

Editorial

The first time the Society re-enacted the Darwin-Wallace Meeting was for National Science Week 1995 when Gareth Nelson took the part of Wallace and Stephen J. Gould that of Darwin. Since Wallace had been a firm believer in Spiritualism it seemed appropriate that he should return within the body of Gareth Nelson (see *The Linnean* 11, 2: 20–31). Gould on the other hand endeavoured to show how Darwinism had become modified by the concept of punctuated equilibrium.

The success of the Darwin-Wallace meeting of 1995 prompted the Society to re-enact it at the Edinburgh International Science Festival in March 1996. On this occasion the part of Darwin was played by Richard Milner who like Nelson imagined that Darwin had returned to the present day. This issue contains a transcript of the paper delivered in Edinburgh by Richard Milner. In it he emphasises both Darwin's and the scientific establishment's antagonism towards spiritualism but concedes that Darwin would have accepted Huxley's (and Eldredge and Gould's, 1972) notion of punctuated equilibrium. But as Fortey (1985; 1988) has demonstrated, much of the debate about phyletic gradualism versus punctuated equilibrium depends on the fossil record and on the density of sampling. This in turn hinges on an analysis of individual morphological characters. As Smith (1994) has so trenchantly pointed out, species problems are beyond the resolution of palaeontology, while much of the discussion of species durations and speciation rates is plagued by problems of paraphyly and arbitrary taxonomic boundaries. Smith further notes that there are three kinds of rates of evolution: rates of morphological evolution, rates of taxic evolution, and rates of genomic evolution, and concludes "that there is evidence that both rapid and gradual modes of character evolution occur though each can be interpreted differently".

Unlike Darwin, Wallace was a political animal and a true socialist*. *Unfortunately his ideas on human evolution were eventually influenced by spiritualism. Initially his views on the evolution of man (Wallace, 1864) followed strictly Darwinian lines – although he believed that structural changes in the brain had occurred early in man's evolution and that this had led to mental elaboration – giving man power over the environment.*

"Can natural selection be applied to the origin of the races of man or is there anything in human nature that takes him out of the category of those organic existences, over whose successive mutations it has had such powerful sway? ... but man guards himself from such accidents by superintending and guiding the operations of nature. He plants the seeds of the most agreeable food, he domesticates animals – he has taken away from nature that power of changing the external form and structure which she exercises over all other animals. Man does this by his intellect alone, which enables him in an unchanged body still to keep in harmony with the changing universe – Man has become superior to nature inasmuch as he knew how to control and regulate her action, and could keep himself in harmony with her, not by a change in body, but by an advance of mind (by the mind I always include the brain and skull – the organ of the mind – the cranium and the face)"

* He defined socialism as "the organisation of the labour of all for the benefit of all" and "the duty of everyone to work for the common good, and the right of each to share equally in the benefits so produced, and in those which nature provides". See also *The Revolt of the Democracy* 1913.

On May 10th, 1864 Wallace wrote to Darwin:

“I send you now my little contribution to the theory of the origin of man. I hope you will be able to agree with me. If you are able [to write] I shall be glad to have your criticisms. I was led to the subject by the necessity of explaining the vast mental and cranial differences between man and the apes combined with such small structural differences in other parts of the body, and also by an endeavour to account for the diversity of human races combined with man’s almost perfect stability of form during all historical epochs.”

A year after he had written this paper Wallace attended his first séance with Mrs Marshall (July 1865). Spiritualism provided Wallace with the answer to the problem of why the human mind had become modified more than the body. He concluded that man’s intellectual and moral being was the result of influences other than natural selection alone – it was a consequence of some spiritual influx!

By March 1869 Darwin had come to realise that Wallace’s views on the evolution of man were no longer reconcilable with their theory of natural selection. But more in hope than expectation he wrote to Wallace about his review in the forthcoming (April) number of the Quarterly, in which Wallace was reviewing the 10th edition of Lyell’s *Principles of Geology* (as well as Lyell’s 6th edition of the *Elements of Geology*):

“I shall be intensely curious to read the Quarterly. I hope you have not murdered too completely your own and my child.”

But Wallace after noting that Lyell had for the first time given up his opposition to evolution, proceeds to give a short account of the views set forth in the *Origin of Species* and then upholds the view that Natural Selection alone could not account for the human mind.

“In the brain of the lowest savages, and, as far as we know, of the prehistoric races, we have an organ ... little inferior in size and complexity to that of the highest types. ... But the mental requirements of the lowest savages, such as the Australians or the Andaman Islanders, are very little above those of many animals. ... How, then, was an organ developed so far beyond the needs of its possessor? Natural Selection could only have endowed the savage with a brain a little superior to that of an ape, whereas he actually possesses one but very little inferior to that of the average members of our learned societies.”

Despite his views – Wallace was appointed President of the Biological Section of the British Association meeting of 1876. Here he presided over the ‘Anthropological Department’, giving an address entitled: Rise and Progress of Modern Views as to the Antiquity and Origin of Man where he argued the case for Preglacial Man (shades of Piltdown to come).

Finally Wallace’s views on man’s evolution mellowed with time and became utopian. Thus in his book *Social Environment and Moral Progress* (published the year he died aged 90) he concludes:

“Affection, sympathy, compassion form as essential a part of human nature as do the higher intellectual – faculties – so that the laws of evolution as they really apply to

mankind are all favourable to the advance of true civilisation and morality.”

- ELDREDGE, N. and GOULD, S.J. (1972). Punctuated equilibria; an alternative to phyletic gradualism. In Shopf, T.J.M. *Models in Paleobiology*, pp 82-115. San Francisco, Freeman.
- FORTEY, R.A. (1985). Gradualism and punctuated equilibria as competing and complementary theories. *Special papers in Palaeontology* no 33 : 17-28.
- FORTEY, R.A. (1988). Seeing is believing: gradualism and punctuated equilibria in the fossil record. *Science Progress*, Oxford, 72 : 1-19.
- SMITH, A.B. (1994). *Systematics and the fossil record*. 223 pp. Oxford: Blackwell Scientific Publications.

Final Report of the Strategic Planning Group May 1997

The Society exists to promote all aspects of biology, and in particular, those concerning the diversity, systematics and ecological interrelationships of organisms.

Specifically, the Society aims to:

1. Play a central role in facilitating and promoting research and knowledge sharing in the field of systematic biology. This it will do through its meetings, publications, grants and enhancement of its library.
2. Raise awareness among decision makers of the importance of systematics (and the training of systematists) for meeting the Rio Challenge.
3. Increase the public understanding and awareness of the importance and value of biodiversity and its conservation.

Strategy for 2000 and beyond:

The Society will liaise and network with other bodies in the pursuit of common goals, in particular those relating to public awareness and research.

The Society will also explore the development of strategic partnerships with a small number of biological organisations, again, in the pursuit of common goals.

The Society will retain a particular focus on the UK and continental Europe and will take an active role in the documentation and description of Europe's biodiversity (including information such as the biogeography of individual taxa).

Initial Targets:

1. The establishment of a Euro-Mediterranean plant systematics initiative by May 1997.
2. The establishment of a Fauna Europaea initiative by December 1997.
3. Activation of Linnean www site, by May 1997, to include calendar of meetings, grants, The Linnean, Annual Report, publications etc. (www.linnean.org.uk.)

Annual Targets:

Hereafter the Society will develop annual targets as a means of reviewing the Society's performance and for ensuring our continuing commitment to environmental protection, conservation and the development and implementation of biodiversity action plans.

This statement will be included in the Annual Report.

Society News

Alarm and despondency having been expressed in some quarters about attendances at Society meetings (and our apologies go to those inconvenienced by the cancellation of the 9/10th April meeting), it is good to report that attendance at the debate on 6th March was 160, which did at least give us a marker for the Meeting Room (a few more *could* have been squeezed in, but not many). And attendance at the four events organised for National Science Week (set97) and the Edinburgh International Science Festival totalled 400. The Society has been fortunate in securing good press coverage for some of its meetings, notably on Piltown, Beatrix Potter (or Miss Helen B. Potter, as she is known in the Society's archives) and on the bioacoustics programme *Sounds Intriguing* in Edinburgh. The bioacoustics theme will be taken up again at the British Association for the Advancement of Science Meeting in Leeds on 12th September, where the programme will include Professor David Pye FLS, who has organised the event, Professor Michael Claridge, a Past-President of the Society, Professor AD Hawkins, Dr. WR Langbauer Jr., Professor Brian Lewis and Professor Axel Michelson. A day to look forward to.

For 1997/98, longer meetings include *Evolution and Behaviour of Monkeys, Apes and Humans* at Chester Zoo (4th/5th September), *Ecology of the Chagos Archipelago (British Indian Ocean Territory)* on 7th October, *Malacological Pioneers – the Next Generation* on Saturday, 22nd November, *Taxonomy, Evolution and Classification of Lichens* on 9–11th January 1998 and *The Ecological Impact of New Roads* (11th/12th March 1998). To round off the session we have two other major meetings – the Palynology Specialist Group is organising an international meeting on *Pollen and Spores: Morphology and Biology* on 6–9th July 1998 and the summer will also see the Annual Regional Meeting in Chicago on the theme of *Ecological Restoration* on 6–7th June 1998. Additionally, the Society is participating in a meeting at Bath on *The Mathematical Biology of Pattern and Process* with a day on *Insect Societies: Models for the Evolution of Biological Organisation* on 9th April 1998. An impressive hand, it is to be hoped that members will agree, and we are grateful to all those who give up their time to make these events possible. Most meetings involve other societies and organisations; this was a pattern set in the Bicentenary Year which it has seemed sensible to continue, particularly given the problems of organisation of meetings, which is mentioned below.

One of these meetings takes in a Sunday. Two involve Saturdays. Council has agreed to the Sunday meeting to test this particular ground. It is a fact of life that attitudes to work, particularly in the public sector, have changed and it is no longer easy for many to participate in or organise meetings and other activities of learned societies during the working day. Nor are budgets exactly supportive. Weekends offer cheaper travel and accommodation and are, generally speaking, less likely to raise the eyebrows of employers.

Having called off the meeting on 9/10th April, the Society received a number of visitors who were unaware of the fact. Professor Victor Dragavtsev FLS, of the N.I.Vavilov All-Russian Scientific Research Institute of Plant Industry in St. Petersburg, came bearing gifts for the Society, which the President was very happy

The Anne Sleep Award

Dr. Anne Sleep was a long-standing Fellow of the Society until her untimely death from prolonged illness in 1993, at which time she was on the staff of the University of Leeds. She recalled that one of the formative experiences in her life was a Science Research Council NATO Fellowship which enabled her to spend nearly three years working as a botanist in Japan in the 1960's and which allowed her to travel widely in the East. From her travels she built up a wide circle of professional and personal friendships. Undoubtedly another major influence on her was the late Professor Irene Manton, Past-President of the Society, with whom she studied and shared an interest in ferns, and in their cytology in particular.

Anne's mother, Mrs. Ivy Sleep, died in 1996 and left the sum of £120000 to the Linnean Society of London in fulfilment of her daughter's wishes, the interest on this sum to be used by the Linnean Society at appropriate intervals to assist one or more scholars to carry out biological research in the middle or far east, or similarly for scholars from the middle and far east to pursue their own researches in the UK. It will normally be expected that those selected for the Awards have recently obtained a Ph.D at a recognised institution and be of the highest academic standing. As a means of distinguishing between candidates of similar abilities, the Society will bear in mind Dr. Sleep's interest in botany and, particularly, ferns. It will normally be expected that the Award will lead to publication in peer-reviewed books or journals, where receipt of the Awards will be acknowledged.

The Society is pleased to be able to acknowledge Mrs. Sleep's generosity in this way and it is grateful to her Executors for their advice on the wishes of both Dr Sleep and her mother.

to accept. The gifts included a sculpture portraying Nikolai Vavilov, one of the World's leading plant geneticists, who died mysteriously in 1943, during the rise of Lysenko. Additionally, the Society has received a medal for its contribution to the study of crop genetic resources. We are most grateful for the generosity of the Vavilov Institute. Professor Dragavtsev, whose picture appeared with the President and the Lord Mayor of Belfast in the latest *Annual Report*, was one of the plenary speakers at the Belfast meeting in the summer of 1996.

Another visitor was Miss Sally Parker FLS, who started her career in India some years ago studying Sanskrit, but who subsequently became intrigued with Indian wildlife and its conservation. In addition to setting up a zoo in Coimbatore, Tamil Nadu, Sally has been organising courses for local people in conservation strategies and ethnobotany.

Two other visitors who addressed the Northern Ireland meeting were Professor Lynn Margulis FLS, of the University of Massachusetts in Amherst and Professor Ricardo Guerrero FLS, a microbiologist from the University of Barcelona. Lynn provided another idea for a Society meeting – *Darwin and Molecular Biology*.

There may not have been a formal meeting on 10th April but the providential arrival

of such a cosmopolitan group of the four visitors listed above certainly made an interesting lunch party in the local hostelry. The Society's reach is, indeed, world-wide.

The Society has been asked to note the Oleg Polunin Memorial Fund, administered by Charterhouse School, which exists to support botanical/biological fieldwork, abroad or in the UK. Applications to the Fund, which are considered in February each year, should be made to the Headmaster, Charterhouse, Godalming, Surrey GU7 2DJ. A number of Fellows have benefited from this fund in the past. Members are also asked to note the Tom ap Rees Memorial Fund, commemorating Professor ap Rees of Cambridge, tragically killed in a road accident late in 1996. Donations should be sent to Mrs. Julie Deane, Caius College, Cambridge CB2 1TA, made out to the Fund.

Members are reminded that a meeting *New Directions in Systematics* will take place on 15–18th October 1997 at Hersonisos, Crete under the auspices of the European Science Foundation's Network in Systematic Biology. Enquiries should be addressed to Nicola Donlan, The Natural History Museum, Cromwell Road, London SW7 5BD (+44 171 938 9506 (fax) or nd@nhm.ac.uk).

The London Natural History Society meets in the Society's rooms on various evenings throughout the year. The diverse programme of the LNHS stretches from bird conservation in Bhutan to the use of rotifers as environmental indicators. A warm welcome is extended to Linnean Society Members by the LNHS; details of the LNHS programme will be made available to members in due course.

Amongst other meetings noted are: *Entomology '97: Insect Populations in Theory and Practice*. 10–12th September 1997, Newcastle UK. Contact the Royal Entomological Society on +44 171 581 8505 (fax) or reg@royensoc.demon.co.uk; *Human Evolution* 4–8th October 1997 (at Cold Spring Harbour 1, Bungtown Road, Cold Spring Harbour, NY11724-2213, USA, e-mail: meetings@cshl.org) *1997 2nd World Congress for Medicinal and Aromatic Plants* 10–15th November 1997 (Mendoza, Argentina – AL Bandoni, Sociedad Argentina para la Investigacion de Productos Aromaticos, Libertad 1079, 2 piso, 1012 Buenos Aires, Argentina, +54 1 91617637(F)); *International Course on the Identification of Fungi of Agricultural & Environmental Significance*. 11th August – 19th September 1997; *Mycorrhiza – Identification and Techniques*. 13–17th October 1997; *Culture Preservation Techniques for Filamentous Fungi and Bacteria*. 29–31st October 1997; *PCR Techniques and Applications*. 17–21st November. Details of these last from Mrs S Groundwater at IMI, Bakeham Lane, Egham, Surrey TW20 9TY, where the courses are being held. A dual congress of the IV International Congress of Human Palaeontology with the International Association of Human Biologists is being held in South Africa from 28th June to 4th July. Contact Dr. Lee R Berger on +27 11 643-4318 (fax) or 055dc98@chiron.wits.ac.za.

Volunteers remain welcome at the biological stations in Ecuador run by the Fundacion Jatun Sacha. Volunteers must pay their own expenses, including travel and a \$25 application fee. Details from Ana Luc-a Ben-tez on (02) 441 592, 253-266 (fax) or abenitez@jsacha.ecx.ec. Members interested might consider the possibility of travel by broomstick; a copy of *The Witches' Broomstick Manual* (Cosmic Vision Press, Whitehall, Pennsylvania, 1983) notes, however, that "A real broomstick, of the

enchanted kind, is made entirely by hand with organic materials. Fakes are made of plastics, aluminium, dowel sticks and many other inferior materials. There can be no magic in anything that hopes to imitate or counterfeit the natural phenomenon of organic life". Genuine broomsticks have a kitemark, naturally.

The Society's computer system has been assailed by a virus. Fortunately, this virus left the machinery awkwardly operable. Some, it is said, can wreck whole systems. Yet another piece of witchcraft, *Dr. Solomon's Anti-Virus Toolkit*, seems to have disinfected the system. Viruses are said to generate a lot of work these days for computer repairmen, so much so that it has been said, doubtless unkindly, that these folk are responsible for the contagion which is currently sweeping the virtual world. Most come in through electronic mail connections and those using them need to be careful with attachments. Dr. Solomon's Toolkit comes with a hefty book – *Virus Encyclopedia* – which outlines the history of this plague. There is a lot of borrowing from biology – there are polymorphic viruses, Maltese Amoeba, the Self-Mutating Engine, pinworms and the SMEG Pathogen, which did actually land its UK inventor in prison. Our own virus, WM, the first macro virus, upset macros, single keystrokes which allow things like "Yours sincerely", "e-mail: john@linnean.demon. co.uk" to print out automatically. Since the Executive Secretary is the only one with the tenacity (read "time to waste" – Ed.) to sweat through the manual to set up macros (it is a very boring business), he has been proportionately most affected; he has lacked the application to recreate his missing macros.

