Editorial

This *Linnean* contains the Presidential Anniversary address of 28 May 1998 which includes a short account of Wallace's visit to the Malay Archipelago. Wallace's second expedition lasted eight years during which time he travelled some 14,000 miles and visited every group of islands between Malaya and Australia, as far east as the Aru Islands and New Guinea. In this interval he not only published his two essays on the origin of species but also turned zoogeography into a scientific discipline with a series of papers on geographical distribution.

Wallace was apparently stimulated into publishing his zoogeographical views upon reading two papers by P.L. Sclater entitled 'On the general Geographical Distribution of the Class Aves' and 'On the Zoology of New Guinea' published in 1858 *(J. Proc. Linn. Soc. Zool.,* **2:** 130–145; 149–170*)*. Wallace had already written to Bates earlier in 1858 (Amboyna, January 4) commenting on the Malay Archipelago:

> "Yet there is nothing on the map or on the face of the islands to mark their limits. The boundary line passes between islands closer together than others belonging to the same group. I believe the western part to be a separated portion of continental Asia, while the eastern is a fragmentary prolongation of a former west Pacific continent. In mammalia and birds the distinction is marked by genera, families, and even orders confined to one region; in insects by a number of genera, and little groups of peculiar species, the families of insects having generally a very wide or universal distribution".

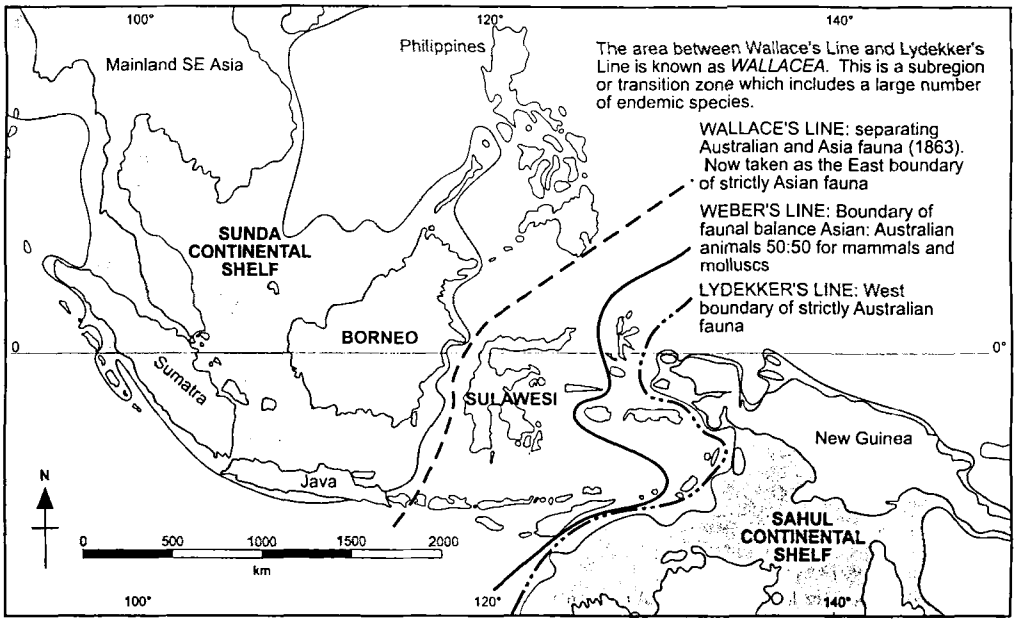
Upon receiving Sclater's papers Wallace's initial reply from Batrachian on March 1 1859, was his 'Letter from Mr Wallace concerning the geographical distribution of birds' (*Ibis* **1**:449) and then a paper to the Linnaean Society communicated by Mr Charles Darwin, titled: 'On the Zoological Geography of the Malay Archipelago' (*J. Proc. Linn. Soc., Zool.*, **4:** 172–184, 1860). Wallace noted that the Straits of Lombok abruptly separated two of the great zoological regions of the globe, pointing out that whereas:

> "Borneo and Java have species in common by hundreds, Borneo and the Celebes only in units and we shall be forced to believe that the former have been connected at no very distant epoch while the latter have been ever separated or at least during a long geological epoch".

The distribution of the various species of birds of paradise (Australia, New Guinea, the islands of Aru, Mysol, Waigion and Jobie) and the species of *Cuscus* (a marsupial common in the dense woods of Celebes (Sulawesi) with a second species common to the islands of Amboyna, Waigion, Banda, New Guinea and to Cape York) convinced him that Celebes, Timor, the Moluccas, New Guinea and Australia were remnants of a vast Pacific continent.

