

## MIRIAM ROTHSCHILD AND JOHN FOSTER HUMAN RIGHTS TRUST

DAME MIRIAM ROTHSCHILD, CBE, FRS 5th August 1908 - 20th January 2005

Elected a Fellow of the Royal Society on 21st March 1985

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Miriam Rothschild was born at Ashton Wold, Northampton on 5th August 1908 and died there on 20th January 2005 at the age of 96.

She was born into a family which made her interest in natural history all but inevitable. Her father Charles was the founder of the modern conservation movement and he campaigned long and hard for the establishment of national nature reserves. He and George Verrall purchased Wicken Fen and donated it to the nation as the first such reserve. Miriam always used to say "I did not leave school, school left me", for she was educated at home by a governess and her father until the latter's death in 1923. Early in her life she was fascinated by what could be seen under a microscope and the plants and insects she saw at Ashton, as well as her grandfather's country seat at Tring Park. Her uncle Walter, the 2nd Lord Rothschild, built a large private museum at Tring which he administered for 50 years. He took over the encouragement of Miriam's interest in the natural world after the death of her father. As well as establishing the museum, he kept many exotic animals. Miriam was later (1983) to write the fascinating book *Dear Lord Rothschild* (259) which recounts many of her uncle's eccentricities, including the use of zebras to power his carriage in London.

As part of an evening class in zoology at Chelsea Polytechnic, Miriam spent one Whitsun visiting the Marine Biological Laboratory at Plymouth. Here she discovered, by chance, a previously undescribed larval trematode parasite of the littoral gastropod *Nucula*. This led to co-authorship with Or Idris Jones of her first scientific paper (1). In the 1930s, Miriam divided her time between the farm at home and as a visiting scientist at Plymouth and Naples (with a University of London Scholarship) studying trematode parasites of gastropods on the mudflats at Plymouth enabled Miriam to solve life cycles of several trematode species. One such study involved the attachment of an 8m high glass tube filled with sea water to the outside of the house at Ashton. She also showed that infected gastropods had a faster growth rate and displayed sex-reversal and altered shell morphologies, which had clear implications for gastropod taxonomy. The phenomenon indicated an effect of the parasite on the hormones of the host, but the work was stopped by the outbreak of war.

Lord Rothschild's home at Tring was the home of the Rothschild flea collection which moved to the British Museum (Natural History) in 1971. Miriam actually published her first paper on Siphonaptera as early as 1934 (2). Many papers followed, but one of her most significant contributions to entomology was her six-volume magnum opus, published over a long time span (1953 - 1983),

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*The Catalogue of the Rothschild collection of Fleas in the British Museum* (Natural History) (58/ 68, 86/ 129/ 169, 261). Equally remarkable was her 1952 New Naturalist volume *Fleas, Flukes and Cuckoos* (with Theresa Clay) (57), considered by many to be one of the two finest natural history books ever to have been written (her great friend E.B. Ford's *Butterflies* being the other), in which she achieved the extraordinary feat of popularising her beloved parasites.

The switch in emphasis away from trematodes was completed when in 1952 she temporarily relocated her family to Oxford in connection with her childrens' education. Here she was greatly influenced by Professor Geoffrey Harris, but also by Professor E.B. Ford, who steered her increasingly to work on lepidoptera. However, Miriam published many other papers on fleas, and was central to the discovery that these insects spread the myxomatosis virus of rabbits (see later). As her eyesight deteriorated towards the end of her life, Miriam blamed the long hours spent at the microscope studying fleas. She did seminal work on the role of the corticosteroid and oestrogen hormones of the rabbit host (105, 108, 127, 131) in determining that the ovaries of the fleas only matured on pregnant rabbits. This ensured that emerging adult fleas synchronised with the availability of newly-born rabbits on which the fleas copulated although they were already sexually mature on the pregnant mother. This was the first-known instance of the reproductive cycle of an insect being regulated by that of its host. Miriam also elucidated the mechanism involved in the flea jumping action (80, 210, 211), using high-speed photography and anatomical studies to identify the presence of the elastic protein resilin in the thorax of fleas, derived from the flight mechanism of their winged ancestors.