Picture Quiz

The Christmas Picture Quiz (12(4):7) featured another T.H. Maguire portrait but this time of James Clark Ross (1800–1862).

Born at Balanrroch, Wigtownshire on 16 April 1800 he entered the navy at the age of 12 as a midshipman on board his uncle's boat *Briseis*. He later accompanied him (John Ross) on the *Isabella* on his first quest to find a Northwest passage (viz off Davis Strait).

James subsequently made four more arctic voyages under William Parry (1st 1819–20 on the *Hecla*; 2nd 1821–23 on the *Fury*; 3rd 1824–1826 on the *Fury*; 4th 1827 on the *Hecla*) and then accompanied his uncle on his second arctic expedition (Felix Booth expedition) and was the actual discoverer of the magnetic pole (70°7'N. and 45°9'E.) on 1 June 1831.

The animals encountered on Ross' first expedition (1819–20) were described by Sabine, Gray and Kirby, the plants by Robert Brown. Those of the second expedition (1821–23) by Dr John Richardson (including *Larus rossii*) while William Jackson Hooker compiled the botanical index (all collected material was deposited in the British Museum with a duplicate set in the University of Edinburgh). Ross, however, described the animals encountered on the third (1824–26) and fourth (1827) expeditions while William Hooker again described the plants.

As interesting letter from Parry to James Ross on the conclusion of the fourth voyage reads:

“With respect to the plants and animals, I wish you would as soon as possible, commence a list of each for publication – I believe you call it a catalogue – you Linneans, I mean. Or would you like to confine yourself to the Zoology and have the plants sent to Dr. Hooker? At all events begin to prepare as I wish to get out the work soon”.

In 1838 Ross was employed by the admiralty on the first magnetic survey of the United Kingdom and his determination of the points of magnetic deviation and declination formed the basis for the isodynamic lines of subsequent charts. Later that year at the British Association Meeting in Newcastle (attended by both W. and J. Hooker) the question of magnetism was being hotly debated and this prompted the Royal Society to support the British Government’s initiative to mount an expedition to the Antarctic “for the purpose of investigating the phenomena of Terrestrial Magnetism in various remote countries and for prosecuting Maritime Geographical Discovery in the high southern latitudes”. They commissioned James Ross (veteran of 17 summers and 8 winters in the arctic) to lead the expedition which comprised two bomb vessels* of 340 tons the *Erebus* and *Terror* each ship with 64 persons.

Through his father’s connection with Ross and through another personal friend of the family Dr. J. Richardson, the naval physician, Joseph Dalton Hooker was appointed assistant surgeon on the *Erebus*. The surgeons were also to serve as naturalists although Ross himself was a good taxidermist and naturalist.

They sailed from Chatham on 29 September 1839 and the voyage terminated on the 23 September 1843 when they were paid off.

The expedition touched on most of the Atlantic islands (Madeira, Canaries, Cape Verde, St. Helena, Trinidad) where they set up a number of fixed magnetic observatories and took magnetic bearings while McCormick the surgeon from the *Erebus* collected rocks and minerals and shot dozens of birds which Ross made into skins.

Eventually they reached Christmas Harbour and Kerguelen’s Island on 12 May 1840. Here they found spectacular fossil trees although there were no living trees present. They left on the 20 July and arrived in Tasmania on the 16 August**. From here they set out on their first voyage to the South Pole. They got within 160 miles of the magnetic pole after crossing the Antarctic Circle on the 1 January 1841, discovering Victoria Land and the Ross ice shelf (“a marvellous range of ice-cliffs which barred the way to any nearer approach to the pole”) they returned to Van Diemen’s Land (renamed Tasmania in 1853) in April 1841.

In November 1841 they commenced a second voyage first to New Zealand and then to the Falklands where they remained from April to September 1842. Here Hooker made an extensive collection of plants (especially the Tussocks of which he sent seeds back to Kew because he thought they would be a good economic plant for providing fodder). Then to Hermite Island off Cape Horn from whence Ross transported many

* Small warships of rugged construction for carrying mortars - they were reinforced, shallow boats with a tendency to roll - an advantage in pack ice!

** There were three breaks in the voyage during southern winters, in Tasmania (Van Diemen’s Island), New Zealand and the Falklands.

hundreds of trees (mainly southern Beech) back to the treeless Falklands in November. Live trees were also dispatched by Hooker to Kew in 3 Wardian cases (southern Beech and a Winter's Bark tree). Fuegia decided Hooker, was "the great botanical centre of the Antarctic Ocean".

Their third cruise to the South Polar region commenced on the 17 December 1842 when they once again left the Falklands. Ross named first the Danger Islets, then took formal possession of Cockburn Island then to the Weddell Sea where they encountered dense, impenetrable pack ice. They crossed the line of no variation on the 22 February when Ross confirmed that there was but one pole of verticity in the southern hemisphere. On 5 March they reached their farthest point south (latitude 71°30'S., 14°51'W.) when Ross threw overboard a small cask recording their achievement. They then sailed for home reaching the Cape on the 4 April 1843 and anchored off Folkestone on the 4 September; they were paid off on the 23 September.

Ross was knighted, he got married in 1843 and then to please his wife announced his retirement from polar exploration (turning down the command of the Franklin expedition which was, in the first instance, offered to him).

Meanwhile Sir John Franklin (1786–1847) had returned from being Governor of Van Diemen's Land (then a convict station) where he had welcomed Ross and the *Erebus* and *Terror* when they called there on 16 August 1840. Ironically at the age of 60 Franklin was given command, by the Admiralty, of a new expedition in search of the Northwest Passage using Ross's old ships the *Erebus* and the *Terror* which had been newly equipped with steam engines and propeller screws.

Franklin's expedition departed from England in June 1845*. By late June he was in Baffin Bay but by September he was imprisoned in pack ice some 12 miles off King William Island – he had led his men into a deadly trap from which they were destined not to escape.

The first major search was launched in 1848–49 with Sir James Ross being commissioned to command the *Enterprise* which was to approach from the east through Lancaster Sound, meanwhile an overland expedition led by Richardson set out from the south (carrying large supplies) and travelled via the Coppermine and Mackenzie Rivers. Ross's expedition, however, was prevented from advancing beyond Barrow Strait by thick pack ice and so he eventually returned to England.

Four other relief and search expeditions also set out in 1848, three more in 1849, ten in 1850, two in 1851, nine in 1852, six in 1853, two in 1854 and one each in 1855 and 1857. These numerous expeditions which had all set out to find Franklin, resulted in valuable additions to the geography of the regions visited and incidentally proved the existence of the Northwest passage to the Pacific.

* Franklin's first Arctic voyage has been in 1818 when he and Buchan sailed between Spitzbergen and Greenland looking for a possible route to the Bering Straits.

In 1819 he commanded the first Arctic land expedition (1819–1822) in company with Dr. J. Richardson (see above) and eighteen other men. Only 9 returned and for some of them, survival involved cannibalism.

He made a second arctic Land expedition in 1824 again with Richardson when they travelled via Great Bear Lake and the Mackenzie River to the coast.



Clue: An exponent of vicariance biogeography?

Ross saw no further service, although he continued to advise the Admiralty on matters relating to magnetism and Arctic navigation. He died at Aylesbury on 3 April 1862.

There were three correct entries: Geoffrey Miller, Peter Dance and Jim Green each of whom will receive a uniquely decorated celebratory mug.

From the Archives

THOMAS BATES BLOW IN MADAGASCAR 1924

Thomas Bates Blow, bee-keeper and naturalist, made an expedition to Madagascar in 1924 to study the larvicidal properties of Charophyta. He had become a Fellow of the Linnean Society in 1884 and his diaries and accounts of his seven weeks in Madagascar are held in the archives, and give a vivid account of the primitive conditions in the island at that time.

For about three years before his visit there had been considerable medical interest in efforts to isolate the alkaloids of certain species of *Chara* as a possible specific against malaria. Blow and his friend James Groves had been working on this for some time, but plants from Madagascar had hardly ever been collected before. It had, however, been observed that some waters in Madagascar were full of *Chara* and free of mosquito larvae. Others, where there was no *Chara*, abounded in larvae. Accordingly Blow set out to collect as many species of *Chara* as he could find.

Madagascar is an island as large as France, Belgium and Holland and in 1924 contained only 3 million people (its population is now about 11 million). Blow found the expedition very arduous on account of the great heat, the mosquitoes and the difficulty of getting about to some of the remote lagoons and swamps. Near the capital, Tananarive, there were wood-fired luggage trains which he could use, but elsewhere he had to travel by canoe, "pousse-pousse" (rickshaw) or "filanjana" (chair carried on poles by four men). Fortunately the hire of men was very cheap (about 4d a day). Only one missionary had an old car in which he was driven about. His diaries and letters are full of gratitude to the French authorities and the various Anglican missionaries who helped him with generous hospitality and transport arrangements. Some of the missionaries were in charge of schools and were doing wonderful work in raising the standards of literacy in remote places. He mentions particularly Rev. Joseph Radley, who spoke seven languages and was always ready to help in negotiations with the French authorities. Another man who helped him greatly, despite being very busy, was the Rev. F. Fairbairn: he had lived for many years on the East coast in a poisonously malarial area, fifteen miles from the nearest railway station, overseeing 20 churches and having only a canoe for his travels. Shortly after Blow's visit he contracted blackwater fever and had to return to England to convalesce. Dr. Moss of the medical mission at Amerimandroso, "120 miles from anywhere", entertained Blow for 4 days, despite working in his hospital with a very small staff from 8 a.m. to 6 p.m. He died very shortly afterwards from bubonic plague.

Blow collected numerous specimens of the various species of *Chara*. It was very difficult to dry and mount the thread-like plants in damp conditions by candlelight in the evenings. But he succeeded in sending about 400 specimens back to England. He then cultivated various species in large glass jars. He also obtained the glucoside from dried *Chara zeylandica* and observed the effects on mosquito larvae of a dilute solution. Some experiments with other species had already been done at Wisley, so Blow used the following species: *Chara desmacantha*, *C. macropogon*, *C. delicatula* and *C. contraria*. The results of his experiments, which lasted a year, were presented to the Linnean Society and are recorded in Proceedings Session 139 1926. He found that all three species of mosquito larvae flourished and nearly all reached the winged stage.

He concluded that *Chara* had no larvicidal properties, and that some other cause must be found for the absence of larvae in waters where *Chara* grew, and *vice versa*.

In addition to this rather dry account of his expedition and its results, his papers include very lively and interesting copies of his diaries, and two articles in "*The Friend*" on "Impressions of Madagascar" and "Missionary Work in Madagascar". He observed other botanical species, such as *Davallia* ferns, blue waterlilies and a rare *Ranunculus*. His accounts of hotels in Madagascar, from the splendid Grand Hotel in Tananarive to the worst hotels in more remote places are well worth reading.

DIANA FURLEY

Correspondence

91 Front Street,
Sowerby, Thirsk YO7 15P

15.7.96

The Secretary, Linnean Society

Irene Manton – an anecdote

From 1955 to 58 I was an under-graduate at Leeds University where one of my teachers was Professor Irene Manton.

She appeared to be a distant and towering figure in her field and somewhat aloof and too pre-occupied with her subject to give much attention to such adolescent students as myself ...

... until one day she became somewhat more informal and told us of the experiment she was conducting that spring/summer.

She believed that all annual plants could be made to become perennial if they were prevented from flowering (seeding ?).

On the roof of the Botany Department – she told us – she had a "chick weed plant" and she wanted student volunteers to watch this plant – round the clock – and to remove flower buds from it as soon as they were detectable.

I was one of the students who looked after her chick-weed.

When I left her sphere of influence, I understand that this plant – normally an annual – was two years old and three feet high.

PETER F. WILDE

Voorstraat 41,
Egmond aan Zee

15.11.96

Dear Editor,

I spent 18 years of my life on what was called Dutch East Indies and more recently visited Indonesia several times. You can imagine I was very interested in your write-up on Raffles in *The Linnean* 12,3 of Oct '96. Permit me to mention some flaws. On p.19 of the issue in question you give the wrong name for the Dutch E.I.C. The official name was "Vereenigde Oostindische Compagnie". The capital letters VOC formed the logo, which also appears on the coins issued. In my youth VOC 1 cent pieces were still in use (for instance in attempts to pass them on as the official 1 cent coins) and at least till some years ago these VOC 1 cent coins were offered for sale to tourists in Bali. On p.23, footnote, you enumerate trading posts among which "Macassa". I doubt very much if this was a then current spelling of Makassar (also spelt Makasser or Makasar), a place on the South coast of Celebes, now called Sulawesi, or wrong phonetics. In any case the V.O.C. had a post at Makassar.

I hope you don't mind my reaction – it shows you at least that I have read your account very thoroughly.

Best regards,
Yours sincerely,

A.D.J. MEEUSE

Editor:

It should have read Macassar or Mangkasar (my proof reading was at fault). The Dutch called it Vlaardingen. It stands on the W. shore of the Celebes 8° 20'S; 119° 28'E. (250 miles from Borneo). The British also called the straits that separate Borneo from the Celebes: Straits of Macassar.

Carnegie Mellon University,
Pittsburgh, Pennsylvania.

18.12.96

Dear Professor Gardiner:

I was saddened to see that the list of deceased Fellows in the latest *Linnean* included Mr. O'Grady. The Society owes an enormous debt of gratitude to him and I hope that he will be given appropriate recognition when the Society's recent history is fully recorded at some future date.

I first came to know Th. O'Grady, as he always signed himself, in 1969 when I left the Natural History Museum and entered the Society employed as Librarian, Archivist & Publications Officer. American Fellows, so used to referring to everybody by their first name, invariably wrote to him as "Thomas," but he was actually Theodore. To us who worked with him, he was simply "Mr. O'Grady," a personality inseparable from the Linnean Society and its affairs, man and boy, for well over forty years.

His was a large personality in a diminutive, energetic body, and his ever broad

smile, his powerful voice, his irrepressible ebullience and especially his hearty laughter filled the large, and in those days, gloomy rooms at Burlington House. In the late 1960s he was still working in cramped and difficult conditions at one end of the first floor (what is now the Library annexe) with shabby desks, old typewriters, the only telephone, dreary dented filing cabinets, threadbare carpet, and ancient lighting, always surrounded by a cheerful clutter of piled-up papers and dog-eared files. He had lived through all the wartime and post-war years of stringent finances and had to make do with whatever was at hand – new furnishings or equipment were virtually unthinkable and he had stopped ever hoping for any. When the mechanical adding-machine went wrong, it was Mr. O’Grady who took it to bits and spent the afternoon fixing it up again. Needless to say, his remuneration for all those lean post-war decades was correspondingly frugal.

When I was considering whether to take the post of Librarian, I enquired of the Treasurer whether I could expect any kind of pension scheme like to the one I had at the Natural History Museum. The Treasurer offered to arrange one. However, this brought to light the fact that, with only ten years left until retirement, Mr. O’Grady had no Society pension at all. A simple one was quickly drawn up.

In 1969 the results of the Society’s first big fund-raising drive began to be implemented. These affected every floor of the building in the most disruptive and disturbing way. The end results, the new Council Room over the archway, the new housekeeper’s apartment, the re-furnished library, the conversion of the old Post Office to Secretary’s Office, the Linnean strongroom, the basement bookstacks, and the booklift, filled the Society’s rooms with rubble and filth on a scale not seen since the wartime blitz. A couple of years later when all was finished, everybody working at Burlington House had endured great upheaval and disorganization, yet Mr. O’Grady had remained cheerful and hard working through it all and had kept all the Society’s affairs in full order.

I was already a Fellow of the Society when I entered its employ in 1969. It was realized that my voting rights should be suspended whilst I remained in the Society’s employ to obviate the possibility that employees in my position might ever be able to vote on matters affecting their own conditions of service. Professor Cave, President at that time, took the opportunity to introduce the policy that thenceforth any Executive Secretary and Librarian employed by the Society should automatically become an Honorary Fellow. Mr. O’Grady was the first.

For many years of his service the Society had no full-time librarian and Mr. O’Grady frequently had to function as *ad hoc* librarian when the need arose. As a result he acquired an extensive knowledge of the Society’s history, its archives, Linnaeus’s collections and papers, and the overall library bookstock, and cheerfully entertained innumerable casual Swedish and other visitors to impromptu tours of the Society’s treasures. He also assisted many botanists and historians with their Linnaean researches, as their published acknowledgments so frequently testify. To most Swedes, Mr O’Grady was the Linnean Society and, what’s more, he was an ardent champion of their country’s great figure. When the bicentenary of Linnaeus’s death was about to be celebrated in 1978, some influential Swedes realized that Mr. O’Grady had never

seen the home or homeland of the man he had so helpfully championed. After Mr. O'Grady's retirement in 1979, he and his wife made a first visit to Sweden and many Swedish friends and acquaintances had the opportunity to repay their gratitude with hospitality and tours of places with Linnaean associations.

The fullest recognition of Mr. O'Grady's service really came from outside the Society when King Carl XVI Gustaf of Sweden visited the Society in 1975 and awarded his personal gold medal to Mr. O'Grady.