Wallace found the faunal break to be most pronounced between Lombok (with its Australian bee eaters and long-necked honey suckers) and Bali (with its Javanese orioles, barbets and woodpeckers) whereas Celebes provided a mixture of endemics and Australian forms with a few western species such as tarsiers, civets, pigeons, cuckoos and woodpeckers.

Finally, on returning to London and in between sorting around 3,000 bird skins and



From Moss & Wilson, 1998[1]

20,000 insects (mainly beetles, moths and butterflies) he read a paper to the Royal Geographical Society 'On the physical geography of the Malay Archipelago' (*J. Geogr. Soc.*, **33:** 217–234, 1863) in which he described a definite boundary line separating the Oriental from the Australian faunal region. This line later became known as Wallace's Line[1] and is faithfully marked on many atlases and geological maps.

Today we know that Celebes lies exactly on the edge of the Australian tectonic plate. The question is, do the plates and biogeographic areas coincide as Wallace's Line predicts? Vane-Wright (1991, *Aust. Syst. Bot.*, **4:** 183–197) has shown through an analysis of the 470 species of butterfly known from Sulawesi that virtually all the genera are Asian but with no special links to Borneo! Alternatively the distribution of angiosperms (Humphries, pers. comm.) suggests that Wallace's Line passes through the middle of Celebes with the eastern finger-like projections having been contributed by the Australasian plate (Moss & Wilson 1998). Wallace, I am sure, would have welcomed this solution. He would also have been more than interested in the discovery of a second coelacanth population at a depth of about 150 m in the sea off Sulawesi (some 5,400 miles east of the Comoros, where the first population had been recorded) earlier this year.

This issue also contains a profile of Robert Grant (1793–1874) a disciple of Lamarck, for whom freshwater sponges, with their simple siliceous spicules and gemmules, formed the basis for his evolutionary views.

1 Moss S.J. & Wilson M.E.J., 1998. Biogeographic implications of the Tertiary palaeographic evolution of Sulawesi and Borneo. In Hall R. and Holloway J.D. (Editors). 1998. *Biogeography and Geological Evolution of S.E. Asia*, pp 133-143. Backhuys, Leiden.

Linnaeus described some 14 species of sponge including the freshwater species, *Spongia lacustris* and *S. fluviatilis*. In his *Flora Suecica*, Linnaeus speaks of grains found in these freshwater algae in autumn (= gemmules), but in later works he believed these grains to be foreign bodies and the plants to be a species of sponge. The grains he described as being the size of the seeds of thyme, straw coloured in *S. lacustris* but green and gelatinous in *S. fluviatilis*. Initially Lamarck (and Lamouroux) thought these gemmules showed it to be a plant. Like Linnaeus, however, he eventually decided it was a sponge and put it in the new genus *Spongilla*.

Grant described the gemmules as distinctly visible to the naked eye, green coloured and made up of some 300 gelatinous globules. He imagined that they grew in a similar manner to the ova of marine sponges. From the simplicity of the organisation of these freshwater sponges Grant deduced that they were more ancient than the marine sponges and probably their original parent. He further believed that the boring parasitic sponge *Cliona* (with its contractible papillae) formed a connecting link between such zoophytes as *Alcyonium* and the sponges, while the free swimming ciliated (= flagellated) ova (= amphiblastula) of the marine sponge formed a link with the ciliated ova (= larvae) of zoophytes (Hydrozoa, Bryozoa etc.) and the mollusca.

Today Grant is remembered by the genus *Grantia* (a calcareous sponge) named after him by J. Flemming (1828: 524):

"to commemorate his valuable services to elucidating the physiology of sponges".

We, however, shall remember him for his intellectual relations with Darwin and in particular for introducing Darwin to Lamarckian inheritance, embryological development, universal monadism, the origin of life and atheism.

Society News

The Primate Society of Great Britain is holding its Winter Meeting on Wednesday, 1st December 1999 at the Institute of Zoology, London. The theme will be *Mating and Social Systems of Old World Monkeys*. Suggestions for speakers and offers of posters are very welcome. Please contact: Dr Caroline Ross or Mairi Macleod, School of Life Sciences, Roehampton Institute London, West Hill, London SW15 3SN, e-mail: c.ross@roehampton.ac.uk or m.macleod@roehampton.ac.uk.

The Society was represented at the memorial service for Sir Francis Avery Jones CBE MD FRCP Hon FRCS FLS on 6th August 1998 by Dr Arthur Hollman FLS and the Executive Secretary. The service was held at St. Giles, Cripplegate and afterwards at the Worshipful Company of Barbers.