During the war, Miriam spent time at the code-breaking centre at Bletchley Park where she worked on the German 'Enigma' code (she received a Government Defence Medal for this work). Her habit of bringing birds back to Ashton for study led to rumours that she was involved in espionage and the transfer of secret messages by carrier pigeon. During the war she also discovered that the pigeons with darker plumage which appeared in winter were not migrants from outside England, but were suffering from tuberculosis of the adrenal glands. Publication of this finding had to be delayed till after the war (McDiarmuid, 1948), since wartime censorship considered the finding sensitive because pigeons were an important source of avian tuberculosis in cattle.

In 1954, she served on a government Advisory Committee on myxomatosis in rabbits and, at Oxford with Professor Harris, identified that the virus was not vectored, as was previously thought, by mosquitoes, but by the rabbit flea.

Miriam Rothschild 'broke the mould' left, right and centre. She argued strongly for increased floral diversity in the countryside, arranging for road verges to be planted with wild flowers and becoming an early leader in the technique of establishing wild flower meadows. Her techniques for improving wild flower establishment and her recreation of a 100-species rich flowering meadow earned her a gold medal of the Royal Horticultural Society. Some fields on her farm at Ashton became sites for the commercial production of wild-flower seed mixes. As her farm manager put it "It has taken me a long time to accept cultivating the same weeds I've spent most of my career trying

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to eliminate". Her seeds (in a mixture Miriam called "Farmer's Nightmare") were later used with her advice by the Prince of Wales to develop several hectares of wild-flower meadow at Highgrove. Her book with Clive Farrell, *The Butterfly Gardener* (1983) (260), very much aimed to enthuse others with her passion for wild flowers. In her campaign she formed an alliance with Lynda 'lady Bird' Johnson, wife of the then American president. Anyone who saw them together immediately recognised that although Mrs Johnson might be 'a ladybird' it was Miriam who was the 'bee' and a 'queen bee' at that. Often they would telephone each other, their conversations spanning from gardening to world politics. Special friends were encouraged to remain in the room and overhear such conversations. In one such phone call, near General Election time, the two discussed the Conservative Party candidate for Prime Minister, whom Miriam dismissed with: "But I think he's rather harmless".

In addition to her own innovations, Miriam was driven by the desire to complete her father's great work to safeguard the country's finest wildlife sites as nature reserves. By the time of Charles Rothschild's early death in 1923, a final 'shortlist' of 182 key sites had been compiled, but only one or two were established reserves. There was then a hiatus of 30 years before the Nature Conservancy was founded and Charles' list at last provided the foundation of our current network of National Nature Reserves, with Miriam in the vanguard of those making sure that all this finally happened. Alas, many were degraded or unavailable by the second half of the 20th century, and one of Miriam's late initiatives was, with Peter Marren, to document the fate of all sites on the original list in the book *Rothschild's Reserves - Time and Fragile Nature* (1997) (323). This, however, was no melancholy documentation of missed chances, but it was used by Miriam as a springboard for a new initiative to restore some of the most degraded, but most important, sites of her father's day to their former richness using the techniques of ecosystem restoration that she herself had helped pioneer. Many ambitious projects, from the massive current restorations of heath land back from arable fields and conifer plantations to the flooding of a vast new fen land area in Cambridgeshire, are now underway and are showing every sign of success. Miriam was justly proud of this last great contribution to conservation, but she was also characteristically modest. Very few of those involved in these projects are aware how they stemmed from her original ideas and were dependant on her tireless lobbying of the most senior politicians, officials, scientists and funding bodies.