Mr. O'Grady was one of the most generous souls it has been my pleasure to know and would go out of his way at any time and in any possible way to help anyone around him. It is absolutely certain that he personally paid the annual contributions of some Fellows who experienced straitened circumstances and he personally assisted some in time of sickness or the bewilderment of old age. There is no formal record of that. I never heard him speak ill of anyone; at worst he would shake his head and mutter a little when seriously bruised by some arrogant or hurtful person, but no more. What spare time he had was devoted to his garden and he looked forward to being able to do much more of that in his retirement in Scotland. To his widow and daughter I send my sympathy. They have lost a good and cheerful companion, Husband and Father.

There are so many who will always remember, as I so vividly do, Mr. O'Grady's mirth. When he laughed, as he frequently did, he positively shook with mirth, emitting a boyish "Tee! Hee! Hee! Hee! Hee!!" reminiscent of characters described in the "Greyfriars" stories. His youthful ebullience was not always appreciated by some sombre souls in the Society's fellowship but in truth, he needed that kind of optimistic personality to get him through a very hard-working life at Burlington House. Every Fellow should be thankful that he kept so much strung together when the Society really, really needed it.

Finally, I congratulate you on having the courage to publish the unvarnished story of poor Kappel in the latest *Linnean*. When I first heard Mr. O'Grady's anecdotes and found the odd papers referring to Kappel in the archives I realised what a terrible injustice had been done to him in those xenophobic days. I always felt that B.D. Jackson was an unsympathetic personality in that business.

I hope you are enjoying your busy term as President.

With Season's Greetings to all.

Yours sincerely,

GAVIN BRIDSON

17 King Edwards Grove,
Teddington, Middx. TW11 9LY

1.1.97

Dear Brian,

I am not sure if you still expect answers to the picture quiz? But for once I actually recognise one. The gentleman depicted on p.7 of *The Linnean* vol 12 No 4 is Rear Admiral Sir James Clark Ross (1800–1862), Arctic and Antarctic explorer, described

by Roald Amundsen as “one of the most capable seamen the world has ever produced”.

In addition to his gull, there is also *Thinornis rossi* known from a single specimen, and possibly an aberrant specimen of the New Zealand Shore Plover.

Musophaga rossae a Turaco, was named after his wife, by John Gould.

Best Wishes for the New Year,

JIM GREEN

23 Goodwood Close,
Midhurst, West Sussex, GU29 9SG

17.1.97

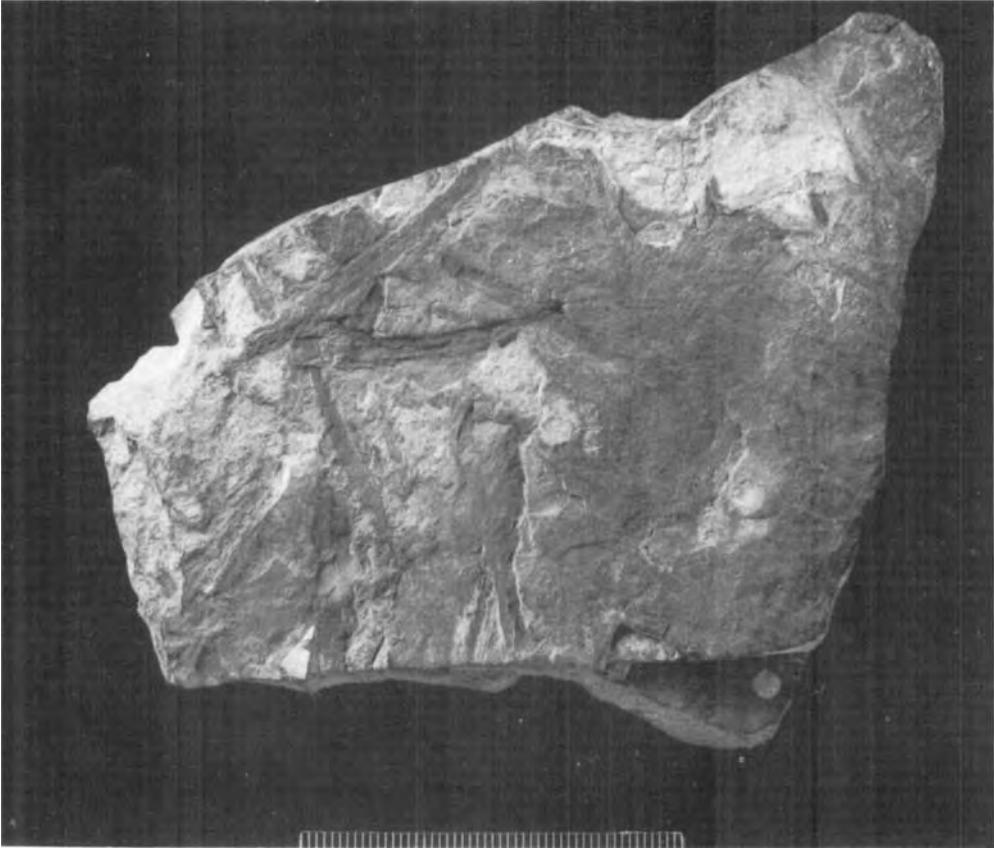
Dear Brian,

Your reference to the death of Lawrence Oates during Scott’s Second Antarctic Expedition in your Postscript on the *Wakes* in the last number of *The Linnean* reminded me that few people are aware that the fossil plants collected on that expedition are in the Natural History Museum. David Moore (1981) has endeavoured to indicate the whereabouts of the various geological collections made in Antarctica during the earlier expeditions of this century. He also weighed all the rock and fossil specimens from the Second Expedition currently surviving in the collections of the Museum, finding that their total weight now only amounted to 30 lbs – not quite the 35 lbs. reported by the rescue party!

These Fossil plants, considered to be Permo-Carboniferous in age, were regarded as highly important in that they clearly established the presence of the *Glossopteris* flora in Antarctica and provided evidence of its past climate and its palaeogeographic relationship. Seward (1914:15) regarded the specimen shown in the accompanying photograph as the best found by Wilson’s ‘sharp eyes’ at Bickley Island (because of the numerous fragments of ‘the distinctly beech-like’ *Glossopteris* fronds and rachises).

Elsbeth Huxley in her biography of Scott (1977) has traced the long chain of mishaps that contributed to the fate of the Polar party. In her post-mortem, she concluded that without the loss of ‘four days’ on the outward journey they could well have avoided the blizzard that finally led to their deaths. However, although not one of the main factors, these geological specimens would also have had an influence by slowing their progress. In fact, during their afternoon off ‘geologising’ on February 9th, Evans fell into a crevasse which led to his deterioration and eventual death, which also affected their progress. After Oates walked out into the blizzard on 17th March, they left Oates’ sleeping bag, their theodolite and a camera at that camp – but not the 35 lbs of geological specimens which, at Wilson’s special request, were dragged on. The rest of the story is well known. When the rescue party spotted the almost buried tent eight months later (12 November 1912), by its side was the sledge with the 35 lbs of rocks!

Finally, perhaps you will permit me to add to the comments made in your editorial concerning Bell’s behaviour at the significant Anniversary meeting of May 1859. Bentham, his successor as President, when referring to the controversy (Address 1862:18) commented that discussion of Darwin’s hypothesis “was beyond the province of the Society” and Bentham acknowledged that Bell, as President, had “very



Glossopteris Flora, a Primary constituent of Permian Gondwanaland flora. It was also the most stable of all the early floras, remaining almost unchanged until the end of the Permian - over c100 million years. Stems of *Vertebraria*; leaves of *Glossopteris indica*; Permo - Carboniferous. Beacon Sandstone, Buckley Island, Antarctica, Terra Nova Expedition 1910. Figg Seward, A.C. 1914. Rept. Brit. Antarctica "Terra Nova" Exped. (1910), pl. 2, Fig. 8, pl. 3, Figs. 9,10.

judiciously checked" any attempt to do so, which would seem to support the interpretation by Foxen that you mention (1971).

If you should have a spare print of the portrait of Bell used in *The Linnean*, No. 3 p.24: I would be very grateful, as I only have a copy of the Maguire portrait.

Yours sincerely,

RON CLEEVELY.

HUXLEY, ELSPETH. (1977). *Scott of the Antarctic*. Weidenfeld & Nicholson, London: xiv + 311 pp.

MOORE, D.T. (1981). Some background to the Antarctic geological collections of Captain R.F. Scott RN (1868-1912) and Sir Ernest Henry Shackleton (1874-1922). *Archives of Natural History*, **10** (2): 259-60.

SEWARD, A.C. (1914). *Antarctic Fossil Plants*. British Antarctic ('Terra Nova') Expedition, 1910., Natural History Report Geology. Vol.1, No.1:1-49.

Dear Brian Gardiner,

16.10.96

It is now a month and a half since we left Belfast and I have for a long time wanted to tell you that we look back at our days there as one of our most happy encounters. Not to mention the medal* which naturally has been a most satisfying recognition of many lonely days and nights spent at the drawing board with dry and withered specimens.

The best days in Ireland were quite up to standard. Saturday Paul Hackney from the Museum took the last 8 of us in a small bus up the coast to the Giant's Causeway. Very fine sightseeing-tour. Up there I spotted some *Montbretias* down the steep slope and went down to take some pictures, as I had never before seen *Crocoshmia* naturalised. It nearly killed me to get back up in time for departure. Like treading water in grass up to the armpits, and the tufts so high that you had to lift the knees to the shoulders. But the slides came out fine, and now I can say I have walked the Irish Countryside!

Sunday by train to Dublin for the plane home. After a rather trying and noisy train ride we went into a pub to relax and have something to drink. I have heard of Irish pubs but this really became quite an experience. First we met a lady on her way back to Malone Road where she had worked at Queens Elms. Later I talked to a man from London visiting his sister Mary in Dublin. He had worked for seven years in the Atomic Industries in Sweden and his wife was Swedish. He asked us to join their party and in some way Linne' was mentioned and he told me there was a Linnean Society in London. In my not quite sober state I slipped that I knew and that they had just given me a medal. He asked to see the medal, and before I knew what was happening it circulated the whole pub. Everybody wanted to congratulate me with a lot of handshaking and more pints came on the table. A game was on the TV and sister Mary tied the Limericks white and green colours around my left arm to keep forever. We all cheered and touched glasses when they bettered the score.

As you will understand we never saw more of Dublin but the pub and the airport. The plane was one and a half hours delayed and when it eventually came it was an odd substitute with little space between the seats. But they did what they could to compensate for the inconvenience. Free drinks etc.!

Some passengers were late for the connection to Singapore and several Swedes had to face a long bus ride. We happily found a taxi after walking for miles through a desolate Copenhagen Airport after midnight.

Now I am back at the old drawing board. Work has piled up. Illustrations for the new National Encyclopaedia and some conifers for the *Flora Nordica* Project. I have just delivered an *Astragalus* that Arne Strid is going to publish in an Austrian paper. Behind it all waits the 50 still unfinished plates for a new textbook for the Department of Agriculture. Some days I think seriously about retiring and putting up the legs, but to hell, the work is too interesting. Today the local paper came to write about my medal and tomorrow they send the photographer. You have to take it all in your stride.

With our best regards

MULLE AND BENT JOHNSEN

* Bent Johnsen won the Jill Smythies Prize for Botanical Illustration, 1996, which he collected in Belfast. Ed.

Hope Cottage, Crowood Lane,
Ramsbury, Marlborough,
Wiltshire, SN8 2PU.

19.2.97

Dear Professor Gardiner

Beatrix Potter

I was delighted to read in the Times the other day that the Linnean Society is to acknowledge Beatrix Potter's very real, but long unrecognised skills as a naturalist and scientist.

I am sure you will take it in the right spirit, however, if I put in a prior claim for this recognition on behalf of my father the late W.P.K. (Philip) Findlay. My father was a mycologist, and while President of the British Mycological Society, I recall attending your soirées with him, though his research was mainly in the field of applied mycology, timber decay, on which he published several titles.

Relatively late in his career he discovered the naturalist work of Beatrix Potter through Warne's *'The Art of Beatrix Potter'* and subsequently in Margaret Lane's life of her, in which as you may know she describes Beatrix Potter's ambitions to be a serious naturalist. She recounts how Beatrix Potter wished that some expert could write a book on fungi which she could illustrate. This inspired my father, and I recall clearly the excitement we both felt when we opened her beautiful hand-made folios in the Armit Museum in Ambleside, and he saw immediately that they were indeed of sufficient accuracy to be used in a serious text. Fortunately the publisher Warne's published both Beatrix Potter's work and the *'Wayside and Woodland'* series, so the outcome was, happily, that in 1967 Warne's published the first *'Wayside and Woodland: Fungi'* written by my father and with 59 coloured illustrations by Beatrix Potter.

My father tells the story more fully in the opening chapter of that book.

You will understand therefore why I was so pleased to see the Linnean Society is now to recognise Beatrix Potter's work more fully. I was interested to re-read in my father's book that she did have a paper read at the Linnean on 'The Germination of the Spores of Agaricineae' on 1 April 1897, though it was withdrawn at her request and never actually published.

I think I read in the paper that a lecture is to be given in April to commemorate Beatrix Potter's work as a naturalist. I would be delighted if it was possible to receive an invitation to that.

With best wishes,
yours sincerely,

GEOFFRY FINDLAY

Not only was Beatrix Potter a keen naturalist who made hundreds of accurate drawings of fossils and plants as well as fungi, she was also a convert to the Darwinian theory of evolution. Thus when in 1894 a local Harescombe (a village three and a half miles NW of Stroud, Glos.) girl lay dying of consumption – she remarked to her cousin Caroline that though Huxley was sufficient for educated persons, it would be poor exchange and indeed an impossible creed for the lower classes!

“The Funguses will come up again and the fossils will keep. I hope I may go back again some day when I am an old woman, unless I happen to become a fossil myself, which would save trouble. The fatigue and petty annoyance of a removal rather painfully obtrude the advantages enjoyed by disembodied spirits”. Editor.

“In my Day...and Today”; Darwin at Edinburgh, 1996

RICHARD MILNER

The American Museum of Natural History, New York

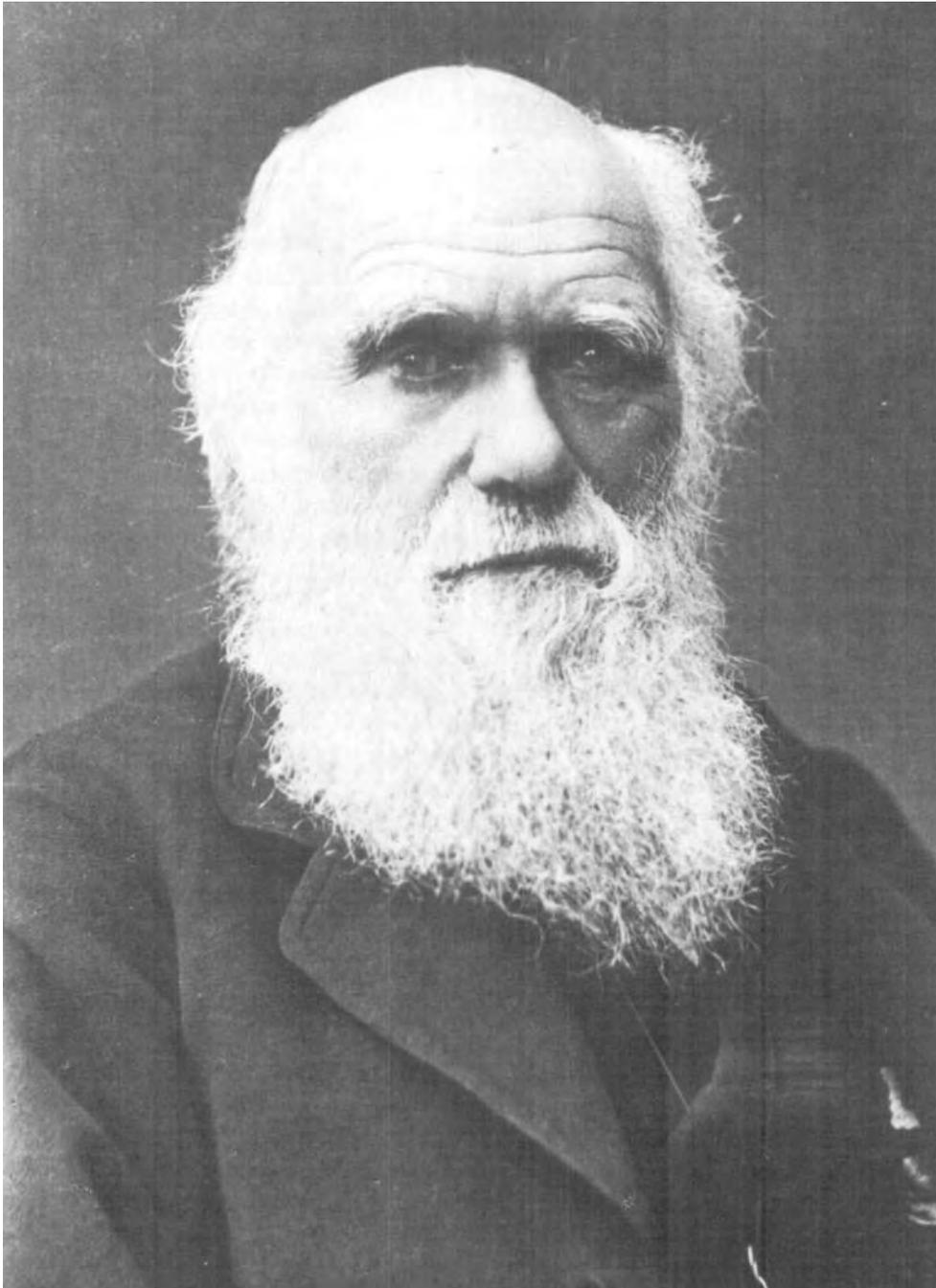
Distinguished Colleagues in Natural Science:

I am honoured to address this accomplished and congenial assemblage. But when the Secretary of the Linnean Society invited me here today, I admit that my first thought was to importune my dear friend, Professor Thomas Henry Huxley, to appear in my stead – which service he has performed so ably in the past. When he was not available, I protested to the Secretary that I have been ill, which did not in the least impress him. He gently reminded me that I am always ill – and most consistently and acutely at the prospect of speaking in public.