Mrs G. Crompton is working on a Historical Flora of Cambridgeshire, and is most anxious to see the copy of John Ray's *Synopsis of British Plants* edn. 2, 1696, which has been copiously annotated in the margins for many localities of the rarer plants in Cambridgeshire. Canon C.E. Raven described this book as being in his library in his article 'The Early Scientists of Christ's College: III John Covel', published in *Christ's College Magazine* No. 154 for the Easter term 1942, and reprinted in No. 217, 1992. It is believed to have been sold with the rest of Canon Raven's library within the last

20 years. Please send any information to Gigi Crompton, c/o The Herbarium, Department of Plant Sciences, Downing Street, Cambridge CB2 3EA.

The following message has been received from Dmitry Geltman FLS at the Komarov Institute:

> "....having in mind the current situation in Russia, nevertheless, we are still alive! Our colleagues of the Zoological Institute proposed jointly (with the Komarov Botanical Institute) to organise an international Symposium *Computer Science in Biology: Databases in Biodiversity Research* 22–27th May 1999 in St. Petersburg. We hope that despite the current situation many people working on this subject will come to St. Petersburg. For western biologists it will be a unique possibility to see a wide range of such works in the former USSR, which are at a very good level.
>
> I would like to ask Linnean Society to help us in organising this Symposium. First of all, we need assistance in the wide distribution of the information about the Symposium. Also, the question at the moment is how to collect registration fees from western participants and, maybe, the Society can help in this matter as well. The key person in this enterprise in the Zoological Institute is Dr Alexander Ryss (alex@ryss.spb.ru) and, if necessary, he can add some necessary information. He will come to Belgium for research work soon, but will play a key role in the Symposium preparation."

The Society will, of course, be helping in this worthwhile endeavour and Members may like to consider a spring break in one of the World's most beautiful cities.

Details of the following longer meetings are included with this issue: *Climate Change: the Biological Response* on Saturday, 6th March organised by former President, Professor Bill Chaloner; *Evolution on Planet Earth: The Impact of the Physical Environment* on Thursday and Friday, 6/7th May organised by Lynn Rothschild (NASA) and Adrian Lister (UCL) and to which NASA is contributing $10,000, for which the Society is most grateful; finally, *Interrelationships of the Platyhelminthes* on Wednesday 14th to Friday 16th July, organised by Tim Littlewood and Rob Bray (KCL).

The Society received recently from the 5th Lord Cranbrook FLS the donation of a microscope. It had been sold by the Society when it was hard up in the 1960s and was bought by the then Treasurer, the 4th Lord Cranbrook. The Society is most grateful for the return of the microscope, which had been originally presented in 1909 by A.O. Walker FLS, who was a businessman and amateur marine biologist, working with Herdman in Liverpool at the turn of the century. Walker, who owned a lead works in North Wales, was connected with the Liverpool Biological Society, being their President in 1892–3. He was elected a Fellow in 1874 and died in 1925 near Maidstone, Kent, where he had retired.

The first marine laboratory at Liverpool University was on Puffin Island on the NE corner of Anglesey, but the hazards of getting there, which caused a number of fatalities, led directly to the Port Erin station being founded, on the occasion of the opening of which nearly a century ago Walker made a speech. Both Herdman and Walker were benefactors to the Port Erin laboratory.

Much of Walker's work is encapsulated in *The Fauna of Liverpool Bay*, a five-volume work in the Society's Library. Anthony Walker, a current FLS, is of the

same family, although A.O. Walker had no children. A.O. Walker's archives are believed to be in the hands of the University of Liverpool and we hope to be able to do a piece on the career of this interesting man in due course.

The Harold Hyam Wingate Foundation awards each year a number of Wingate Scholarships. These are "to help people of exceptional talent who have interesting projects in a variety of fields, and who for one reason or another are unlikely to obtain funding from the usual sources, for example because of their nationality". Markedly original and/or cross-disciplinary topics are preferred.

Picture Quiz

The October Quiz (**14**(4):19) featured Robert Edmond Grant (1793–1874), comparative anatomist and Darwin's first mentor. The seventh son of Alexander Grant, he was born in Argyle Square, Edinburgh, on 11th November 1793. He had eight brothers and three sisters, all of whom died before him, and as none of them left any children Robert Grant was the last survivor of his family.

