REMEMBERING MIRIAM

SIR JOHN GURDON, FRS

Let me first say how grateful I am to be invited to say something about the scientific life of Miriam, whom I have known for nearly half a century. I first met her in Oxford, purely by chance, through our mutual interest in butterflies and glacier skiing.

Miriam's scientific life goes back to the age of 4, when she started breeding ladybirds in her bedroom. She started to collect butterflies, but soon stopped and became increasingly committed through her life to kindness to animals. She helped her father collect fleas, a subject on which he had become very expert. After her father's premature death at her age of 15, she signed on for evening classes on Zoology at Chelsea Polytechnic, having had only private education up till that time. One day she went with the class on a day outing to the Plymouth Marine Biological Station. While most students would have seen this as a day off from work, eating ice creams, etc, Miriam chose to spend the time examining rock pools, and remarkably discovering a previously undescribed marine parasitic worm living on a mollusc. This was just luck, one could say; but a more thoughtful reflection would point out that luck favours the prepared and activated mind. I really believe it was her extraordinary level of activation and interest in all around her that led to her outstanding achievements in life. In her case, as so often happens, intellectual ability was enhanced rather than hindered by sporting achievement; in fact, she reached a national standard in squash and cricket.

As time went on Miriam became increasingly influenced by her uncle Walter, who was a passionate collector of almost every kind of animal. It was he who started the famous Tring Museum, now part of the British Museum. Encouraged by her uncle, Miriam embarked on the taxonomy of fleas, a bigger subject than you might think, since you may be surprised to know that there are almost as many different kinds of fleas in the world as there are of ill-known mammals from a field vole to an elephant.

Long nights of examining flea genitalia led Miriam to publish the definitive work on world fleas in 6 volumes, and to her becoming recognized as the world authority on this group, and this includes the vectors of the plague and many other human and animal disorders.

While most taxonomists would sit back to enjoy recognition of their labours, Miriam chose to pursue her knowledge to a much deeper level, and did so in two innovative ways. First, she found that a flea can jump to a height ten times its own body length at an acceleration exceeding that of a rocket. She went even further in finding that this remarkable capacity depended on a rubber-like substance, identified as resilin, and used, as she pointed out, by dragonflies to achieve their unique ability to fly backwards. On one occasion, Miriam was invited to describe her work on fleas in the Scientific American, which publishes only articles of exceptionally broad interest.

She used to add anecdotes on reprints that she sent me. On this occasion the hand written note records her visit to the Middle East, when she hired an Arab driver who could navigate with ease through any unmarked desert track. But she needed to reach a place in town. After a few hours getting absolutely nowhere she remonstrated mildly. The driver responded by saying "Lady, to me, all roads look exactly the same." She also added in her note to me that she thought the same of molecular biology labs, which she felt looked identical. This might imply that she didn't understand molecular biology. Actually she did,

remarkably well, and this accounts for her exceptional judgment in choosing collaborators with skills precisely complementary to her own.

Miriam's second important scientific discovery connected with fleas was based on experiments in which she used aerosol sprays to show, remarkably, that a flea controls its reproduction by sensing a urinary olfactant released by baby rabbits. This gave a novel insight into how a flea can achieve transmission from one host to another, and so facilitate the otherwise impossible precarious survival of a parasite. Her book on fleas, flukes and cuckoos was an enormous success.

In mid career, Miriam followed another direction in her lifelong analysis of interactions between animals and their environment by managing to interest Tadeus Reichstein, a Nobel laureate in Chemistry, in the identification of a novel cardiac glycoside, or heart poison. She found that certain butterflies sequester this compound from their food plant to give them protection against predators. She co-authored no less than 16 scientific papers with Reichstein, out of some 350 scientific papers that she published in her life.

In addition to her purely scientific life, Miriam played a major part in insect and plant conservation. She carried on her father's original work by establishing plant and insect habitats and by the creation of Nature Reserves. As most of you know, she gave away enormous supplies of wild flower seeds for people to grow in their gardens.

In the course of her career, Miriam received numerous scientific accolades. Apart from a host of Entomological medals, she was awarded the Premier Victoria Medal of Honour by the Royal Horticultural Society. Notably she was elected to Fellowship of the Royal Society, making her and her brother the only two living brother-sister FRSs.

She also received a special award from the Editor of the premier scientific journal Nature when she had achieved the probably unique distinction of having 27 papers in Nature. Most of us would be well pleased if we could get one paper accepted by Nature every 10 years. Lastly I should say that Miriam is probably the only person ever to have received 8 honorary degrees having never had her own lab, nor a single PhD student, nor even a single degree by normal examination.

Let me finish with a comment on her most recent years, when she was in her mid 90s.

She developed a consuming interest in what could yet turn out to be the single greatest scientific contribution of her life. In collaboration with Naomi Balaban and Robin Nash, she found that a number of British butterflies contain a very unusual chemical of food plant origin that gives them protection from predation. This is a chemical belonging to the group known pyrrolidizine alkaloids. Remarkably, she found that these are able to kill certain bacteria that are notoriously resistant to all currently known antibiotics. In her Romanes Lecture, published as a book, and in effect an autobiography, she says that initiated this discovery by noting that exceptionally healthy populations of the Meadow Brown and Ringlet butterflies were thriving under conditions where cattle in the same field were suffering severely from an outbreak of anthrax. If this work progresses as we might hope, it would yield an entirely new class of antibiotic for humans.

This latest work brings together so many of Miriam's major contributions to life namely human-animal-plant-interactions, protective toxins, a compelling reason for nature conservation, especially for butterflies, and finally benefits for human health.

This last fascinating work gave her relief from blindness and other discomforts in her final years and kept her mentally alert to the end. To me, this provides a fitting final tribute to a truly remarkable career and to her lasting contribution to science, and to the environment.