 and 1961 she joined QIMR teams collecting for arboviruses at Mitchell River Mission (now Kowanyama) near the west coast. The first isolation of MVE from wild-caught mosquitoes, *Culex annulirostris*, was made from the 1960 collection. Torres Strait islands and Cape York Peninsula have provided new species and many new records of New Guinea species.

From 1951 to 1956 the CSIRO Wildlife Survey Section, headed by F. N. Ratcliffe, was engaged in extensive studies of myxomatosis and its vectors in the southern states. Many problem specimens were referred to Pat who thus became familiar with a different range of species, especially the southern *Aedes* (*Ochlerotatus*). She and Dobrotworsky exchanged species for description so that each was dealt with in its appropriate species group. She herself collected in other states and in New Zealand during vacations. Later interesting collections were received from colleagues in Northern Territory and northern Western Australia.

In 1958 she was granted three months leave to undertake a systematic and ecological study of New Guinea mosquitoes with a travel grant from the Bishop Museum and collected in many areas. At Minj she met S. H. Christian, who had been sending culicines to UQ since 1948, at Maprik visited Wallace Peters and H. A. Standfast, and at Hollandia met D. Metselaar and W. J. O. M. van Dijk. The highlight was a 5-day yacht trip with J. van den Assem, by invitation of the Resident, to Pionierbivak at the upper limit of navigation on the Mamberamo River. Collecting near villages along the river was under armed guard. A week's collecting on Daru I. followed a malaria conference in Port Moresby in 1959. In 1961 at the invitation of the director of Public Health, Territory of Papua and New Guinea, she went to Port Moresby to effect the transfer to UQ from the Malaria Section of a large collection of New Guinea mosquitoes. This comprised the bulk of the culicines collected by Peters, which he was anxious to see safely housed. In 1956 she joined Mattingly, W. A. Steffan and Yiau-Min Huang in another collecting trip for the Bishop Museum at Lae and Wau, and in 1979, at the invitation of the PNG Institute of Medical Research, visited localities on the Purari River to report on potential arbovirus vectors; this team included Telford and Martine Work from UCLA.

A good liaison was established with Health Inspectors in the earliest days of the MCC. They collaborated by submitting samples for *Aedes aegypti* surveys of Queensland in 1955-56, 1965-66, and also 1970-72 (for which WHO provided a supporting grant). Their Association asked the UQ Entomology Department to arrange courses in mosquito trapping and identification. Pat organized five two-week courses which were run at Brisbane and Townsville in 1966 and 1973. "An atlas of common Queensland mosquitoes," first produced in 1966, has been widely used in medical entomology teaching.

Attendance at six International Congresses of Entomology since 1960 gave her the opportunity of meeting many overseas colleagues enroute or at the meetings and of examining museum collections. In 1960 her two days in Los Angeles were spent discussing with John Belkin the ms of "The Mosquitoes of the South Pacific" and Alan Stone hosted a week working at the Smithsonian Institution.

At QIMR grants from the Australian Research Grants Scheme and from the Australian Biological Resources Study supported a part-time assistant, Marlene Harris, who worked with her 1979-85 on *Culex*, *Aedes* and *Anopheles* and they had productive field trips together, to north Queensland and Tasmania. A catalogue project that had been long in preparation with David Lee and his colleagues began to come to fruition with publication of the first volume of "The Culicidae of the Australasian Region" in 1980.

In 1945, when Pat attended a memorial address on T. L. Bancroft which made no mention of his work on mosquitoes, her interest in biographies of scientists and naturalists was aroused. This topic has been pursued in various addresses and articles. Interest in local history led to her editing booklets of reminiscences for the Samford District Historical Museum. A hobby interest in marine Diptera arose when she took part in a scientific expedition to Low Isles in 1954.

She has been active on the councils of scientific and conservation bodies and held various offices: Treasurer, Excursion Secretary, Editor and twice President of QNC; Secretary and President of the Entomological Society of Queensland; Treasurer and President of the Royal Society of Queensland; member of the Executive Committee of the Australian Conservation Foundation; foundation Vice-president and Chairman of the Executive of the Australian Entomological Society and its President 1975-77. She has been an Honorary Research Associate of the Bernice P. Bishop Museum since 1974 and has been honored by life membership of QNC, the Royal Society of Queensland and the Australian Entomological Society and Fellowship of QIMR and of the Royal Historical Society of Queensland. In 1981 she received the Australian Natural History Award from the field Naturalists Club of Victoria and in 1986 she shares with John Reid the Belkin Award of the American Mosquito Control Association for excellence in systematics.

The pleasures of her career in mosquito systematics include the friendships, the interesting places visited, and cracking life-history secrets and the mysteries of ancient type specimens. The regrets are in having so many unfinished projects, especially those with joint authors, though she is still working on these. Alone or jointly she has described 38 new species.

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