He was educated at the Edinburgh High School and then the University where he studied medicine and also natural history under Jameson, graduating M.D. in 1814. That same year he had published both his inaugural dissertation *De Sanguinis Circuiti* (in which he cited Erasmus Darwin's *Zoonamia*) and *An Essay on the Comparative Anatomy of the Brain*, and was elected one of the Presidents of the Medical Society of Edinburgh. The following year he embarked on the *grand tour*, spending four years visiting universities in France, Germany, Italy and Switzerland, and so learned to speak the principal European tongues fluently. Two of these years, however, were occupied studying medicine and natural history in Paris where he came under the influence of Jean-Baptiste Lamarck, Etienne Geoffroy St Hilaire, J.F. Meckel, C.G. Carus, Karl Rudolphi and Etienne Serres.

He returned to Edinburgh in the summer of 1820 and took up residence in his native city. That November he was elected a Fellow of the Linnean Society. Despite becoming a Fellow of the Edinburgh College of Physicians he seems not to have engaged in medical practice. Instead, he began to study marine life, particularly sponges (cf. Lamarck), using the small legacy from his father to buy a house on the rocky shore at Prestonpans. During the next seven years Grant published over 20 scientific papers dealing with such subjects as sponges, Bryozoa and other zoophytes (viz. Hydrozoa, Anthozoa, Gorgonia), cilia in gastropod larvae, *Lernea*, *Pontobdella*, *Octopus*, *Vigularia*, swordfish, *Ornithorhynchus* and *Perameles*.

In 1827 Dr Grant was elected the first Professor of Comparative Anatomy and Zoology in the newly founded University of London (see *The Linnean* **13**(4):5), afterwards University College. His inaugural lecture, delivered on 23rd October 1828 (*An Essay on the study of the Animal Kingdom*, published by John Taylor, London 1828), was clearly designed to attract students (and therefore to obtain financial gain). In it he offered both the deity and a continuously originating microbial life:

"To exalt our conceptions of the infinite wisdom, power and goodness of the great

Author of Nature, as displayed in his minutest works; and thus lay the most rational and lasting foundations of piety and virtue, and strengthen the best principles of morality and religion".

Then later:

"Naturalists have been led to believe that the simplest organised bodies as *Monads* and *Globulinae* – originate spontaneously from matter in a fluid state and that their simple bodies of spontaneous origin, are the same with the gelatinous globules which compose the soft parts of animals and plants".

He subsequently became absorbed in teaching, lecturing five times a week for forty-six years without missing a single lecture, and always formally attired in full evening dress.

In 1833 he delivered, without charge, a course of forty lectures on the Structure and Classification of Animals to the Zoological Society[1] which was all the more surprising since, at University College, he had to rely on the subscriptions paid by the students and the public attending his lectures for his meagre salary (said to average about £40 per year). These lectures to the Zoological Society were reported in the *Lancet* and in them Grant quite unambiguously states his evolutionary views. Grant subsequently embodied the substance of these lectures in his *Outlines of Comparative Anatomy* (1835–44); Darwin wrote on the back cover of his copy:

"Nothing" (Jespersen 1948–9).

Following his election to the Royal Society in 1836, Grant was rewarded with a three year appointment as Fullerian Professor of Physiology at the Royal Institution and later the Swiney Lecturer on Geology at the British Museum (for five years). He also lectured at the Aldersgate Street and Windmill Street medical schools, and many other institutions.

His scientific papers, principally on subjects of invertebrate anatomy number over 40 and extend from 1825 to 1861, including the 'Animal Kingdom' in Todd's *Cyclopaedia of Anatomy and Physiology*. His final book *Tabular View of the Primary Divisions of the Animal Kingdom* (Walton & Maberley: London, May 1861) he dedicated to Charles Darwin.

"Intellectual triumphs like yours which have been hailed with the assent and applause of all competent unbiassed minds at home and abroad, while they charm away the clouds of mysticism which overhang some parts of our science and of philosophy, and obscure the greatest truths of nature, alone add permanent glories to the annals of our country in the great struggle for intellectual preeminence and ascendency among the nations of the earth. With one fell sweep of the wand of truth, you have now scattered to the winds the pestilential vapours accumulated by *species-mongers* –"

1 "Your friend Dr Grant is working away at the Mollusca and Infusoria, publishing at a great rate. He gave a Course of Lectures on the Regne Animal, but did not elicit much novel matter. As a Lecturer he is rather too grave and rather too pedantic, too much given to *coin* hard words; at times he was eloquent and animated, generally verbose and lengthy. He is however, what is more valuable a very amiable Man and strictly conscientious" (F.W. Hope to Darwin, Jan 15, 1834)

with an accompanying letter pointing out that:

> "nearly forty years have rapidly fled away since you and I were busied in exploring microscopically the delicate structures and the living phenomena of the lowest organisms abounding in the rich fauna of the Firth of Forth."