Surely you are now thinking, “on what a man am I wasting my time in listening to?” One who is said to have voyaged round the world in a “floating coffin” – for that is what my fellow sailors called the *HMS Beagle*. Someone whose published *Journal* describes bold treks through unexplored jungles, ascents of uncharted mountains, and weeks of galloping on horseback among banditti-like gauchos. Can this be the same intrepid personage whose very stomach rebels when merely called upon to address his fellow naturalists? Yes, I’m afraid it is. I could not even show up to read* my theory of evolution by means of natural selection at the Linnean Society; it was submitted in my absence by my friends Sir Joseph Hooker and Sir Charles Lyell, in what some historians of science have called “the great non-event of 1858”.¹

I return to this cultured city of Edinburgh with strong, mixed emotions. Here, at my father’s insistence, I entered your world-famous Medical School at sixteen years of age. Whenever possible, however, I escaped the endless lectures on *Materia Medica* to explore the fascinating little worlds of tidepools at the Firth of Forth, not far from here. My mentor in invertebrate zoology was Professor Robert Grant, who held some radical opinions. His agreement with the transmutation theories of the French zoologist Lamarck, for instance, shocked and surprised me. In my innocence, I thought the idea, which was not yet called evolution, was solely a product of my grandfather Erasmus’s overactive imagination. After stirring up so much mud in grandfather’s day, it was now a Darwin family secret – certainly not something to be discussed in public. Later, in 1844, a famous son of Edinburgh – the publisher Robert Chambers – produced a book on evolution, *Vestiges of Creation*. So controversial was its topic, however, that the author remained anonymous until he was quite safely dead. In my day, I referred to him as “Mister Vestiges”**.

* - listen to. Editor. ** see *The Linnean* 11(4): 3-9.



Charles Darwin: the last portrait
(taken by Herbert Rose Barraud in 1881, the year before Darwin died.)

I also loved to walk the rugged countryside in this part of the world. The enigmatic volcanic cliffs that tower above Edinburgh were calling me to geologise, just as my heroes Sir Charles Lyell and Sir James Hutton had done. But Edinburgh holds dark

memories, too, of medical training in those days before blessed anaesthesia. I clearly remember running out of the University's operating theatre, unable to bear the screams of a strapped-down child in surgery – and thus abruptly ending my medical career. Since then, I have hardly ever, until today, set foot again in Edinburgh; I am happy to return to this great city that was so important to my development. And now that I have been dead for 114 years, public speaking no longer holds for me the terrors that it once did.

Since I was not fitted to be a doctor, and later abandoned theology studies at Cambridge as well, my father feared I would become an idle country squire. But I was saved from turning into a prize Kentish hog by a peculiar constellation of aptitudes and interests. From childhood, I had a packrat's instinct for collecting odd objects, and I yearned to see exotic places. Because I never tired of poking into bird's nests and peering under rocks, my favourite uncle called me "a man of enlarged curiosity". In short, I was born a naturalist. Once, when a suspicious army commandant in Argentina demanded to know my business, I replied "naturalista.". The soldier was puzzled. "Someone who is interested in everything and anything," I explained. "Oho", he said, "a spy!". Only after some desperate denials by my interpreter were we permitted to take leave of that place with our necks intact.

Although my father Dr. Robert Waring Darwin, was disappointed when I declined to follow in his footsteps as a physician, he never tried to thwart my youthful ambitions. Despite his initial objections to my setting off on a voyage round the world – and his fondness for lecturing us every evening on the subject of his own opinions – he was loving, supportive, and protective. His greatest fear was that his twenty-two year old son, like so many others who had ventured to the tropics, would never *return*. Once he was convinced to let me go, however, he paid all expenses and provided me with a servant-assistant. He eagerly read my journals and letters, trembled for my dangers, and even sat under a banana tree in his greenhouse, imagining his distant son, as he put it, "sitting in similar shade".

The Natural History Museum of London still has a large cabinet filled with my barnacle collection. For eight long years, aided by my little microscope, I daily dissected these molluscs until I had reclassified the whole group. By the end of that study no man ever hated a barnacle as much as I did, not even a sailor on a slow-moving ship. Many of you will recall that my son Frank once asked a neighbour's child, "Where does your father work on his barnacles?"² But the barnacle work was wonderful training for understanding the astounding variation of organisms in nature. So long as individuals tend to resemble their parents, but not perfectly, we will have descent with modification, or evolution.

Evolution by natural selection – which should properly be called the Darwin-Wallace theory – soon became incorporated into the common thoughts of men. (Now that my friendly rival, Alfred Russel Wallace, is also gone, I feel somewhat more magnanimous toward him than I did in life.) Even so, I had many guilty pangs about Wallace's plight. He had to support his expeditions by selling tropical beetles and butterflies for a penny apiece to the British Museum, and later fed his family by grading thousands of examination papers, whilst my wife Emma and I, by accidents of birth, enjoyed

lifelong freedom from financial worries. Dear Wallace never acted peevish or envious; he certainly had a most noble and generous disposition.

My great adventure began in 1831, of course, when Captain Robert FitzRoy invited me to join the *HMS Beagle's* surveying voyage around the world. He sought a gentleman companion and messmate, though he doubted I had sufficient energy for the voyage – something about the shape of my nose. Map-making for the Admiralty aside, Captain FitzRoy had a passionate personal agenda, which few historians except Mr. Mellersh seem to have fully appreciated: He set out to demonstrate experimentally the superiority of British civilization³. On the *Beagle's* previous voyage to South America, he had recruited (some say “collected”) four young Fuegian Indians, from one of the poorest, most pitiful tribes. He brought them to England, educated them at his own expense, and even presented them at the Royal Court. FitzRoy solemnly promised that he would return them to Tierra del Fuego, where they could spread the light of Britannia. Now, two things were more dear to the captain than life itself: honouring his word as a gentleman, and being right. When officials of the Admiralty informed him that they neither wanted nor needed another surveying voyage, he successfully begged sponsorship from a wealthy uncle. He simply had to carry through his grand plan and honour his promise to the Fuegians.

Of course, FitzRoy's ill-conceived experimental colony of four, replete with fine linens and silver soup tureens, was an unmitigated disaster based on culpable folly. It ended with the Christianized Indians being beaten and robbed almost immediately on contacting their heathen kinsmen; the missionary with them was left for dead. So much for FitzRoy's dream of tribesmen who would greet shipwrecked English sailors with a spot of tea and shepherd's pie. Poor man, I always saw a streak of madness in him. He aspired to be the savages' great benefactor – a role he attempted again as the colonial ruler of New Zealand. After failing once more, the despairing FitzRoy took his own life. I thought of my old commander and messmate when everyone was talking about Jules Verne's novels during the 1870s. He would have been, I believe, entirely sympathetic to the grandiose schemes of Captain Nemo.

While I am on the subject of the voyage, I want to mention a debt that has long gone unacknowledged. I owed my naturalist's berth on the *Beagle* to the stubbornness of two women: the wives of the Reverend John Henslow and the Reverend Leonard Jenyns. Both men were qualified naturalists who very much wanted to join FitzRoy's expedition; Jenyns even had all his clothing packed. But both women, who were sisters-in-law, put their feet down and forbade their husbands' going. In the end, it was because I had neither a wife nor family responsibilities that the opportunity passed to me – as FitzRoy's last choice.

Within two years after returning to England, in 1838, I had the great good fortune of marrying my cousin Emma Wedgwood, thus cementing a longstanding alliance between our two families. The Wedgwoods, you know, were famous for two things: their piety and their crockery. After my collections had been looked after in London, the pull of the countryside became irresistible, and we moved to the little village of Down, near Bromley, in Kent.

At our country home, Down House, I quite presumptuously set myself the task of

discovering “the laws of life”. How did the plants and creatures I saw on my voyage originate? And how did they disperse to the far-flung regions of the earth? Eventually, I took up the idea of transmutation, or evolution, which my grandfather Erasmus had published in his four volume *Zoonomia* shortly before I was born. Grandfather believed that species had developed gradually over immense periods of time, from common ancestors. After many years of experimenting in my garden and greenhouse, and incessant reading of the scientific literature, I arrived at a mechanism for evolution,



Down House, 1997.

which I called natural selection: that favourable variations in organisms would be preserved while others would be eliminated from the population. But before I could write my big species book, a younger naturalist called Alfred Russel Wallace, working alone in the jungles of Malaysia, came up with exactly the same theory. He wrote it down and sent it to me by post. It reached me several months later, and threw me into a panic. So, all my originality would be smashed. So Wallace would be first to publish the theory of evolution by natural selection. To deliberately beat him into print would be acting in a paltry spirit. Yet, I simply could not stand the thought that someone might publish my theory before me.

But Wallace was not first to publish. Through the efforts of my friends Lyell and Hooker, the Darwin-Wallace theory was presented jointly at the Linnean Society in 1858. Meanwhile, I managed to complete the *Origin of Species* in thirteen months – a task that had eluded me for the previous twenty years. While he was still in Malaysia, Wallace wrote to say he was quite content with the arrangement, and felt he was treated more than fairly in the matter⁴. When he returned to England, Wallace made

no claims to priority for the idea of natural selection. "I shall always maintain that it is yours and yours alone", he later wrote. Within a decade, our theory, was embraced by many scientific men, who found in it the basis of much fruitful research.

Some writers who pronounce our ideas to be dead – usually a lawyer or engineer who has never studied variation in a tray of beetles or barnacles – begin with the delusion that I was some kind of armchair philosopher. The truth is, I was much more interested in field observations, in measuring variation in populations, and in constant – some would say obsessive – experimentation. The armchair came in only to write up my results in the real world of animals and plants.

Soaking seeds in brine for months to see if they would still germinate, setting a large, stone in the garden to measure the rate at which earthworms could bury it, back-crossing fancy varieties of domestic pigeons – all require a very different approach to nature than that of the classically-trained philosophers who dominated the universities of my youth. Professor John Wesley Judd, the famous geologist, had an amusing conversation with the poet Matthew Arnold in 1871. "I cannot understand", said Arnold, "why you scientific people make such a fuss about Darwin. Species changing through time – it's all in the ancient Roman philosopher Lucretius." To which Judd replied, "Yes, Lucretius guessed what Darwin proved." Whereupon Arnold rejoined, "Ah! That only shows how much greater Lucretius really was, for he intuitively divined a truth which Darwin spent a life of labour in groping for."⁵ That gives you a picture of how classically trained scholars – even brilliant ones – thought in my day.

I will subject anything to an experiment – especially those "facts" which I am quite sure are true. Once I left potted male and female plants on the same table overnight, each covered by a bell jar – to see if they could affect one another's fertility without the physical exchange of pollen⁶. Most sensible people would have deemed it hardly worth the effort, but I love a fool's experiment. You never really know how nature will behave until you put her to the test.

For some years after my death, many thought the theory of natural selection could not survive if it had to be reconciled with the pea-plant genetics of the Abbot Gregor Mendel. And, of course there was tremendous confusion over whether "use and disuse" inheritance was necessary for evolution to take place at all. Isn't it amazing and amusing, therefore, that the long-sought mechanisms of heredity – the twentieth century's triumphant development of molecular and population genetics – really didn't affect the heart of my theory? When it comes to the validity of natural selection, genetics may just as well be a black box. So long as we grant that individuals tend to resemble their parents, but not perfectly, then there will be a situation in which natural selection can, and must, operate⁷. I called it descent with modification, or, following the philosopher Herbert Spencer, evolution.

In my day, I never expected that anyone could actually see evolution, to observe natural selection operating in the wild, because I believed that evolution worked by slow, insensible degrees. I was elated when Henry Walter Bates returned from the Amazon with a wonderful series of butterflies he had collected over thousands of miles of rain forest. From one side of this vast area to the other, the individual wing

colours graded beautifully from one pattern to another – with all the intervening phases forming a complete series. I remarked at the time that Mr. Bates's butterflies brought us as near as we could ever hope to witnessing the evolution of a species on this earth.⁸ If we could not watch it over time, we at least could see its results over geographical space.

I thought surely that the next century of palaeontology would expose similarly graded series of fossil species everywhere in the rocks. But here I was completely mistaken. As the fossil record became substantially better known, it showed the same pattern my friend Professor Huxley had noted in the 1850s: extremely long periods during which species hardly evolve at all, and then relatively brief periods when they do. Good old bulldog, he tried to protect me even here. "You need not burden your theory with this doctrine of slow, gradual change", he warned me, "it may eventually prove an embarrassment". How right he was! It now appears that he was not misled by what I presumed was a very fragmentary and poorly known fossil record: the story told in the rocks is truly one of long periods of little change in species, punctuated by relatively rapid episodes of evolution.⁹

Often and often I wished that someone could observe natural selection in the wild, but I never dared hope that it could be done during the short span of a human lifetime. Until just a few decades ago, hardly anyone had even attempted it. Of course, during the 1930s there was the notable exception of Mr. Kettlewell's peppered moths, whose wings changed from light to dark in a few generations because of polluted woods. In no wise would I detract from that fine piece of research, yet what extraordinarily heavy duty it has been made to bear! For sixty years, every textbook on biology has repeated the moth's story like a religious litany.¹⁰

But now those tired old moths – along with the geneticist's captive fruit flies – can rest their tattered wings, for we have some wonderful new studies of evolution made visible. There is, for example, a little guppy fish that lives in forest streams in Venezuela and parts of the Caribbean. Males sport irregular patterns of coloured splotches, which Mr. John Endler has used to monitor natural selection in the wild. In the 1970s, he noticed that in streams near the tops of mountains, most of the males were adorned with large brilliant blue spots, but in the pools formed below, they had small dots of many colours. Seven predators, mainly cichlid fishes and a prawn, eat these guppies, and most live at the lower habitats. Higher in the streams, male guppies with the garish blue spots predominate, perhaps because they are more often chosen by females for mating. At lower levels, where such visibility carries much higher risks, the subdued patterns resemble the gravel stream beds. "The more numerous the guppies' enemies, the smaller and fainter the guppies' spots. The fewer their enemies, the larger and brighter their spots."¹¹ In other words, sexual selection operates unimpeded in the upper stream, while in the lower stream resident predators continually select out the gaudier blue-spotted fish.

Guppies were carefully measured and counted, and the data on thousands of individual fish stored in your latest models of Babbage's calculating engines. At his University, Mr. Endler set up artificial ponds, stocked them with wild guppies and their predators, and at one point even reshuffled the deck by hybridizing. During

twenty years of elegant experiments, he has re-evolved the colour patterns using the same selection pressures that occurred in the wild streams. He has continued to shift experiments between the laboratory and field to confirm and reconfirm the results. That is my kind of research programme: field observation, measurement of variation, experimentation.

Now let us move to the Galapagos Islands, off Ecuador, which I visited in 1835. I always said that remarkable archipelago would bring us “ever closer to that mystery of mysteries, the origin of species”. We now have more than three decades of work there by Peter and Rosemary Grant and colleagues on certain species of birds that are close to my heart – the little charmers that have come to be known as *Darwin’s* finches. I wrote in the *Origin of Species* that nature is like a breeder who is daily and hourly scrutinizing individuals in all their most minute details, winnowing out those who will live and reproduce from those who must die. The Grants chose some of my beloved Galapagos islands that had contained the simplest ecosystems – stripped bare of almost all but finches, plants, seeds, and a few predators. They caught finches and measured their variability; they experimented with how much force it takes to crack the various seeds; they familiarized themselves with every kind of seed found on the island. And *mirabile dictu*, they were able to demonstrate with hard numbers that a half a millimetre of beak could make the difference between survival and starvation. And they watched the beaks change, first in response to three seasons of drought, when only large, tough seeds remained on the islands, to years that saw the little islands buffeted by storms and soaked by heavy rainfall. After each climatic event, the differential survival and reproduction of birds on the islands changed dramatically, and their beaks changed in size and shape¹².*

We have seen that the fossil record shows very little change in most species during millions of years, yet persistent field biologists can see adaptive evolution occurring during only a few years’ time. How can *both* of these propositions possibly be true? The seeming paradox is easily resolved, and wonderfully explained in a recent book, *The Beak of the Finch*.

If I may quote from its author, Jonathan Weiner, “There is an enormous gulf between what we see when we take the time to watch the living world in action, and what we see when we look at the world recorded in stone... The closer you look at life, the more rapid and intense the rate of evolutionary change. The farther back in time you stand, the less you see... If the species changed first one way and then the other way, over and over again, as Darwin’s finches did in the first decade of the Grants’ observations, then the fossil record would register virtually no change, a near equilibrium. Yet the beak of the finch is in fact in so much evolutionary motion that as soon as people started watching closely enough, they saw it change right before their eyes.”¹³ So, in a sense, Huxley and I were both right about rates of evolution.