Miriam Rothschild was the first (and still the only) woman president of the Royal Entomological Society (1993 -1994). She was similarly the first (and as yet the only) female member (elected in 1967) of the exclusive Entomological Club (founded in 1826 and limited to eight members). In 1998, when it had become physically hard for her to travel and attend Meetings, she was elected the first Honorary Life President of the Club. Her undeniable scientific standing also dealt the death blow to the chauvinistic rules excluding woman from attending the annual Verrall Supper for entomologists. Miriam and her brother Victor were the first brother and sister to be elected to Fellowship of the Royal Society, but she was not too impressed by Victor's report to the then Prime Minister, Edward Heath, on the future funding of science. The year after the report was published Miriam chaired the Verrall Supper under a huge banner which read "I am not my brother's keeper".

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Although she started collecting insects (including butterflies) at the age of four, it was only in the 1950s that she used butterflies to start one of her most productive and innovative research themes in what is today called 'chemical ecology'. Her standing in this subject is perhaps illustrated in the invitation in 1974 from the Royal Entomological Society to represent this theme by a contribution (186) to the Society's symposium coining the phrase 'Insect/Plant Interactions'. Miriam became fascinated by differences in distastefulness to birds even among supposedly palatable butterflies. It was this work that led to the conversion of rooms on the upper floor at Ashton Wold to aviaries for accommodating owls and other potential predators of Lepidoptera. Her observations on the selective foraging by birds between Lepidoptera species (80, 82) led to studies (101, 103, 117, 142) on mimicry, including classic studies on the role of plant-derived carotenoids in insect camouflage.

She showed that caterpillars of the large cabbage white butterfly (*Pieris brassicae*) fed a carotenoid-free diet developed into pupae which no longer were able to match the colour of their background (205) and that Monarch (*Danaus plexippus*) caterpillars treated similarly developed silver rather than gold flecks on their pupae (239). Miriam was the first to demonstrate that some Lepidoptera synthesise vertebrate-toxic compounds themselves, e.g. hydrocyanic acids produced by all stages of the Burnet moth *Zygaena* (92). She was also the first to demonstrate sequestering by Lepidoptera of such vertebrate-toxic compounds from plants (92, 145, 149). Some of her best-known work concerns the sequestration of cardiac glycosides (220) - including in aphids, cardenolides (202) developed into pupae which no longer were able to match the colour of their background (205) and that Monarch (*Danaus plexippus*) caterpillars treated similarly developed silver rather than gold flecks on their pupae (239). Some of her best-known work concerns the sequestration of cardiac glycosides (220), cardenolides (202) and carotenoids (197, 201, 203, 208, 212) in insects as diverse as cabbage white butterflies and locusts (223). A particularly famous collaboration with Nobel laureate chemist Tadeus Reichstein established that the poison in Monarch butterflies is sequestered from the caterpillar's food plant, the milkweed. Many entomologists will have first encountered her, probably at a meeting of the Royal Entomological Society at 41 Queen's Gate, giving a paper on this theme, for among her attributes was an ability to hold an audience with her interesting ideas, amusing jokes and charming manner. A meeting at which there was a presentation by Miriam was always worth attendance. With her love of colour she had a particular eye too for quality illustrations and always had dramatic slides to show in talks, and beautiful photographs for publications. She would stand at the podium, in flowing purple Liberty silks with matching headscarf, delivering outrageous 'adult' jokes with such aristocratic style as to offend no one. Indeed the apparel of the Purple Emperor was her 'logo' throughout her life, with the later addition of short white Wellingtons in the summer and moon boots in the winter. It was in white Wellingtons that she met Her Majesty the Queen on the occasion of the reception to mark the Royal Entomological Society's 150th anniversary. Some of her sartorial eccentricities stemmed from her passion for animal welfare following a visit to an abattoir and her immediate conversion to vegetarianism. Although for many years she had run a pedigree Jersey herd (she was a qualified dairymaid) and an Aberdeen Angus beef herd, she now gave up the animal side of her farm. However, the success of her cattle herds remained

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evident to visitors at Ashton, since the walls of the downstairs lavatory were papered to the ceiling with the certificates she had won for her beasts at agricultural shows. Miriam campaigned on many matters other than animal welfare; wild flowers and conservation in general have already been mentioned, but she also lobbied hard for the rights of homosexuals. Other philanthropic work included the aid and hospitality at Ashton that she gave to refugee Jewish scientists during and after the war, and her founding of the Schizophrenia Research Fund.