Whether or not this dedication finally prompted Darwin to mention Grant in the enlarged Historical Sketch of the third edition of the *Origin* (published March 1861)[1] we cannot be sure since *Tabular View* seems not to have been printed before May 1861. Nevertheless, it is possible that Grant sent a copy of his letter and the dedication to Darwin in advance of publication. In any event, the dedication shows the high regard in which Grant held Darwin.

Neither his lecturing nor his publications earned him very much money; in 1848 (after he had lectured for more than 20 years) his friends purchased an annuity for him of £50. In manner he was said to be both gentle and courteous, strongly built, with a very intellectual countenance. Moreover he often spoke out strongly against shams and in favour of reforms. He was a true radical:

> "Whenever a good, honourable, generous, and liberal cause was in agitation there you would find the name of Professor Grant" (Desmond & Moore 1992:199).

He never married, and having no surviving relatives he left his property, collections and library to University College.

Grant and Darwin

As a consequence of his sojourn in Paris, Grant returned to Edinburgh in 1820 an uncompromising evolutionist extolling the views and ideas of Lamarck and St Hilaire. Not only was he the first Lamarckian academic in the United Kingdom, he was also the only man to teach evolution before Darwin. As Huxley commented:

> "Within the ranks of biologists of that time (1851–58), I met with nobody except Dr Grant of University College, who had a word to say for Evolution – and his advocacy was not calculated to advance the cause."

But Grant went much further that Lamarck. Through his study of the embryological development of invertebrates he articulated the theory of recapitulation while through his studies on protozoa, sponges and zoophytes he taught that life originated spontaneously and that the plant and animal kingdoms are intimately blended at their origin (see his inaugural lecture to the University of London, 1828).

Charles Darwin went up to Edinburgh in October 1825 to study medicine (where he stayed for two years or sessions) and the following November was elected a member of the Plinian Society. It was through this society that Darwin first met Grant, who was to become perhaps his first and foremost mentor. Together with other students, Grant took Darwin along the shoreline of the Firth of Forth, collecting and examining the marine life, sometimes as far afield as Prestonpans.

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1 "In 1826, Professor Grant, in the concluding paragraph in his well-known paper (*Edinburgh Philosophical Journal*, 283) on the Spongilla, clearly declares his belief that species are descended from other species, and that they become improved in the course of modification".

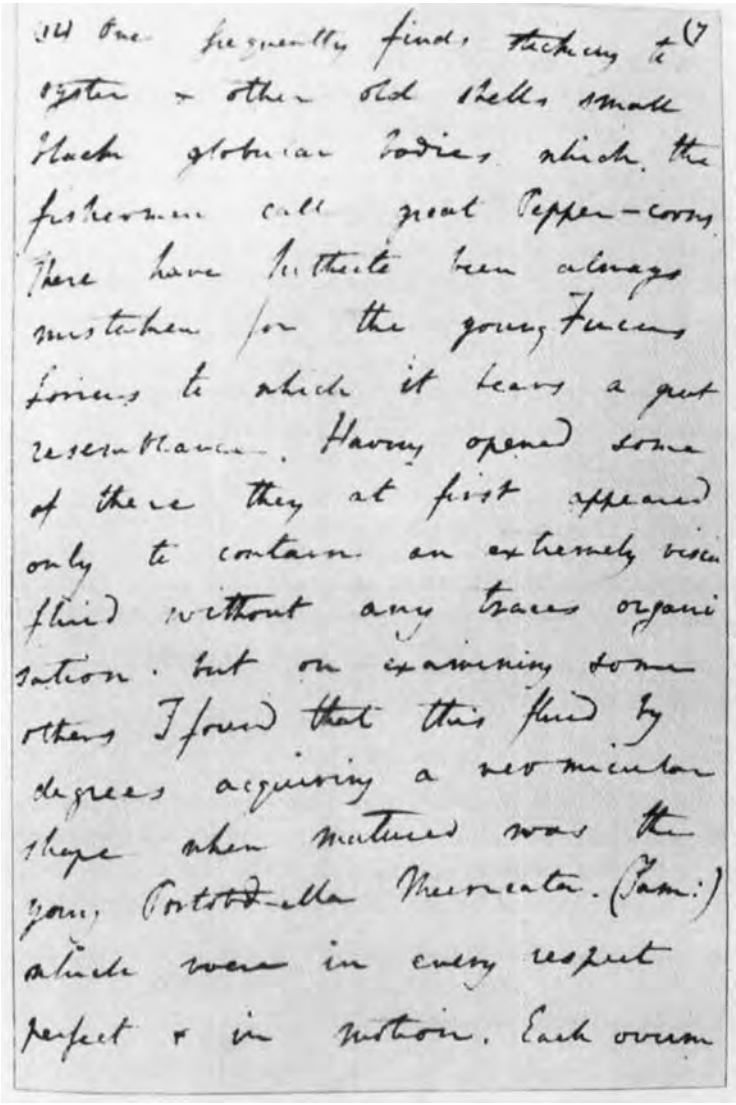


Figure 1. Portion of page three of Darwin's Edinburgh note book, dated March 28, showing sketches of white capsules found on *Fucus* with ciliated embryos within (=*Lacuna vincta*). Near the bottom of the page is a sketch of another mass of ova in much larger capsules (= *Littorina littoralis* (L)). From Ashworth, 1936.