Speaking of the Galapagos, I must tell you that this once paradisiacal little world for naturalists is threatened with destruction as never before. It is a remarkable place: Ninety-five percent of the reptiles, seventy-five percent of the insects, half of the birds

* See *The Linnean* 11(3): 14-23.

and nearly a fifth of the fish appear nowhere else on earth. In my day, sailors carried off thousands of the giant tortoises and kept them alive in the holds of ships, awaiting their turn to become soup. (Some superstitious sailors believed that wicked naval officers who died were reborn as giant tortoises.) Since then, introduced rats, cats, and goats have gobbled up fragile native plants and the eggs of the rare tortoises, birds, and iguanas. Despite these depredations, Ecuadorian National Park rangers and visiting scientists and volunteers have managed to protect the island's creatures – until now.

Today the place is virtually a battleground between a population swollen with prosperity-seeking migrants from Ecuador's mainland, and long-resident conservationists dedicated to the islands' preservation. Last November, in a protest against Park Service policies, a number of Ecuadorian workers and fishermen went on strike, threatening guerilla warfare and a siege of Park facilities. The New York Times, in a story headlined "Homo Sapiens at War on Darwin's Peaceful Isles," said "The commotion in these far-off islands... drew competition for survival in terms sharper than most tourists cared to see."¹⁴ Fifteen years ago there were 2,500 people living in the Galapagos; today there are 15,000, and the population is rapidly growing. More than 50,000 tourists flock here each year to see the giant tortoises, blue-footed boobies, marine iguanas, and other animals that evolved so completely unafraid of humans. A research station on the islands – the Charles Darwin Research Station – has had great success in breeding giant tortoises, and in some cases restoring dwindling natural populations. But local fisherman and large industrial fisheries have been overfishing the region's lobster, shark and sea cucumbers.

My great-great-granddaughter, Sarah Darwin, who is a botanical illustrator, has been making her first visit to the Galapagos. I have just received a letter from her:



Sarah Darwin

Dearest Great-great-grandpa:

I'm on the island of Santa Cruz, where I have been painting some of the native plants. I was up in the highlands today drawing some of the very same species you collected when you were here: *Scalesia*, the lush giant sunflower trees.



Scalesia by S. Darwin

I have been here for five weeks – as long as you were – but I don't think that twenty-five years from now I will be coming up with any earth-shattering theory. Nevertheless, I have had a fascinating time and met many dedicated scientists whom I know you would be so interested to meet.

While I sit here in a café on the Avenue de Charles Darwin, I am watching tourists go in and out of the shops buying tee-shirts and mugs with your picture on them. As I look up towards the hills, I can see cultivated farmlands with cattle paddocks and orchards. *Cinchona*, an introduced plant used in the production of quinine, has taken over the highlands. (You used *Cinchona* to try to help your illness, didn't you?) There are still lots of the delicate Darwin's asters, *Darwiniothamnus*, growing here. And today I saw a beautiful Galapagos rail, the bird you so admired.

I am sorry to relate, though, that many problems here would sadden you – and all are caused by human greed or thoughtlessness. The giant tortoises are facing threats from all directions. Two years ago, it was from fires and poaching. More recently, a deadly virus threatened to decimate an entire variety; fortunately, park scientists managed to contain the afflicted chelonians. Of the fifteen subspecies of giant tortoises that were here in your day, five have already become extinct. And this year an ominous population

explosion of goats has taken place on central Isabela, near the Alcedo volcano – and another is beginning to the north, at the Darwin Volcano as well. A hundred thousand grazing goats are causing soil erosion, destruction of endemic plants – and future death to giant tortoises, which will find no food, no pools to bathe in, and no shade from the equatorial sun.

Indeed, the main difference 160 years after your visit is that so many introduced species – and especially *Homo sapiens* – have invaded the archipelago. Many dedicated scientists and others are doing wonderful work here – you would certainly have enjoyed meeting them. Nevertheless, it will take a tough, caring international effort to ensure that this place of marvels is not destroyed, but will remain to delight and instruct my own great-grandchildren.

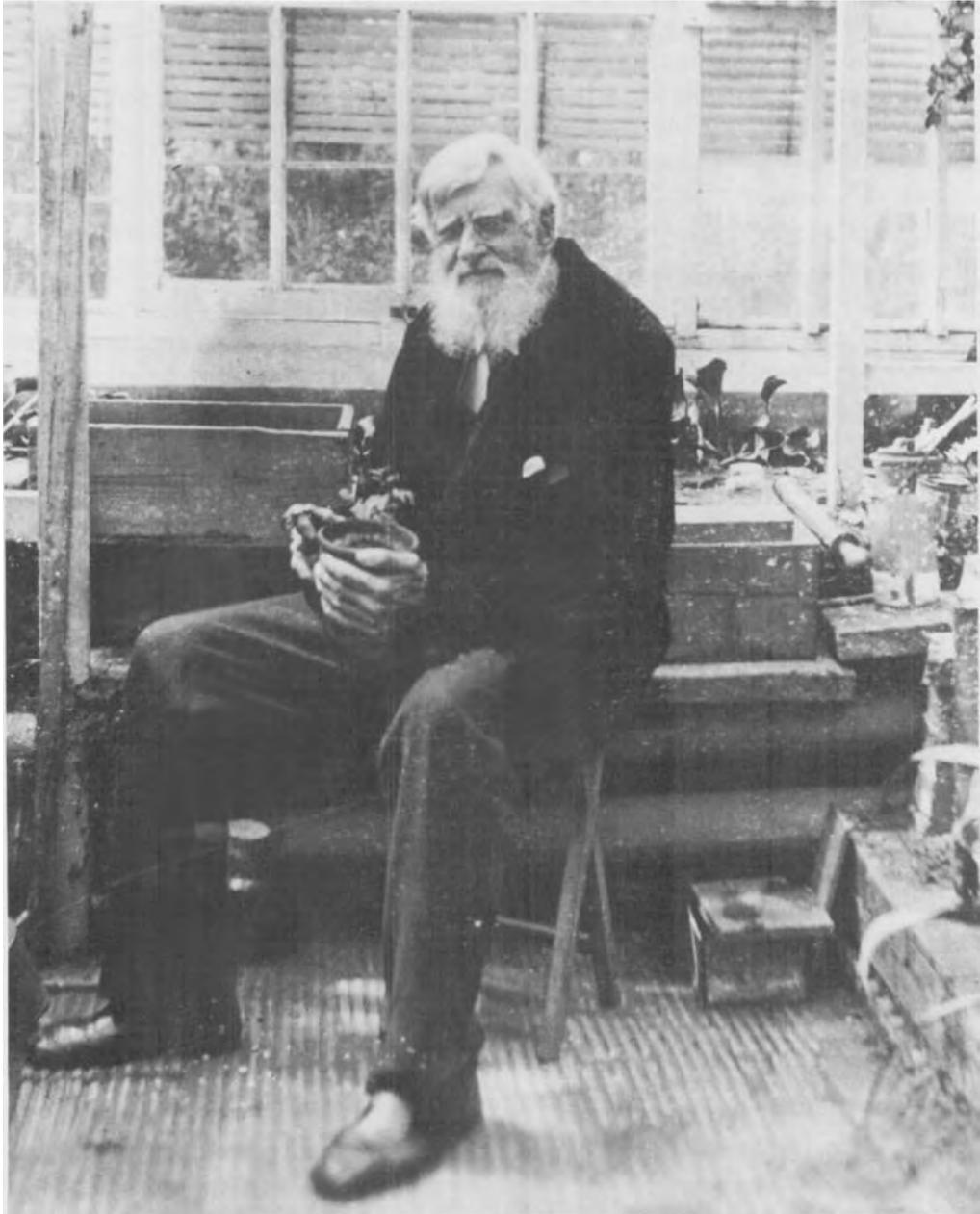
How I wish you could be here with me. What wonderful walks and talks we would have.

With all my love,
Sarah¹⁵



A dead goat!

Another writer, moved by concerns similar to Sarah's, wrote an article in the *Journal of the Geographical Society of London* some 133 years ago: "The modern naturalist... looks upon every species of animal and plant now living as the individual letters which go to make up one of the volumes of our earth's history; and, as a few lost letters may make a sentence unintelligible, so the extinction of the numerous forms of life which the progress of cultivation invariably entails will necessarily render obscure this invaluable record of the past... Future ages will certainly look back upon us a people so immersed in the pursuit of wealth as to be blind to higher considerations. They will charge us with having culpably allowed the destruction of some of those records



Alfred Russel Wallace - taken around 1900.

of Creation which we had it in our power to preserve... seeing many of them perish irrecoverably from the face of the earth, uncared for and unknown.” Those are the words of Alfred Russel Wallace.¹⁶

As Wallace’s old age approached, I twisted many arms and personally petitioned the government to grant him a pension for his lifelong service to natural history. But this was accomplished without the happy unanimity that most biographers have celebrated.¹⁷ My old friend, the botanist Sir Joseph Hooker of Kew Gardens, for

instance, flatly refused to help. He was outraged at Wallace's public adherence to Spiritualism, the belief that the dead can communicate with the living.¹⁸ I replied that Wallace's beliefs were no worse than the superstitions of the majority of the country.¹⁹ Of course, Wallace's public advocacy of such other radical causes as women's rights, pacifism, land nationalization, socialism, and wildlife conservation cost him credibility, but he continued to speak his mind. I admired, but could not emulate, his outspoken candour; there were controversies enough in my life without seeking more.

In the end, Wallace got his pension. He gardened and continued to write books right up until his death, at ninety. Only last year, one of his descendants, John Alfred Russel Wallace was asked whether the family harbored any resentment toward me for having relegated their patriarch to a footnote in history. "Grandfather didn't mind", said John Wallace cheerfully, "why should we?"²⁰ Even after a century, you see, the Wallaces are still maddeningly noble and generous.

Speaking of ecology, I'm sure you know that the term was coined by the German evolutionist Ernst Haeckel⁷ to express my notion about complex interrelationships between species and their environments – what I metaphorically referred to as "the tangled bank". My point was that species did not evolve their lineages in a vacuum, but in the context of convoluted, messy, interdependent relationships with other species. On any river bank in the English countryside, the vegetation, the insects, the birds, the earthworms and fungi – the whole system – evolves together. Species, even closely related ones, divide up the labour and the niches. In this manner, the presence of many species increases, rather than decreases, an ecosystem's productivity.

I believe I literally broke the ground in biodiversity experimentation by stripping the turf from small plots in my garden to see what would sprout there, and by observing how the various species might compete as they grew. To my astonishment, after only a few weeks, I counted 53 different varieties and species in a square 3 by 3 feet. This result goes against common sense, for I expected the crowded mass of vegetation to be all but strangling itself. But the truth of the matter is that the more species that are present, the better health and vigour for all concerned. Where monocultures are artificially created, the plants do nowhere nearly as well. So you can imagine how pleased I am to note that some ecologists have recently (after a century and a half) at last repeated my little experiment – but on a much larger scale.²¹

David Tilman, of the University of Minnesota, directed a team of fifty workers to burn, plough, plant by hand, and tend 147 plots of grassland in the Minnesota prairie. In each of these 100-square-foot plots between 1 and 21 native species grew. What I found in my garden at Down House holds true today. The more species within a given plot, the more plant material it produces. Mr. Tilman went on to demonstrate that the plots with more species retained nitrogen – the plants' most crucial nutrient – much more efficiently.²² When I worked out the principle of divergence – the keystone of my evolutionary theory – I was struck by the idea that closely related species would tend to exploit slightly different resources in the same habitat, and the resultant diversity would be beneficial for all.

* see *The Linnean* 4 (2):7

I recall my life at Down House with great pleasure. Little by little, I transformed that comfortable country estate into a biological research station. I added a dovecote out the back for breeding pigeons, built a greenhouse (which still stands), a laboratory (now in ruins), and later, a clay tennis court for the children – one of the first in England. Several times a day, I strolled the Sandwalk, my thinking path that winds through the fields and woods. Although Down village is only sixteen miles from London – less than an hour by rail and bus – the area retains the isolation and “extreme rurality” that I prized a century and a half ago. An occasional jet plane may fly overhead, but badgers and foxes continue to trot across my fields, and the wild English orchids I studied still thrive nearby. Several rooms of the house contain their original furnishings and books – including my hand-written journal of the five-year voyage aboard *HMS Beagle*.

Once, when I paused during a walk in my woods, a couple of immature squirrels ran up my back and legs while their mother barked at them in agony from a nearby tree. If you go to Down House today, you will still see lots of squirrels, but not the red ones with elfin ear tufts that mistook me for an oak. Around the turn of the century, they were outcompeted by the “jolly greys” from North America, which continue to displace native reds at the rate of six miles a year. I miss the charming little reds, but why should the harsh laws of nature act differently at Down House than elsewhere? Evolution operates not only in the Galapagos Isles or the Brazilian rain forest, but right here in the familiar English countryside. That was exactly my point.

My old homestead has escaped the wrecker’s ball. But time and lack of funds have exacted a toll, and the place desperately needed a major overhaul. Last year, I am happy to say, The Natural History Museum of London stepped in to save it once and for all. After raising well above 3 million pounds for the restoration, the Museum turned the house and grounds over to English Heritage, which manages so many historic sites.²³ My beloved Down House, I am delighted to report, is rescued, and just in the nick of time. Echoes of forty years of my life and thought will continue to reverberate there. Your modern poet T.S. Eliot wrote a few lines that, to me, sum up my life at Down:

“And the end of all our exploring
Will be to arrive where we started,
And know the place for the first time.”²⁴

Most of my biographers mention that after settling in Kent, I served for many years as a part-time police court magistrate or Justice of the Peace, beginning in 1857. Several times a month I sat in the Petty Sessions Court at Bromley, where my name is still listed on the courthouse wall, and sometimes I journeyed to the county seat at Maidstone. Many have expressed curiosity about what kinds of criminal activity I was required to adjudicate, but no records of these cases remain in the courthouse or among my letters and papers.²⁵

However, a persistent Yank thought to look through the surviving issues of my home town newspaper, and there found accounts of the Petty Sessions.²⁶ Most of my cases had to do with domestic squabbles, drunkenness, vandalism, fights in the local pub, abuse of domestic animals, and, most commonly, violations of the draconian antipoaching laws. In my court during March 1869, for example, a young man was

fined for “catching a rabbit [in a wire snare] on his father’s plantation”. Another case involved a bemedalled soldier charged with assault in a taproom. One man was charged with “furious driving” of a horse and cart in a public thoroughfare. The driver pleaded guilty and was fined. However, according to the *Bromley Record*’s account, someone in the courtroom opined that if the horse had been allowed to testify, the driver might well have got off free: “The animal was well treated by his master, did not like staying out late, and was anxious to have a good feed in his stall... If the little fat beast could have been examined in the matter, perhaps he would have taken the blame on himself”.²⁷

I do have a special sympathy for horses. Once I witnessed a man brutally whipping his horse in the road. I got out of my carriage and told the driver that I was a magistrate, and that if I saw him abusing the animal again, I would haul him into court and throw the book at him. Another time, I got a neighbourhood farmer convicted for neglecting and starving his sheep. I was much more lenient to deer and rabbit poachers who were only trying to feed their families; the game laws were unduly harsh, a throwback to medieval times. I usually tried to find an excuse for such defendants, and, if they were indigent, sometimes paid the fines myself. Once I told my fellow magistrates that I could not concentrate on the evidence, as my mind was full of orchids.

I must say that I am absolutely cock-a-hoop over the work that has been done in understanding animal behaviour, and particularly in studying primate societies over the past fifty years. In my day, anthropoid apes were barely known; accounts of gorillas were limited to explorers’ tales. When Alfred Russel Wallace tracked orangs in Borneo, it was the first time a European had studied the behaviour of great apes in the wild. Today we have had long-term, intimate studies of each species in their native forests, based on a mutual trust by the scientists and the apes. And all first accomplished – I confess, to my astonishment – by a few very brave, dedicated young women!

When I published “*The Expression of the Emotions in Man and Animals*” in 1873, I tried to show that some of what we consider the “higher” faculties, such as religious feeling, an idea of right and wrong, and social communications have their roots in animal behaviour. Now I see that a Dutch psychologist, Franz de Waal, has carried that idea much farther along, based on his many years of observing communities of chimpanzees.²⁸ He and his colleagues have counted when and how frequently animals share food, groom, or threaten and fight one another. Following an act of aggression by a dominant chimp, they observed, the victim usually receives a good deal of grooming, and gentle touching by sympathetic kin. Apes often care for handicapped members, form alliances, and demonstrate an awareness of social rules. Their “political” behaviour shows that human morality clearly was based on primate biology, and not on the “social contract” of some philosopher’s imagination.

If we can now begin to document continuities between the societies of humans and apes, what about transitional fossils? In my day, most people asked, “but where is the missing link?” Human-like fossils were so scarce that I truly wondered if we ever would find intermediate forms. Well, has not that picture dramatically changed? Since the first australopithecines turned up in South Africa early in this century, there have been so many “missing links” one hardly knows what to do with them all. It is an



Thomas H. Huxley, 1865.

embarrassment of riches. We have fossils ranging from small, upright ape-like creatures to a bewildering assortment of human-like varieties. Clearly, we can see that a complex radiation occurred, a branching evolutionary bush of hominids, of which we are but a surviving twig.