Over time, chemical ecology took her into collaboration with entomologists and chemists round the world, people she would captivate with her charm and enthusiasm. For example she worked with Louis Schoonhoven in the Netherlands on oviposition-marking pheromones in butterflies and plant chemicals (222, 286), Rosemary Mummery on cardenolides (201, 203, 205, 212, 217, 221, 217, 221, 239, 267, 275), Barry Moore on pyrazines (265, 283, 288, 294), John Edgar on alkaloids (228, 236, 250) and Ritsuo Nishida on cyanoglycosides (310, 318).

To realise her diverse ambitions, the walled garden glasshouses at Ashton Wold began their long-lasting change of use to experimental facilities. Although simple laboratory/office facilities were established in her bedroom, Miriam realised that she would need collaborators for the chemical work involved, and so she began her long tradition of working with natural products chemists, and only the 'best in the business'. The roll call is impressive, including Silverstein, Reichstein, Harborne, Bergström and Pickett.

Miriam had a wonderful ability to see something new and interesting wherever she looked. Once, upon seeing a friend's photograph of a queen butterfly feeding on liquid oozing from a dead grasshopper, she immediately wondered if the grasshopper fed on pyrolizidine alkaloid-containing plants that the butterfly needed, and she quickly set up the collaborations which eventually proved that her hunch was right on target (228). She also noted the strong response to sound (the so-called 'snap-bending') by the Monarch caterpillar, and she thought this was accompanied by odour secretion, which she and Bergström indeed found to be the case. Her description of this behaviour (324) possessed both scientific clarity and drama: "*The most surprising exaggerated reaction was seen when jet aircraft (Hawker Harrier jump jets) passed overhead. Once or twice weekly, these machines sweep across the greenhouse, the pilots from the local base thus exhibiting their skill in low flying exercises. The loud aerial disturbance frightens the human bystanders if unaccustomed to the sudden rushing sound, and the vibration not infrequently cracks panes of glass in the roof of the greenhouse. The caterpillars, in unison, are then thrown into violent paroxysms of head jerking and tentacle waving, which subsides equally as suddenly as the jets vanish. The effect is striking; occasionally onlookers burst out laughing as the food plant appears momentarily to have come alive!*" While working on the chemical ecology of the Large cabbage white butterfly, she noticed that the butterfly responded negatively to visual cues such as the presence of conspecific caterpillars or chewing damage to leaves. Furthermore, by olfactory cues, the butterfly was able to assess the egg load already deposited on a plant or leaf (222).

Not surprisingly, the moth family Arctiidae was a great favourite, because of the widespread ability of both larvae and adults to sequester all manner of compounds for self-defence. Her publications (81, 123, 133, 144, 175, 184, 241, 246) were important in the development of interest in the biology of many species in the family and the basis for many other recent studies on chemical ecology of the group. She especially loved the garden tiger moth (*Arctia caja*), whose biology she studied with collaborators in several different disciplines. Among other things she discovered that the caterpillars were opportunistic at sequestering plant poisons (see later), being able to accumulate alkaloids and cardenolides and most fascinating, cannabinoids (229). For this study she had to obtain approval to grow cannabis, and being Miriam she was able to do so with little difficulty.