Through the winter and spring of 1827 Grant became Darwin's friend and tutor[1] and Darwin filled a notebook in March/April 1827 with observations and drawings of marine life. Grant also introduced him to the local Newhaven fishermen whom Darwin sometimes accompanied when they trawled for oysters.

1 "He was dry and formal in manner, with much enthusiasm beneath his outer crust. He one day when we were out walking together, burst forth in high admiration of Lamarck and his views on evolution" (Darwin: *Autobiography* p. 49).

After Darwin had become a member of the Plinian Council (5th Dec. 1826) he was in regular weekly contact with Grant, who meanwhile took him along to meetings of the Wernerian Natural History Society as his guest. By this time (1826) Grant had already published much of his work on sponges in which he deduced that the marine sponges had evolved from the simpler, freshwater forms while calcareous and phosphatic spiculae were indicative of the higher orders. He was also well on the way to a thesis of universal monadism and to testing a more general law – that the ova (= larvae) of zoophytes (Bryozoa, Hydrozoa, Anthozoa, Gorgonia) and sponges are cilliated (motile). These papers were not only transmitted to Darwin by word of mouth but the reprints were presented to him by Grant, suitably enscribed:

"For Mr Darwin with best wishes from his friend the Author".

Under Grant's tutelage Darwin's Edinburgh notebook had become filled with notes on the life histories and development of the ova (larvae) of zoophytes as if he were testing the generality of Grant's suspected law (Sloan, 1985 : 81) particularly in relation to the Bryozoa:

"Having procured some specimens of the / Flustra Carbacea (Lam) from the dredge / boats at Newhaven; I soon perceived / without the aid of a microscope / small yellow bodies studded in / different directions on it. – They were / of an oval shape & of the colour / of the yolk of an egg, each occupying / one cell. Whilst in their cells / I could perceive no motion; but / when left at rest in a watch / glass, or shaken they glided to & / fro with so rapid a motion, as / at some distance to be distinctly / visible to the naked eye [....] That such / ova had organs of motion does / not appear to have been hitherto / observed either by Lamarck Cuvier / Lamouroux or any other author: – / This fact although at first it/ may appear of little importance/yet by adducing one more to / the already numerous examples / will tend to generalize the / law that the ova of all Zoophytes / enjoy spontaneous motion." (Darwin's Edinburgh note book pp. 5-6)
NB: *Flustra* is a bryzoan.

On 24 March 1827 Dr Grant read a paper to the Wernerian Society 'On the Anatomy and mode of generation of *Flustrae*'. The subsequent publication (*Edinb. New Phil.*, **3:** 107-118; 337-342, 1827[1]) refers to five species of *Flustra* namely *truncata*, *carabacea*, *pilosa*, *dentata* and *telacea*. The minutes of the meeting record that Grant noted that the motility of the ova of *carabacea*:

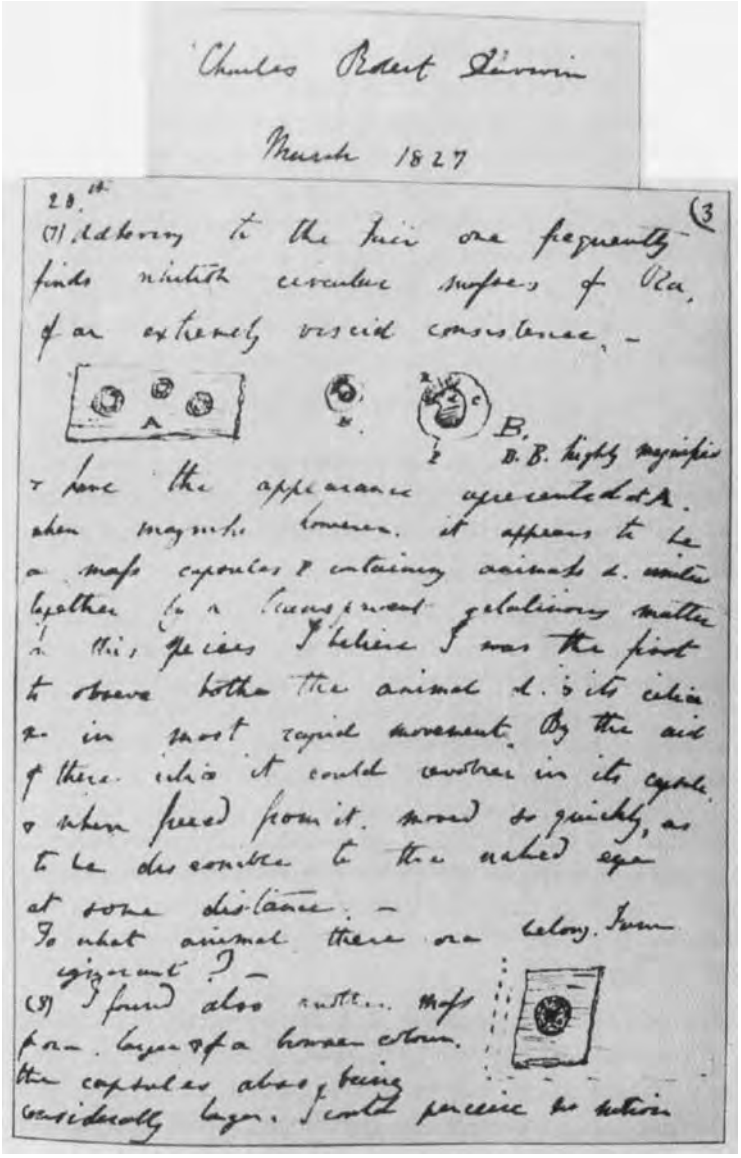
"have lately been ascertained by Mr Charles Darwin."

As Darwin later commented:

"I believe Dr Grant noticed my small discovery in his excellent memoir on *Flustra*."

With Grant's prompting Darwin announced his discovery that the ova of *Flustra carabacea* possesses organs of motion to the meeting of the Plinian Society on the 27 March 1827 while at the same time announcing another modest discovery: that the

1 It should be noted that Grant's published paper on the bryozoan, *Flustra* gives a lengthy and elaborate description of both the eggs (= pilidium larvae) and the general structure of *Carabacea (Flustra) carabacea*. We also know that Darwin was Grant's guest at the Wernerian Society Meeting on the 24 March and must have heard Grant's acknowledgement of his discovery.


Charles Robert Darwin

March 1827

28th

(3)

(7) Adhering to the hair one frequently finds minute circular masses of Ova, of an extremely viscid consistence. –

A. B. B.

B.B. highly magnified

Have the appearance represented at A. when magnified however, it appears to be a mass of capsules & containing animals d. united together by a transparent gelatinous matter. In this species I believe I was the first to observe both the animal & its cilia in most rapid movement. By the aid of these cilia it could revolve in its capsule, & when freed from it, moved so quickly, as to be discernible to the naked eye at some distance. –

To what animal these ova belong, I am ignorant? –

(8) I found also another mass of ova, larger & of a brown colour. The capsules also being considerably larger. I could perceive no motion

Figure 2. Page Seven of Darwin's note book, containing the first part of his description of the cocoons of *Pontobdella muricata*. From Ashworth, 1936.

ova (cocoons full of eggs) of the skate leech occur inside oyster shells. Grant subsequently published this latter information in a paper entitled 'Notice regarding the Ova of the *Pontobdella muricata* Lin'. (*Edinb. J. Sci.*, **7**: 160–161, 1827) where he noted:

> "The merit of having ascertained them to belong to that animal is due to my zealous young friend Mr Charles Darwin of Shrewsbury, who kindly presented me with specimens of the ova exhibiting the animal in different stages of maturity."

Despite Grant's acknowledgements of Darwin's contributions to both *Flustra* and the skate leech, their relationship after 1827 seems to have become surprisingly distant.

One possible reason for the cooling of their friendship came to light through the researches of Jesperson (1948-49) who traced a folder of notes presumed to have been written by Mrs Henrietta Litchfield, a daughter of Darwin's, for Francis Darwin's edition of *Life and Letters of Charles Darwin*:

> "I then made him repeat what he had told me before, namely his first introduction to the jealousy of scientific men. When he was at Edinburgh he found out that the spermatozoa (?) / ova? of (things that grow on seaweed) / *Flustra* move. He rushed instantly to Prof. Grant who was working on the subject to tell him, thinking he wd be delighted with so curious a fact. But was confounded on being told that it was very unfair of him to work at Prof. G's subject and in fact that he shd take it ill if my Father published it. This made a deep impression on my Father and he has always expressed the strongest contempt for all such little feelings – unworthy of searchers after truth."