Unfortunately, practically each new fossil discovery is proclaimed a new species. Just as in my day, many naturalists still seek fame by creating new labels. But I truly believe that there is no such entity as a species, any more than varieties or genera exist – except as artificial categories for the biologist's convenience.²⁹ Some have

since redefined “biological species” as natural breeding populations – a view I once held but later abandoned.³⁰ Perhaps some of my readers took the title of my book, *On the Origin of Species*, too literally. My true position might have been better expressed if I had called it *On the Mutability of Species*, or perhaps even *On the Nonexistence of Species*. Was not my final contribution to science therefore somewhat ironic? Shortly before my death, I funded the *Index Kewensis* – a massive list of botanical species that is kept up to this day.

Finally, I should like to return to an issue about which I was publicly silent in my day, but constituted the greatest chasm in opinion between Alfred Wallace and myself: the already-mentioned debate over Spiritualism. Wallace, as you know, was a public champion of the Spiritualist cause, and his beliefs deeply affected his scientific views. In 1876, as anthropology chairman at the British Association for the Advancement of Science, he became entangled in a bitter dispute over alleged psychic phenomena. A physicist had submitted a controversial paper on the reality of mental telepathy. Wallace’s tie-breaking vote, allowing the paper to be read, caused such an uproar that he shunned scientific meetings for the rest of his life.³¹

Wallace once wrote that while natural selection could account for the body of man, there was something infused into the human brain that could only have come from “the unseen world of spirit”. I answered him, “I hope you have not too completely murdered your own and my child” – meaning our theory of natural selection. But there was more to the matter than a difference of opinion: Wallace and other gentlemanly men of science had been callously and cynically duped by swindlers who preyed upon their trusting natures.

My own brother-in-law and cousin Hensleigh Wedgwood – the same man to whom I once entrusted publication of my natural selection theory in the event of my death – begged me repeatedly to attend the séances of a spirit-medium named Charles Williams. I sent my son George and Professor Huxley to attend one of his table-rapping sessions in my stead. They confirmed that it was all imposture, as I had thought. Two years later, Huxley’s student and lab assistant, Edwin Ray Lankester, decided to catch out another celebrated medium, Henry Slade, and prosecute him – the first time a scientist had legally charged a psychic with fraud. To Wallace’s dismay, Lankester had deliberately brought Slade to trial within a week after the fireworks at the “Brit. Ass.” (1876). Since I considered the exposure of this charlatan a public benefit, I gladly (but discreetly) contributed funds to the cost of the prosecution. I was not surprised when the star witness for the defence, a sincere believer in Slade’s integrity, was none other than Alfred Russel Wallace.³²

Although Slade was convicted, he managed to wriggle free on a technicality and fled the country. It is astounding that today, more than a century later, such swindlers can still be tolerated and prosper, but now calling themselves “channelers” rather than “mediums”. I still call them frauds, cheats, and clever rogues who prey on the credulity of the grief-stricken. And I stand by a scientific enterprise that is free of gods, demons, ghosts, and supernatural intervention in the working of nature’s laws.

I am also amazed, and somewhat saddened, to see the continuing resistance to the teaching of evolution to biology students, particularly in certain parts of America. I

had expected that by now my theory would either be established, disproved, or obsolete. But if it were to prove entirely fruitful in understanding nature, as I believe it has been, I would never have expected religious resistance to persist so tenaciously almost into the twenty-first century.* It is the same kind of opposition – and from the same source – as that made when the sun was first said to stand still and the world go round.

And so the arguments continue, although the players change. Toward the end of my life, despite my attempts to avoid disputes, I became painfully embroiled in a feud with the popular novelist Samuel Butler, who bitterly accused me of many offences – not the least of which was singlehandedly depriving mankind of faith, hope, and purpose. When my son Frank defended me, Butler complained that Charles Darwin's offspring have descended from their father without any modification whatsoever. But soon after I was gone, Butler wrote an extraordinary sonnet, which he entitled "Life After Death". I would like to quote from it in closing, for I suspect he may have had me more than a little in his thoughts:

We shall not argue, saying "'Twas thus" or "Thus,"
Our argument's whole drift we shall forget
Who's right, who's wrong, 'twill be all one to us,
We shall not even know that we have met.
Yet meet we shall and part and meet again
Where dead men meet, on lips of living men.

ACKNOWLEDGEMENTS

I wish to thank Dr. John Marsden and Prof. Brian Gardiner, Executive Secretary and President of the Linnean Society of London, for inviting me to write and deliver this speech in the persona of Charles Darwin at the Royal Museum of Edinburgh on April 13, 1996 as part of their "Darwin-Wallace" programme. It was meant as a companion piece to ichthyologist Gareth Nelson's tribute to Alfred Russel Wallace at the Edinburgh Science Festival. Dr. Nelson, my colleague at the American Museum of Natural History, graciously consented to share the platform for this programme, as he had done the previous year with Dr. Stephen Jay Gould. I am grateful to the Miriam and Ira Wallach Foundation for their generous longterm sponsorship of my work in communicating and dramatising the history of science. Thanks also to: Jude Bruno Milner, Dr. Ralph Colp, Jr., Dr. James Moore, Martin and Kate Cassidy, Dr. Stephen Jay Gould, Melvin Van Peebles, Michael Denison and Dulcie Gray, and the Trustees of the Galapagos Wildlife Conservation Trust. I have made some additions and changes to the text since the Edinburgh performance, which became the basis of a version presented at the First Annual Galapagos Day at the Natural History Museum of London on September 16, 1996, at the kind invitation of Nancy Giles and Sir Robert May. Another revised version was performed, again with Dr. Nelson as Wallace, at the American Museum of Natural History on April 15, 1997, for which invitation I am indebted to Nat Johnson of the Museum's Department of Education.

* see *The Linnean* 9 (2): 21
and note that 4 out of 10 American scientists believe in God, *Nature* 386: 435-436, 1997!

REFERENCES and NOTES

1. MOODY, J.W.T. (1971). The Reading of the Darwin and Wallace Papers; an historical "non-event". *J. Soc. Bibl. Nat. Hist.* 5:474-476.
2. DARWIN, F. (1917). *Rustic Sounds and Other Studies in Natural History*. London, Murray.
3. MELLERSH, H. (1968). *FitzRoy of the Beagle*. London, Mason and Lipscomb.
4. WALLACE, A.R. (1858). Letter to Sir Joseph Hooker. A common belief among scholars is that Wallace did not find out about the joint publication until his return to London. However, that view is belied by a still unpublished holograph letter in the collection of Quentin Keynes, a great-grandson of Charles Darwin. From Ternate, Molluccas, on October 6, 1858, Wallace wrote approvingly: "I cannot but consider myself a favoured party in the matter..."
5. JUDD, J.W. (1910). *The Coming of Evolution*. pp. 3-4, cited in PARKES-CADMUN, S. 1910 *Charles Darwin and Other English Thinkers.*, p. 12. London.
6. LANKESTER, E.R. (1889). "A Memoir of Darwin." In *Charles D. Warner Library of the World's Best Literature*. pp. 5385-5393. New York, Doubleday & McClure.
7. I am indebted for this point to a discussion with Niles Eldredge, Curator of Invertebrate Paleontology at the American Museum of Natural History.
8. DARWIN, C.R. (1863). *Natural History Review: Quart. J. Biol. Sci.*, pp. 219-24. A review of BATES, H.W., (1862). "Contributions to an Insect Fauna of the Amazon Valley. Lepidoptera. Heliconiidae." *Trans. Linn. Soc. London* 23, 3: 495-566. Reprinted in BARRETT, P. (1977). "The Collected Papers of Charles Darwin," 2: S7-92, Chicago: University of Chicago Press.
9. ELDREDGE, N. (1995). *Reinventing Darwin: the great debate at the high table of evolutionary theory.*, p. 13. New York, J. Wiley & Sons.
9. ELDREDGE, N. and GOULD, S.J., "Punctuated equilibria; an alternative to phyletic gradualism." In SHOPP, T.J.M. (1972). *Models in Paleobiology*, pp. 82-115. San Francisco, Freeman, Cooper.
10. KETTLEWELL, H.B. (1973). *The Evolution of Melanism*. Oxford: Oxford University Press.
11. WEINER, J. (1955). "Evolution Made Visible." *Science* 267, 5194:30-33. Also, see ENDLER, J. (1988). "Sexual Selection and Predation Risk in Guppies." *Nature* 332:593-94 and ENDLER, J. (1986). *Natural Selection in the Wild*. Princeton: Princeton University Press.
12. WEINER, J. (1994). *Beak of the Finch; a story of evolution in our time*. New York, Alfred Knopf.
13. WEINER, J. (1994). *Ibid.*, pp. 110-111.
14. SCHEMO, D. J. (1995). "Galapagos Islands Journal: Homo sapiens at War on Darwin's Peaceful Isles." *New York Times*, November 28, p. A4.
15. DARWIN, S. (1996). Ms. Darwin kindly wrote this especially for the Edinburgh presentation. Current information on the status of wildlife on the islands was helpfully provided by Trustees of the Galapagos Wildlife Conservation Trust.
16. WALLACE, A.R. (1863). On the physical geography of the Malay Archipelago. *Journal of the Geographical Society of London* 33:217-234.
17. COLP, RALPH, J. R. (1992). "I Will Gladly Do My Best: How Charles Darwin Obtained a Civil List Pension for Alfred Russel Wallace." *Isis* 83:1-26.
18. MILNER, R. (1990). "Darwin for the Prosecution, Wallace for the Defense, Part I: How Two Great Naturalists Put the Supernatural on Trial," *North Country Naturalist* 2:19-37. Joseph Hooker to Charles Darwin, 18 Dec 1879. DAR 104, 136-37. Also COLP, R. (1992). *Ibid.*, p. 11.
19. Darwin to Huxley, Circa 26 Nov 1880, Huxley Collection, Imperial College Archives See COLP, R., *Ibid.*, p. 15.
20. MILNER, R., (1995). "Darwin: the Last Portrait," *Scientific American* 273,5:60-61.
21. TILMAN, D., and DOWLING, J. (1994). Biodiversity and stability in grasslands. *Nature* 367:363-365. Also TILMAN, D., WEDIN, D., and RNOFS, J. (1996). Productivity and Sustainability Influenced by Biodiversity in Grasslands Ecosystems. *Nature* 379:718-720.
22. YOON, C.K. (1996) (March 5) "Ecosystems' Productivity Rises With Diversities of its Species: One of Darwin's ideas gains backing in an experiment." *New York Times*, p. B6.
23. MILNER, R. (1996). "Keeping up Down House; Darwin's home, a shrine of science, is being rescued." *Natural History*, 105, 8:54-58.
24. ELIOT, T.S. (1935). "Little Giddings." In *Four Quartets*. Faber and Faber.

25. MARSH, J. (1983). "Charles Darwin, Justice of the Peace in Bromley, Kent." *Justice of the Peace*, October 1, 1983: 636-637.
26. MILNER, R. (1994). *Charles Darwin: evolution of a naturalist*, pp. 91-95. New York, Facts on file.
27. *Bromley Record*, September 17, 1860. In MILNER, R., (1994). *Ibid.*, pp. 92-94.
28. de WAAL, F. (1996). *Good Natured: the origins of right and wrong in humans and other animals*. Cambridge, Mass., Harvard Univ. Press.
29. DARWIN, C.R. (1859). *On the Origin of Species: or the preservation of favoured races in the struggle for life*. p. 485. London, Murray. See also CD to Asa Gray, Dec 21, 1859. In DARWIN, F. (1887). *The Life and Letters of Charles Darwin*, ii: p. 245. London. Murray.
30. MAYR, E. (1982). *The Growth of Biological Thought; diversity, evolution, and inheritance*. pp. 266-267. Cambridge, Mass.: Harvard University Press.
31. WALLACE, A.R. (1905). *My Life: a record of events and opinions*, vol 2., pp. 49-50. New York, Dodd, Mead.
32. MILNER, R. (1996). "Charles Darwin and Associates, Ghostbusters." *Scientific American* **275**, 4: 72-77.
33. BUTLER, S. (1898). The Life After Death. In COLE, G.D.H. (1950). *The Essential Samuel Butler*, p. 414. London. Jonathan Cape.
34. NELSON, G. (1995). "When I was alive by Alfred Russel Wallace." *The Linnean* **11.2**: 20-31.

A Note on the Hair Measurements of Domestic Dogs

MICHAEL L. RYDER

Dimensional data are presented on the hair of ten breeds covering the main functional groups of dog. In general larger breeds had coarser hair than smaller breeds, and males had coarser hair than females. Most breeds had a skewed hair diameter distribution in which the bulk of the hairs were fine (the undercoat) with a "tail" of coarser fibres (the outer hair). In some animals there was a seasonal narrowing of the hair in autumn, which indicates a seasonal cycle of growth with a spring moult.

INTRODUCTION

Ryder (1993) described the use of hair diameter distributions in the identification of wild ruminants. I here put on record similar measurements of the hair of domestic dogs (*Canis familiaris*) since I am not aware of any published figures. There are over 400 breeds of dog, and the great variation in size and shape from the tiny Yorkshire terrier to the Great Dane is entirely due to human selective breeding. This wide variety of breeds and the fact that they tend to be classified by function, makes it difficult to discern their genetic affinities.

Manwell and Baker (1983) reassessed evidence on the ancestry of the domestic dog and questioned the recent view that the wolf (*Canis lupus*) was the ancestor, which (they thought) could have been a now extinct wild dog. Where allometric similarities exist, they relate to the smaller southern wolves e.g. *C. l. arabs*, of the Middle East, the likely centre of domestication. The likelihood that domestic dogs hybridised with wild species makes comparisons difficult.

Ryder (1985) reviewed evidence suggesting the existence of several main ancestral groups of domestic dog. The most ancient group appears to be (1) the sleigh-dog group of the Arctic, the dogs of which appear to have an affinity with the large wolves of the North e.g. *C. l. lupus*. They have a dense coat that is often white and breeds of

the group were originally used in hunting as with the elkhound of Norway, but the samoyed was trained to herd reindeer. A more recent use is to draw sledges as with the well known husky. The next group (2) is the hunting dog (hound) group of the Middle East, which appears to have an affinity with the smaller wolves of that area. It was bred for the chase in the ancient civilisations, a modern representative being the greyhound. By Roman times hounds had spread through Europe, possibly receiving influence from the European wolf. They also interbred with northern sleigh dogs to produce larger breeds of mastiff type (3) such as the bloodhound and the Irish wolfhound.

Although people have claimed to discern different modern breeds among prehistoric archaeological remains, in reality all that is certain is variation in size. Only one population was evident before the Roman period when there appeared to be two or three populations. Saxon dogs were larger, but there were still only two populations. As with farm livestock therefore, breeds as we know them were not developed before the Middle Ages.

As hunting became more specialised "setters" were trained to locate ground birds, which were then caught in nets, and "pointers" were developed to seek out hares, which were then caught by greyhounds. Gundogs were developed later particularly to "retrieve" animals shot. Another group, the "terriers", were trained to go to earth after burrowing animals. The most highly skilled and economically most important still are the herd dogs trained first to guard flocks and later to round them up (Ryder, 1985).

MATERIAL AND METHODS

The hair measured came from domestic pets as a spin-off from a trial of dietary additives aimed at improving coat condition in dogs. This was organised by A. van den Broek of the Royal (Dick) School of Veterinary Studies, Edinburgh. The ten

Table 1. Breeds of Dog Investigated (Key: L= large; S. = small)

Group	Breed	Coat description
GUNDOGS	Large Munsterlander (L)	Long and dense, but not curly or coarse
	Golden Retriever (L)	Flat or wavy with dense undercoat
	Labrador Retriever (L)	Short, straight, dense (hard); undercoat
TERRIER	West Highland (S.)	Straight 5cm outer hair; short, soft undercoat
	Jack Russell (S.)	[Short and dense (hard)]
UTILITY	Bulldog (L)	Short, close and smooth with fine texture.
	Toy Poodle (S.)	Long: dense & harsh; short: close, thick & curly
WORKING	Dobermann (L)	Short, smooth and dense (hard)
	German Shepherd (L)	Straight, hard, dense outer; thick undercoat
TOY	Yorkshire Terrier (S)	Long, straight & glossy, fine silky texture

breeds investigated are listed in Table 1 under the Kennel Club's classification, which does not necessarily have any biological or historical relevance. The letters L and S indicate the designations as either large or small breeds for the purposes of the trial. The (lay) coat descriptions given come from Breed Society specifications. The number of animals investigated in each breed is indicated in Table 2.

Hair tuft samples were cut off at the level of the skin surface and taken from the same area at monthly intervals for up four times. On receipt, the length of the tuft was measured against a mm scale in order to ascertain rate of growth. A sub sample 1mm long was cut from the base (skin end) of the tuft, and a whole mount microscopic preparation of these short lengths of hair was made in Euparal. The shaft diameter of 100 hairs was then measured in each sample using a projection microscope at a magnification of 500 x. The International Standard (IWTO) method used to measure the fibre diameter of wool was used. The hair diameter would be expected to increase when the coat is growing well. The percentage of naturally-pigmented and medullated hairs, features associated with vigorous growth, was recorded.