Miriam was captivated by the interactions between the colour patterns of insects, their chemical ecologies and their predators. In later life, following her recognition of the odour of ladybirds in the smell of nettles, she found fascination in the complex biology of pyrazines and their role in triggering recall by birds (quails) of previous unpleasant experiences. Miriam loved thinking about the interactions between butterfly eyespots, their position on the wing, and the unpalatability of the butterflies due, she believed, to alkaloids derived from endophytic fungi within the leaves of the larval food plants. In her last few years, in the absence of many experts in the biology and chemistry of endophytic fungi in grasses, she set herself the task of understanding the chemistry and sequestration of novel endophyte alkaloids by British Lepidoptera such as the Marbled White (*Mellanargria galathea*) and Meadow Brown (*Maniola jurtina*) feeding on grasses. She had long wanted to prove the Marbled White in particular was aposematic but several laboratories had not found any potential toxins and intrigued that they were not directly plant-derived. The larvae she believed sought out the grasses that contained endophyte in mixed populations to obtain alkaloids that protected the butterflies. She was truly an integrative biologist at heart, dedicated to dovetailing a deep knowledge of natural history with every aspect of biology, from molecules through to ecology and behaviour. Her ideas were manifold and often the epitome of lateral thinking, almost seeming to rain down on one like spray from a fountain. Her last book, *Insect and Bird Interactions* co-edited with H.F. van Emden, derived from such innovative thinking. She realised that unpalatability of some insects to birds was just one of many interactions between the taxa; insect food for birds in farmland, biological control of insects by birds, the effect of insecticides on birds, bird foraging behaviour, insect parasites of birds and the feeding of insects on bird debris in birds nests were others. She persuaded the Entomological Club to run a conference on this theme in 1997, and a new topic in zoology, 'Insect and Bird Interactions', was born.

Initiating research on the defences of the Death's head hawk moth (*Acherontia atropos*); Miriam showed in 1993 that previously unknown alkaloids occurred in potatoes (306). In this connection she often recounted the story of Renwick, who in 1972 said that there were unknown compounds in potato that might be associated with some human disorders. She said she never believed the argument against Renwick that 'we knew everything in potato' since she knew the Deaths head stored something to explain its aposematic behaviour, even though no one had been able to show that any of the then known toxins were stored. Finding the new class of anti-nutritional

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*nor*-tropane calystegine alkaloids in potato and all other Solanaceae, therefore, did not surprise her, although Robert Nash and his co-workers were much surprised to find such major components others had somehow missed (306). The publication includes a classic quote from Miriam which says an unpublished observation that canaries who accidentally ingested calystegines from potato got diarrhoea!

Miriam had extraordinary powers of observation, and she was meticulous about writing down all she noticed. When the terrorist attack on New York in September 2001 raised the spectre of biological weapons, she remembered the abundance of certain butterflies on the river meadows near Ashton Mill at the time of an outbreak of anthrax there in the early 1930s, and decided to investigate the connection. With the help of Robert Nash and the Israeli scientist Naomi Balaban, she was able to progress the work and, even shortly before died, was enthusing about this current work on a new Lepidoptera-derived bactericide. It was very secret, but it sounded as if she hoped it would cure MRSA and anthrax. A friend said to her "If this comes off, you could just about become a millionairess" and got that much-loved chuckle in response.

A few days before her death, Miriam was still telephoning her entomological friends with new proposals for joint work. But as one of them said later "In hindsight, I think she was giving us her instructions for our work programme after her death"!

Her extraordinary productivity and never-ending stream of new ideas brought her countless honours. Just to recount some of them: Dame of the British Empire, Fellow of Royal Society (elected 1985), Honorary Doctorates from at least eight universities (including Oxford and Cambridge), Honorary Fellowship of the Royal Entomological Society, Honorary life Member of the Standing Committee for International Entomological Congresses, Foreign Honorary Member of the American Society of Arts and Sciences, and Trustee of the Natural History Museum (1967 -1975).