RESULTS AND DISCUSSION

Since no clear change in hair dimensions as a result of the dietary additives was observed, the present data can be regarded as a normal sample. A coat in "good condition" appears to owe more to sebaceous secretion than to the dimensions of the hair. For the present paper the results from the up to four hair samples have been pooled for each dog to give mean or otherwise typical values. In Table 2 therefore the diameter range is the overall range of individual hair diameter over the successive samples, whereas the coat length is the maximum observed. Where two values are given, "w" is the length of the undercoat and "h" of the outer hair. The mean hair diameter is a mean of means as is the s.d. and the mode. Where a seasonal trend was obvious, more than one value is given.

Coat structure and hair types

As with other domestic animals such as cattle, one would not expect a wide variation in coat type like that seen in domestic sheep (and to a lesser extent in goats and camelids) as a result of human selective breeding of different fleece types for different uses. However, in common with many mammals, the hair follicles of dogs are of two types: primaries, which are arranged in trios and grow the outer "guard" hairs, and secondaries, which grow the shorter and finer undercoat (Baker, 1966). Therefore, one would expect dogs to have a double coat, and this was apparent in the hair length measurements of at least one dog in each of the groups (Table 2). In only two breeds, however, was this obvious in the hair diameter measurements – the Yorkshire "Terrier" and the West Highland, and in the latter, as well as the finer hair grown by the secondaries, the two kinds of guard hair could be seen by eye. These were the chalky white bristles (equivalent to kemps in sheep) growing in the central follicles of the primary trios, and the awns growing in the two lateral primaries (Ryder, 1973 p.32).

Most breeds had a modified double coat as in many domestic sheep. This was shown by a skewed hair diameter distribution, in which the bulk of the hairs were fine (the undercoat), with a "tail" of coarser fibres (the outer hair). A double coat is also indicated by the modes being less than the means (Table 2). No dog had a double coat

Table 2. Hair measurements (* Seasonal increase in coat length and narrowing of hair diameter; † young coat fur not atypical)

	Breed of dog	Sex	Age in years	Number of samples	Coat length (mm)	Diam. range [#] μ m	Mean \pm s.d.	Mode	%PIG	%MED
GUNDOGS	Large Munsterlander (2)	M	6	3	30	10-108	45.2 \pm 17.5	30	37	60
	Autumn (1)	F	5	3	w5 h35	12-86	48.3 \pm 16.0	52	9	72
	Winter (2)				40	10-90	40.0 \pm 19.3	28	44	65
	Golden Retriever (3)	M	5	3	35	10-94	36.8 \pm 12.9	32	21	96
	Autumn*	F	2	4	15	10-84	34.2 \pm 19.1	30	38	78
	Winter*				30	12-92	26.7 \pm 10.5	22	6	94
		F	unknown	4	w5 h15	10-98	33.8 \pm 17.3	29	1	86
	Labrador Retriever (3)	F	10	3	30	10-100	38.5 \pm 16.5	30	99	66
		M	unknown	4	w5 h30	10-120	37.1 \pm 19.7	27	2	90
	Labrador cross (1)	M	13	2	25	10-100	31.4 \pm 14.5	29	26	90
TERRIER	West Highland White (2)	F	10	4	60	10-76	31.2 \pm 10.1	28	0	17
		M	6.5	2	75	10-90	34.0 \pm 15.0	25	0	30
	Jack Russell (2)	M	8	4	w5 h20	10-52, 72, 80, 88	26.6 \pm 8.3	22	92	95
		M	3	2	30	10-66, 90, 112	33.2 \pm 14.4	32	59	58
UTILITY	Bulldog (1)	M	1.5	2	10	8-116	44.8 \pm 25.9	27	47	90
	Miniature/Toy Poodle (1)	F	7.5	4	w5 h20	10-46, 60	21.9 \pm 8.0	18	18	16
WORKING	Doberman (3)	M	1	3	25	8-126	45.0 \pm 24.6	30	100	50
		F	7 months [†]	4	w5 h15	10-118	43.5 \pm 24.8	30	98	80
		F	2	3	w5 h15	10-108	46.9 \pm 22.7	30	100	80
	German Shepherd (2)	F	unknown	4	w5 h45	10-124	47.9 \pm 19.4	32	37	92
		M	unknown	2	w10 h50	10-74, 90	27.4 \pm 10.6	24	63	96
	Yorkshire Terrier (1)	M	1.5	4	w20 h180	8-56, 82	18.5 \pm 10.6	10	30	1

[#] Diameters outside the main range are listed separately.

as primitive as that of wild ruminants illustrated by Ryder (1993) Figure 1, in which the diameter distributions of the outer hair and underwool are completely separate. A few dogs, notably in the larger breeds, had a continuous or symmetrical (statistically normal) hair diameter distribution. This was not a summer hair diameter distribution as discussed by Ryder (1993) since the observations were carried out in autumn. Domestic cattle lack an undercoat and have a similar symmetrical hair diameter distribution.

Many hairs had a medulla, a largely hollow core that can be regarded as a mechanism allowing hair diameter to be increased without the need to produce extra keratin. Medullae are therefore in general found in coarser hairs. The high proportion of medullated fibres (Table 2) accords with the observation that the finer hairs, too, had a medulla. This was the ladder type of medulla found in fur fibres. In this the medulla is divided into disks that are separated by cortical material which forms the “rungs” that give the appearance of a ladder (Ryder, 1973 Fig. 4-2). The coarser hairs had a continuous, non-latticed, medulla; no hairs were observed with a wide latticed medulla like that seen in the outer hairs of ruminants such as red deer.

Coat length

According to Robinson (1989) the main coat variation in dogs is into short and long coats, the latter being inherited as a recessive to short hair, as in Angora rabbits, the expression being influenced by numerous other genes. In the present observations, only the Yorkshire Terrier appears to have had a long coat. The overall coat length ranged from 10mm in the Bulldog to 180mm in the Yorkshire Terrier (Table 2). Most coats, however, fell within the range 15mm to 50mm, the mode being 30mm. Since the last sample was taken in January, most of these measurements are likely to represent the maximum length, and so they are relatively short when one notes values of 30mm in the cat (Ryder, 1976) and 50mm in the wild sheep. This accords with the view of Robinson (1989) that the coat of most domestic dogs – the smooth, sleek, “tight” coat of the Labrador for instance – is shorter than “normal” and results from human selective breeding. The “hairless” breeds of East Africa and Central America, however, must owe more to natural selection than to human influence, as do the sheep of the tropics which lack a fleece.

Hair diameter

The hair diameter measurements were recorded initially as histograms, which show the range and mode (most frequent diameter); a mean diameter, plus a standard deviation, was calculated from the 100 measurements. The full data are listed in Table 2. The typical mean hair diameter in the larger dogs was around 40 microns, i.e. within the medium range. This value compares with cattle hair and is coarser than most clothing wool, which is less than 30 microns in diameter and cashmere from goats, which is about 15 microns (Ryder, 1993). The maximum hair diameters were around 100 microns, which is the same as in domestic sheep, whereas the maximum in goats is about 200 microns and in red deer 300 microns. The modes were about 30 microns, which contrasts with 20 microns in the fleeces of sheep with skewed fibre diameter distribution.

In general the hair of males was coarser than that of females, e.g. 37 microns

compared with 27 to 34 microns, in the Golden Retriever, such a sex difference being found in sheep. The other major difference was associated with body size, the mean diameter range in small dogs being from 19 to 34 microns, and that in the larger dogs from 27 to 48 microns. Species differences in hair shaft diameter linked to body size are obvious; for instance the hairs of mice are only a few microns thick. But I am not aware of any other intra-specific variations in hair fineness associated with body size. The great variations in the fibre diameter of wool between breeds of sheep are not associated with differences in body size. The explanation in dogs may be that there is much greater variation in body size than in other species.

The low mean diameter of 19 microns in the Yorkshire Terrier is comparable with fine wool and particularly remarkable, the more so since this breed also had the longest coat. This is the exact opposite of the wool of sheep in which the longer the fleece, the coarser the fibres.

Seasonal change.

As indicated above in the discussion on hair diameter distributions and in Table 2, some dogs appeared to show seasonal narrowing in winter. This implies a synchronous rest period followed by a spring regrowth, which stimulates the moult of the old coat. This type of coat replacement is obviously not marked in the dog and indeed Robinson (1989) goes so far as to state that hair replacement in dogs is "diffuse" (as in man), i.e. there is a continuous replacement of a proportion of the hairs. In reality, as in the cat in which winter follicle inactivity never reached 100% (Ryder, 1976), gradual replacement is probably imposed on a basic seasonal cycle of hair growth. Since the seasonal cycle is controlled by day length, and for generations domestic dogs have been largely shielded from such stimuli by being kept indoors, it is not surprising that a seasonal cycle is no longer marked.

REFERENCES

- BAKER, K. P. (1966). Postnatal Development of the Dog's Skin. *British Veterinary Journal*. **122**: 344-347.
- MANWELL, C. & BAKER, C. M. ANN. (1983). Origin of the Dog: from Wolf or Wild *Canis familiaris*? *Speculations in Science and Technology*. **6**(3): 213-224.
- ROBINSON, ROY (1989). An insight into genetics. *Our Dogs*. 10 November, p. 10; 8 December, p7.
- RYDER, M. L. (1973). *Hair*. Studies in Biology (41) London: Arnold.
- RYDER, M. L. (1976). Seasonal changes in the coat of the cat. *Research in Veterinary Science*. **21**: 280-283.
- RYDER, M. L. (1985). The dog. *Biologist*. **32**(4): 229-235.
- RYDER, M. L. (1993). Coats of Himalayan Ruminants Elucidated by Study of a "Yeti" Skin. *The Linnean* **9**(1): 21-26.

Library

By the time this is published we will, once more, be in the midst of our annual session of cleaning and rearranging books and journals. We will have our teams of student helpers wielding dusters and tins of polish to remove accumulated dust and London grime. Most of this work will go on in the Library Reading Room so you may not find it as peaceful and quiet as it usually is. This year we hope to finish off

the Faunas and Travel section on which we began last year and possibly begin on reshelving in the Reading Room itself. Inevitably this will mean that some books will be in temporary locations and thus may take some time to find: if you think you might need books which may be "in transition" to new locations it would be helpful to know what you want beforehand. These subject areas will include some faunas and travel books (accounts of voyages etc.) and cryptogamic botany.

Donations

Due to limitations of space in this issue we have only listed donations received from October 1996 to the end of April 1997. For space reasons we are also omitting detailed listings of large donations of books on the flora and fauna of Hong Kong from Prof. and Mrs Thrower, works on tropical agriculture from the TAA and Mr P. Tuley and a large number of malacological books received from the widow of the late Dr E. Sandor FLS, some of which have already been catalogued. We are most grateful to Mrs E. Sandor for this gift. The remainder are being dealt with and displayed in the Library. We have also received a large number of conservation publications from Prof. G. Ll. Lucas and hope to have a special project to sort and catalogue them this summer. Thanks must also be extended as usual to all those who pass journals on to us, give us copies of reprints or other items which for space reasons we cannot list here.

- | | |
|-------------------------|---|
| Prof. R.J. Berry | Berry, R.J., <i>God the biologist, faith on the frontiers of science</i> . 143 p., Leicester, Apollos, 1996. |
| Brooklyn Botanic Garden | NEW YORK, Brooklyn Botanic Garden, <i>Invasive plants, weeds of the global garden</i> . 111 pp., col. illustr., New York, Brooklyn Botanic Garden, 1996.
NEW YORK, Brooklyn Botanic Garden, Cutler, Karan Davis, ed., <i>Tantalizing tomatoes, smart tips and tasty picks for gardeners everywhere</i> . 111 pp., col. illustr., Brooklyn, Botanic Garden, 1997. |
| Dr H-M. Burdet | GENEVA, Conservatoire & Jardin Bot., Jeanmonod, D. & Burdet, H.M. eds., <i>Compléments au prodrome de la flore Corse: Valerianaceae</i> by M-A. Thiébaud. 116 pp., illustr., map, Geneva, Conservatoire & Jardin Bot., 1996. |
| J. Burton | Beldie, A. & Chirita, C., <i>Flora indicatore din padurile noastre</i> (in Rumanian). 216 pp., 212 col. pl., Bucarest. Ed. Agro-Silvica, 1967. |
| Prof. W.G. Chaloner | Moore, Peter D., Chaloner, W.G. & Stott, P., <i>Global environmental change</i> . 244 pp., illustr. some col., maps, Oxford, Blackwell Scientific, 1996. |
| E.J. Clement | Ryves, T.B., Clement, E.J. & Foster, M.C., <i>Alien grasses of the British Isles</i> . 181 pp., illustr., London, B.S.B.I. 1996. |
| Prof. H.T. Clifford | Clifford, H.T., <i>Etymological dictionary of grasses</i> (on CD-ROM). 16 pp. booklet + CD-ROM, Amsterdam, Expert Center for Taxonomic Identification, 1996. |

- Prof. J.T. Cloudsley-Thompson Fisher, Martin, *Indexed bibliography of natural history and conservation in Oman*. 74 pp., Leiden, Backhuys, 1995.
Gibson, A.C., *Structure-function relationships of warm desert plants*. 215 pp., illustr., Berlin, Springer, 1996.
Smith, S.D., Monson, R.K. & Anderson, J.E., *Physiological ecology of North American desert plants*. 286 pp., illustr., map, Berlin, Springer, 1997.
- Dr J. & Mrs M. Cooper Stephen, Lorne E., *Trypanosomiasis, a veterinary perspective*. 551 pp., illustr. some col., map, Oxford, Pergamon Press, 1986.
ALMATY, National Avian Research centre, *Opredelitel' kliniki ptits Kazakhstana* [Keys to the raptors of Kazakhstan]. 115 pp., col. illustr., Almaty, National Avian Research centre, 1995.
- Dr P. Cornelius Hanson, Earl P., *The origins and early evolution of animals*. 670 pp., illustr., Middleton, Wesleyan University Press, 1977.
Ros, Joandomec, ed., *Topics in marine biology* (Proceeding of the 23rd Marine Biology symposium) 754 pp. 1989.
- The Rt. Hon. Earl of Cranbrook Cranbrook, Earl of, compiler, *Wonders of nature in South-east Asia*. 279 pp., illustr., maps, Kuala Lumpur, Oxford University Press, 1997.
- Dr L.N. Derrick Austin, B. (and others) ed., *The genus Aeromonas*. 350 pp., figs., Chichester, Wiley, 1996.
Campbell, Michael J. & Machin, David, *Medical statistics, a commonsense approach* (reprint of 1993 edition). 189 pp., Chichester, J.Wiley, 1995.
Cotton, C.M., *Ethnobotany, principles and applications* 424 pp., illustr., Chichester, J.Wiley, 1996.
Foster, Gary D. & Towell, David, *Plant gene isolation, principles and practise*. 426 pp., illustr., Chichester, J.Wiley, 1996.
Simmonds, Mark P. & Hutchinson, Judith D., *The conservation of whales and dolphins, science and practise*. 476 pp., illustr., map, Chichester. 1996.
Younis, Mohammed, & Iqbal, Mohammad, eds., *Plant response to air pollution*. 545 pp., illustr., Chichester, Wiley, 1996.
- B.L. Drake Sowerby, Arthur de Carle, Sowerby, Alice Muriel & Stone, J.E., *The Sowerby saga*. 2 vols., 47 pp. & 180 pp., Washington D.C., privately, 1952.
- Mrs L. Evenari Evenari, Michael, *The awakening desert, the autobiography of an Israeli scientist*. 204 pp., illustr., Jerusalem, Hebrew University, 1989.

- Mrs M. Filipiuk Bentham, George, *George Bentham: Autobiography 1800 – 1834*, edited by Marian Filipiuk. 597 pp., frontispiece portrait, Toronto, University of Toronto Press, 1997.
- Prof. B. Fox Kozłowski, Theodore T. & Pallardy, Stephen G., *Physiology of woody plants*. 411 pp., illustr., San Diego, Academic Press, 1997.
- Pietsch, T.W. ed., *Fish, crayfishes and crabs, Louis Reynard's Natural history of the rare curiosities of the seas of the Indies*. 2 vols., col. illustr., Baltimore, John Hopkins University Press, 1995.
- Raff, Rudolf A., *The shape of life, genes, development and the evolution of animal form*. 520 pp., illustr., Chicago, Univ. of Chicago Press, 1996.
- Rose, Michael R., & Lauder, George V., *Adaptation*. 511 pp., illustr., San Diego, Academic Press, 1996.
- Sanderson, Michael J. & Hufford, Larry, *Homoplasy, the recurrence of similarity in evolution*. 339 pp., illustr., San Diego, Academic Press, 1996.
- Young, Mark, *The natural history of moths*. 271 pp., illustr. some col., maps, London, Poyser, 1997
- Prof. T. Frängsmyr Eriksson, Gunnar, ed., *The Atlantic vision, Olaus Rudbeck and baroque science*. 196 pp., illustr. maps, Canton, MA., Science History Pubs., 1994.
- Frängsmyr, Tore, ed., *Linnaeus, the man and his work*, revised ed., 206 pp., illustr. map, Canton, MA., Science History Pubs., 1994.
- Dr R.P. Glyn-Jones Glyn-Jones, P.I., *Porfyra* (text in Greek). 277 pp., illustr. col. frontisp., Alexandria, 1932.
- B.Gooch Gooch, Bernard, *The quiet world of nature..* 243 pp., illustr., London, J. Lane: Bodley Head, 1939
- Gooch, Bernard, *The garden of a naturalist*. 187 pp., illustr., London, Lutterworth, 1959
- Dr P.S. Green Green, Peter S., *A Hawaiian florilegium, botanical portraits from paradise by Mary Grierson*. 102 pp., col. ilustr., Lawaii, Nat. Tropical Bot. Garden, 1996.
- Prof. R. Guerrero Guerrero, Ricardo & Pedros-Alio, C., *Trends in microbial ecology: Proceedings of the 6th International symposium on microbial ecology*, Barcelona, Sept. 1992. 717 pp. illustr., Barcelona Spanish Soc. for Microbiology, 1993.
- Dr G. Wynne Wynne, Goronwy, *Flora of Flintshire...* 400 pp., illustr. some col., maps. Denbigh, Gee & Son, 1993.
- Jill, Duchess of Hamilton Hamilton, Jill Duchess of, *Scottish plants for Scottish gardens*. 164 pp., col. illustr., Edinburgh, HMSO., 1996.