Miriam grew up as a fine sportswoman, attaining international standards in cricket and squash. She was originally a keen huntswoman, but later became a trenchant opponent of blood sports. She was a good landlord and farmer. Although she inherited money, she added to her wealth by the profitability of Ashton estate. This was the source of funds for all her scientific work. She loved the place where she lived from birth to death - the village and Ashton Wold, the house that her father had built at a site chosen because of the diversity of butterflies there. Locally she was not 'Dame Miriam FRS' - she was plain 'Mrs Lane', her married name (see later). Ashton's pub, not surprisingly called 'The Chequered Skipper', has a surcharge of 1p a pint towards the World Wildlife Fund, and she was totally distraught when, not long ago, the thatched roof was destroyed in a fire. But it was not long before the gutted Chequered Skipper had metamorphosed and was flying again. She was a generous person, and her parties at Ashton were legendary and usually pretty crowded. She once said "People think I don't notice they invite their friends, but I do!" When parts of a Roman villa were discovered under one of her fields, she allowed the archaeologists what time they wanted for their excavations - for a time her parties included a visit to 'Roman Ashton'. But her generosity was shrewd, she just did not respond to begging for money.

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When approached for money for art materials by a local establishment for the mentally challenged, she showed her generosity, not by writing out a cheque, but by having a barn on her land near the main road converted to a real art gallery with proper lining and lighting. Here the artists could display and sell their work. On another occasion, she had an excess of red wine for her party requirements from Baron Philippe de Rothschild, of course, who else? She gave several of her friends a bottle as a present, offering to sell them cases at a very good price. She realised everybody would order a case if it was free. However, cases proved to be free for those who came prepared to pay. That was so typical. Gunnar Bergström recalls a conference on mimicry in Paris when, at a session before lunch, Miriam came up to him and said "don't you think this boring?" What about sneaking away to my place and talking some Science!" In the street Miriam asked Gunnar to call a taxi. However, the taxi pleaded a lunch-time break. Miriam, not inclined to take "no" for answer, just entered the back of the cab with a simple "le double". Then they went to her cousin's place in Rue du Bac, where they spent the whole afternoon on the top floor, amid an assortment of wonderful sculptures, with some nice wines, "talking Science". Following the Royal Entomological Society's 1974 symposium on *Insect/Plant Interactions*, the editor of the symposium volume had the temerity radically to revise Miriam's manuscript. He hoped to get away with it by waiting till the page-proof stage before letting her see it together with the comment that any changes would now be very expensive. Miriam was up to the challenge. "Don't worry yourself about the cost", she wrote in return, "I've spoken to Blackwells and I'm paying to have reversed the changes you made".

The use of Ashton Wold during the war as a convalescence home for wounded soldiers caused her to meet and marry a decorated war hero, Colonel George Lane MC. Colonel Lane was a Hungarian exile originally named Lanyi, who fought with the British Army. They have a son and three daughters, but divorced in 1957. None of her children followed her into entomology, though her son Charles as a boy in the late 1950s and early 1960s was a co-author on several papers, and author of a memorable 1961 paper entitled "Negative experiments with butterflies and sweaty socks" in *The Entomologist's Monthly Magazine*.

Tragically for Miriam a whiplash injury, following an emergency stop by her driver on the A1 in the early 1990s, increasing limited her mobility and she spent much of her last ten years in an electric wheelchair which she could propel around her home at some speed. With the millennium her eyesight began deteriorating rapidly and by 2002 she was identifying visitors by voice alone. Indomitably, however, and with the aid of her staff and other helpers, she continued her research interests with undiminished vigour and optimism. At her death, she had published more than 300 scientific papers and about ten books.

Dame Miriam was truly great; a wonderful lady who encouraged many others in their careers. She was an inspiration, as much zest for life and natural history as for her extraordinary scientific brain: she was always keen to talk with a young enthusiast as with some more established figure. She had a lovely impish sense of humour, and indeed could tell wonderful, but frequently rather roguish, stories about some of the great men and women she had known in her long life. She would have loved the twist that her

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obituary in *The Guardian*, published on January 22nd 2005, had been written by someone who had pre-deceased her.

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