- B.H. Harley Preston, C.D. & Croft, J.M., *Aquatic plants in Britian and Ireland*. 356 pp., illustr., maps, Colchester, Harley Books, 1997.
- Prof. J.G. Hawkes Fritsch, R & Hammer, K., *Evolution und taxonomie von pflanzen genetischen ressourcien*, festschrift fur Peter Hanelt. 286 pp., illustr., maps, Bonn, IGR/ZADI, 1996.
- Prof. D.L. Hawksworth Shen, Shih-Chieh, *Fishes of Taiwan*, text in Chinese, English abstract. 960 pp., col. illustr., [1996: all details on imprint in Chinese]
- Greenaway, Frank, *Science international, a history of the International Council of Scientific Unions*. pp., frontispiece illustr., Cambridge, Cambridge University Press, 1996.
- Dr H. Iltis Vazquez, J., Antonio, G. (and others), *Flora de Manant*. 312 pp., col. illustr., maps, Fort Worth, Bot. Research Inst. of Texas, 1995.
- C. Jermy International Union for the Conservation of Nature, *Megapoda, an action plan for their conservation 1995–1999*, by Rene W.R.J. Dekker and Philip J.K. McGowan. 41 pp., illustr., maps, Gland, IUCN, 1995.
- Donald Killick Killick, Donald, *A field guide to the flora of the Natal Drakensberg*. 200 pp., col. illustr., Johannesburg, J.Ball & Ad. Donker, 1990.
- Dr G. Kunkel Kunkel, G., *Hoyas sueltas*:1–20, illustrated by Mary-Ann Kunkel. various, illustr., Almeria, Ed. Alternativas, 1995–1996
- Sir Christopher Lever Caldecott, Julian, *Designing conservation projects*. 312 pp., illustr, maps, Cambridge, CUP, 1996.
- Prins, H.H.T., *Ecology and behaviour of the African buffalo*. 293 pp., illustr. some col., London, Chapman & Hall, 1996.
- Prof. David Yudilavich Darwin, Charles, *Darwin en Chile (1832–1835), viaje de un 'Naturalista alrededor del mundo*, edited by D.Y.Levy & E. Castro Le Fort. 341 pp., illustr. some col., Santiago de Chile, Universitaria, 1995
- Dr R.H. Lowe-McConnell Balon, Eugene K, Bruton, Michael & Noakes, David L.G. eds., *Women in Ichthyology: an anthology in honour of ET, Ro and Genie*. 456 pp., illustr., maps, Dordrecht, Kluwer, 1994
- Prof. G.Ll. Lucas KEW, Royal Botanic Gardens, *Margaret Mee, return to the Amazon*, ed. by Ruth Stiff (catalogue of an exhibition...) 201 pp., col. illustr., London, Stationery Office, 1996.
- Sherwood, Shirley, *Contemporary botanical artists... ed. by V. Matthews*. 240 pp., col. illustr., London, Weidenfeld & Nicholson, 1996.
- Dr.J. Marsden Nowell, William, *Diseases of crops in the Lesser Antilles*. 383 pp., illustr., London, West Indian Committee, n.d.

- Father K.M. Matthew Matthew, K.M., *Illustrations on the flora of the Palni hills*, South India. 976 pp., illustr., Tiruchirapalli, Rapinat Herbarium, 1996.
- Merrell Holberton Catesby, Mark, *Natural history of America*, catalogue of an exhibition of watercolours from the Royal Library Windsor Castle, ed. H. McBurney, 160 pp., col. illustr., London, Merrell Holberton, 1997.
- Mrs S. Natusch Natusch, Sheila, *The natural world of the Trails*. 99 pp. ilustr., Wellington Nestegg Books, 1996.
- Dr E.C. Nelson DUBLIN, National Botanic Gardens, *The art of flowers*, National Botanic Gardens Bicentenary exhibition, 1995 with coloured illustrations by Wendy Walsh and Charlotte Wheeler. 35 pp., col. illustr., Dublin, Stationery Office, 1995.
- Nelson, E. Charles, *The cause of the calamity, potato blight in Ireland 1845–1847...* 20 pp., illustr. maps, Dublin, Stationery Office, 1995.
- Smellie, William, *The philosophy of Natural History*. 2 vols: 417 pp. & 469 pp., Dublin, Chamberlaine and Rice, 1790
- Dr H.J. Oterdoom Gelderen, D.M. Van, De Joong, P.C. & Oterdoom, H.J., *Maples of the world*. 458 pp, col. illustr., Portland, Timber Press, 1994.
- H. Pearson Comstock, William Phillips, *Butterflies of the American tropics: the genus *Anaea**. 214 pp. 30 col. pl., New York, Am. Mus. Nat. History, 1961
- Dr M.J. Petry Linne, Carl von, *Nemesis divina* (edition in Dutch). 245 pp., Kampen, Kok Agora, 1996
- Prof. Sir G. Prance Prance, Ghillean, *The earth under threat, a Christian perspective*. 94 pp., illustr., Glasgow, Wild Goose Publications, 1996.
- A. Priolo Priolo, Angelo, *Uccelli della Sicilia raffigurati da Cupani nel Panphyton siculum*. (Naturalista Siciliano Ser. IV, XX (3-4) 1996) pp. 321-410, illustr., Palermo, 1996.
- Dr. R.F. Raffauf Raffauf, R.F., *Plant alkaloids, a guide to their discovery and distribution*. 279 pp., New York, Food Products Press, 1996.
- Dr P.Q. Rose Rose, Peter Q., *The gardener's guide to growing ivies*. 160 pp., col. illustr., Newton Abbot David and Charles, 1996
- Royal Botanic Gardens, Kew KEW, Royal Botanic Gardens, *Index Filicum Supplement 6: 1976–1990*, edited by R.J. Johns. 414 pp., Kew, Royal Botanic Gardens, 1996.
- KEW, Royal Botanic Gardens, *Index Kewensis Supplement XX*, edited by R.A. Davis. 338 pp., Kew, Royal Botanic Gardens, 1996.
- KEW, Royal Botanic Gardens, *Pteridology in perspective*,

- Proceedings of the Holttum memorial pteridophyte symposium, Kew 1995, edited by J.M. Camus, M. Gibby and R.J. Johns. 700 pp., illustr., maps, Kew, Royal Botanic Gardens, 1996.
- KEW, Royal Botanic Gardens, *World checklist and bibliography of Magnoliaceae* by David G. Frodin and Rafael Govaerts. 72 pp., Kew, Royal Botanic Gardens, 1996.
- KEW, Royal Botanic Gardens, *Holttum memorial volume*, edited by R.J. Johns and S. Dickerson. 272 pp., illustr., maps, Kew, Royal Botanic Gardens, 1997.
- KEW, Royal Botanic Gardens, *The genus Inga, botany* by T.D. Pennington. 814 pp., illustr., Kew, Royal Botanic Gardens, 1997.
- Dr F.R. Schram Schram, F.R. & Hoeg, Jens T., eds., *New frontiers in barnacle evolution* (Crustacean issues No.10). 318 pp., illustr., Rotterdam, Balkema, 1995.
- Truesdale, Frank, ed., *History of carcinology* (Crustacean issues No.8). 445 pp., illustr., Rotterdam, Balkema, 1993.
- Joyce Stewart Stewart, Joyce, *Orchids of Kenya*, photography by Bob Campbell. 176 pp., col. illustr., maps, Winchester, St Pauls Bibliographies, 1996.
- J. Tennent Tennent, J. *The butterflies of Morocco, Algeria and Tunisia*. 217 pp., col. illustr., Wallingford, privately, 1996.
- Dr B.A. Thomas Hutchinson, G. & Thomas, B.A., *Welsh ferns, clubmosses, quillworts and horsetails*. 265 pp., illustr., maps, Cardiff, National Museum of Wales, 1996.
- Prof.V.N. Tikhomirov Tikhomirov, V.N. ed., *9th Moscow symposium on plant Physiology*. in Russian. 164 pp. Moscow, 1996.
- Tikhomirov, V.N. ed., *Flora of the Lipetsk Province*. 374 pp., maps, Moscow, Argus, 1996.
- Dr C. Violani Conci, Cesare, and Poggi, Roberto, *Iconography of Italian Entomologists, with essential biographical data*. (Mem. Soc. Ent. Ital. 75, 1996). pp.159-384, illustr., 1996.
- FLORENCE, University Museum, *The Museum of natural history of the University of Florence*. unpagged, col. illustr., Firenze, University of Florence, 1987.
- Giansiracusa, Paolo, ed., *Vanitas vanitatis, studi sulla ceroplastica di Gaetano Guilio Zumbo*. 77 pp., illustr. some col., Siracusa, Arnaldo Lombardi, 1991.
- Poggi, Roberto & Conci, Cesare, *Elenco delle collezioni entomologiche conservate nelle strutture pubbliche Italiane*. (Mem.Soc. Ent. Ital. 75, 1996). 157 pp., 1996.
- Rafinesque Schmaltz, C.S. *Animale e pianti della Sicilia*

- (facsimile edition) with historical introduction by C. Violani. xxvii, 105 pp., illustr., Palermo, Acad. Nat. Sci. & Lett., 1995.
- Annette K. Walker Miller, David, *Common insects in New Zealand*, revised by Annette K. Walker. 179 pp., illustr. some col., Wellington, Reed, 1984
- J. & M.E.S. Weston Churchill, Stephen P. & Linares, Edgar L., *Prodromus Bryologicae Novo-Gratanensis*, pt. 2, Grimmiaceae Trachypodiaceae. 924 pp., illustr., maps, Bogota, Inst. Cien. & Tech. Nat., 1995.
- Dr Trevor Williams Chua, K.S., Soong, B.C. & Tan, H.T.W., *The bamboos of Singapore*. 71 pp., col. illustr., map, Singapore, IPGRI, 1996.

Book Reviews

Fishes, Crayfishes and Crabs. Louis Renard's Natural History of the rarest Curiosities of the Seas of the Indies. Edited by Theodore W. Pietsch. 2 Vols Vol. 1. Commentary and English Text., Vol. 2. Facsimile and Plates. publ The John Hopkins University Press, Baltimore and London, 1995. H/B ISBN 0-8018-4790-7. Vol.1 xxii + 214, Vol.2.vi + 224 pp colour plates. £78.50 two vols slipcased.

The first edition of Louis Renard's book was published in French in 1719. Louis Renard was described as "a bookdealer, publisher and foreign agent". He was also said to be "a wise, friendly, and obliging man, but unfortunately left a very mediocre capital and many children".

Very little if anything was known about East Indian fishes at that time. An interesting foreword outlining the early history of marine exploration is presented by L.B. Holthuis of the Rijksmuseum van Natuurlijke Historie in Leiden. Volume 1 is a Commentary and English translation of the old French text and legends of the fifty seven plates depicted in the second volume. The additional commentary and historical text, supported by detailed archival monotone illustrations and portraits make this book a fascinating account of seventeenth and eighteenth century marine exploration.

This work is probably the oldest known work on fishes, and is certainly a faithful copy of one of the rarest of natural history books. In the concluding remarks, the editor alluded to one of the important merits of this work. It has "given us an intriguing glimpse of what science was like in the late seventeenth and early eighteenth centuries."

The elegant binding and slip-casing of the books will grace the Linnaean Library for a long time and I am sure will be consulted often.

BRIAN W. FOX

A Student's Guide to the Seashore (2nd Edn.), by J.D. Fish and S. Fish., publ. Cambridge University Press, Cambridge, UK., 1996, xv + 564 pp., line drawings, P/B ISBN 0-521-46819-1, £19.95, US\$39.95., H/B ISBN 0-521-46279-7, £55.00., US\$105.00

To present an overview of the tremendously diverse intertidal plants and animals

(lichens to fishes) of north-west Europe (excluding the Baltic) is a daunting challenge. This is the most comprehensive and useful book of its kind and it fills a great need.

The authors have undertaken to combine detailed identification keys with inspiringly readable information about the biology of the organisms. There is a practical, commonsense approach to prioritising the subject matter. There is a focus on species most likely to be encountered, but less common, locally abundant species are also included. Offshore species are mentioned if their remains are to be seen on the strand line. The book includes just three genera of flowering plants which are common intertidally on sheltered shores. Seashore fishes are included, but birds are not. Species too small to be identified readily outside the laboratory appear to have been sensibly omitted on those grounds. So a minimum of hand-lens detail is described for the seaweeds, and even though swarms of tiny copepods are often noticeable in rockpools, they get only a brief mention in the summary of crustacean taxonomy. In contrast, the key to the tricky gammaridean amphipod families, together with illustrations of specific examples, covers nineteen pages.

The art of producing readable yet informative summaries is vital in a book of this kind. Space permits just two illustrated pages for a clear overview of the immensely complicated field of seaweed reproduction. An equally useful summary introduces each group of organisms throughout the work.

This book has a much broader potential appeal than just a 'student's guide'. It is a shame that many amateur naturalists will overlook it on account of its textbook cover and detailed but uncoloured line drawings. However, the writing style is full of colour, and that is no less important!

IAN RUSSELL

Obituary

WILLIAM THOMAS WILLIAMS

Died 15 October 1995

Elected to Fellowship 1978

Bill Williams was born in Fulham (London) on April 18, 1913 the only child of Thomas and Clara Williams. He was educated first at the Stationers' Company's School where he was a brilliant student and then at the Imperial College of Science and Technology, London where he graduated B.Sc. 1st Class Honours (1933), Ph.D. (1940) and D.Sc. (1956). His professional life fell into two phases. In England he was an Academic Botanist and taught at Imperial College (1933–36); Sir John Cass Technical College (1936–40); Bedford College for Women (1946–51) and the University of Southampton (1951–65). For much of this period he served on the Agricultural Research Council being a Member of its Potato Marketing Board Research and Development Committee, and of the Governing Body of the Glasshouse Crops Research Institute. He was, furthermore, a Member of the Society for Experimental Biology, the Biometric Society and the Classification Society.

In Australia he was a research scientist with CSIRO, initially in the Division of Computing Research (1966–68) but, in order to escape the cold of Canberra he

transferred to the Division of Tropical Pastures in Brisbane (1968–73). On retirement Bill moved to the warmer climes of Townsville where his research interests were maintained through consulting to staff at the James Cook University of North Queensland, Davies Laboratory (CSIRO) and the Australian Institute of Marine Science. A qualified teacher of music (A. Mus A., Lic. M.) he taught the piano and was otherwise active in the musical life of Townsville.

From 1941–46 he served in the Royal Artillery (Sergeant), Royal Army Ordnance Corps (Second Lieutenant) and Royal Electrical and Mechanical Engineers (Major).

In addition to music, both as performer and critic, Bill's non-professional interests were numerous and included ball-room dancing, swimming, the Sherlock Holmes Society (London) of which he was sometime Secretary and beer drinking in convivial, often dockside pubs.

His research, as did his career, followed two quite separate paths. One was physiological and concerned the mechanisms of stomatal movement and the function of parenchyma; the other was mathematical and involved the development of models to detect patterns in a wide variety of observational data such as arise in taxonomic, ecological and agricultural studies. This research, often undertaken collaboratively, resulted in the publication of about 200 research papers. His only book "The Four Prisons of Man" was concerned primarily with the application of logic to a few topical social and philosophical problems associated with science. For sometime he was editor of the *Journal of Experimental Botany* and edited a series of conference papers published under the title *Pattern Analysis in Agricultural Science* (1976).

In England, for many years, he took part in BBC television and radio programmes and in Australia the ABC radio series 'Ockham's Razor' gave him the opportunity to display his wit and penetrating insight into many controversial issues on which a scientist might be expected to have an informed opinion. He was at his best when producing short pithy articles which may account for why he never wrote a substantial text on Pattern Analysis.

In 1973 Bill was awarded a Doctorate of Science (*honoris causa*) by The University of Queensland and in 1980 was admitted to the Order of the British Empire (O.B.E.). As well as being a Fellow of the Academy, Bill was also a Fellow of the Institute of Biology and the Linnean Society (London).

A firm believer in the value of dogs as companion animals, Bill, in later life was a familiar figure being led around the streets of Townsville by Jo, his beloved red kelpie. It was perhaps fitting, that his death should have resulted from injuries sustained through tripping over Jo on leaving his favourite pub following a pleasant evening with "his mates".

Bill never married.