However, it has also been suggested to me that Darwin may have wished to distance himself from such an out and out atheist as Grant for political reasons, and that this was why their friendship became strained.

Returning to the Meeting of the Wernerian Society of 24 March 1827 (at which Darwin was present as Grant's guest) Grant also read a notice on the 'Existence of Ciliae in the young of the *Buccinum undatum*, *Purpura lapillus* and some other molluscous animals'; and also the 'Mode of Generation of the *Pontobdella muricata* of Lamarck'. As we have noted, this latter communication was published in the *Edinburgh Journal of Science*. Likewise was the paper on molluscs 'On the existence and uses of Ciliae in the young of Gastropodous Mollusca and the causes of the spiral turn of the univalve shell' (*Edinb. J. Sci*, **7**: 121–125, 1827). In this paper, Grant demonstrated the remarkable similarity in the structure of the ciliated parts in the embryo of all gastropodous mollusca and argued this demonstrated common ancestry. Although Darwin was said to have been reintroduced to embryological considerations through reading Milne-Edwards influential essay of 1844 on classification[1] there can be no doubt that Grant's early larval work had demonstrated to Darwin the importance of embryological stages in the search for relationships. Moreover, there can be little doubt that Grant would have also discussed with Darwin both unity of plan and homologous structures as well as the fossil record. As Desmond & Moore (1992) pointed out, what Darwin learned from Grant in those brief six months:

> "shaped his own initial approach to evolution ten years later."

Despite the cooling of the relationship mentioned above, Darwin consulted Grant in preparation for the *Beagle* voyage in 1831 and Grant seems to have been the main source of Darwin's information for the preservation of both invertebrates and vertebrates. On marine invertebrates Grant gave him a list of pickling tips:

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1 Of which Darwin made a lengthy abstract in 1846: Darwin's commentary p.77 "considers *Ornithorhynchus* as obtaining its beak by retrograde 'recurrent' development (when we consider that Bird & Mammal have come from the same original cell, it ceases to be less wonderful that under nearly similar circumstances, (compare Placental & Marsupial animals) wd be similarly or parallely developed) ....." Darwin thus clearly considered Mammals and Birds to be sister groups: see also Darwin's letter to Lyell of Sept. 1, 1860.

"crabs and the like to have their abdomens slit and gills flushed out: delicate zoophytes to be killed by gradual addition of fresh water: sea anemones by pouring boiling water in their interiors: crack open spiral shells to allow the preservations to reach all parts: an equal mixture of water and wine spirits should do – except for crabs which take their spirits neat."

Robert Brown, on the other hand, gave Darwin instruction on microscope design for the voyage as well as a list of unusual plants he should collect from Tierra del Fuego. John Coldstream, Darwin's old Plinian friend, provided details on the collection of deep-water invertebrates and on chain-dredge construction.

Finally, during the voyage of the *Beagle*, Darwin spent more of his time working

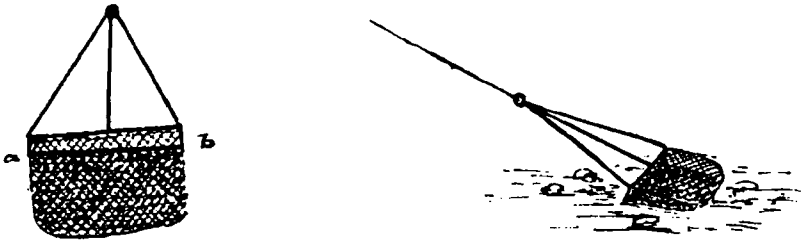


Figure 3. Coldstream's chain-dredge.

on zoophytes than on any other group (Sloan, 1985: 91). In particular he restudied the encrusting bryozoa and their method of regeneration, Grant having already shown in 1827 that the brown body was derived from the withered polypide. But although Darwin recognised that individual polypides were connected (by the funiculus), he failed to explain the cyclic phenomenon of polypide regression (with its brown body formation) and renewal so characteristic of bryozoans. Instead he imagined that the funiculus was comprised of granular matter which gave rise to the new polypides. He further deducted that a similar process of regeneration (branching) occurred in the zoophytes (hydroides) *Obelia, Sertularia* and *Clytia.*

Thus the biological researches aboard the Beagle were highly differential (Sloan, 1985):

"the pleasure of working with the microscope ranks second to geology"

and precisely on those groups with which he had worked on with Grant back in Edinburgh in 1827.

B. G. GARDINER

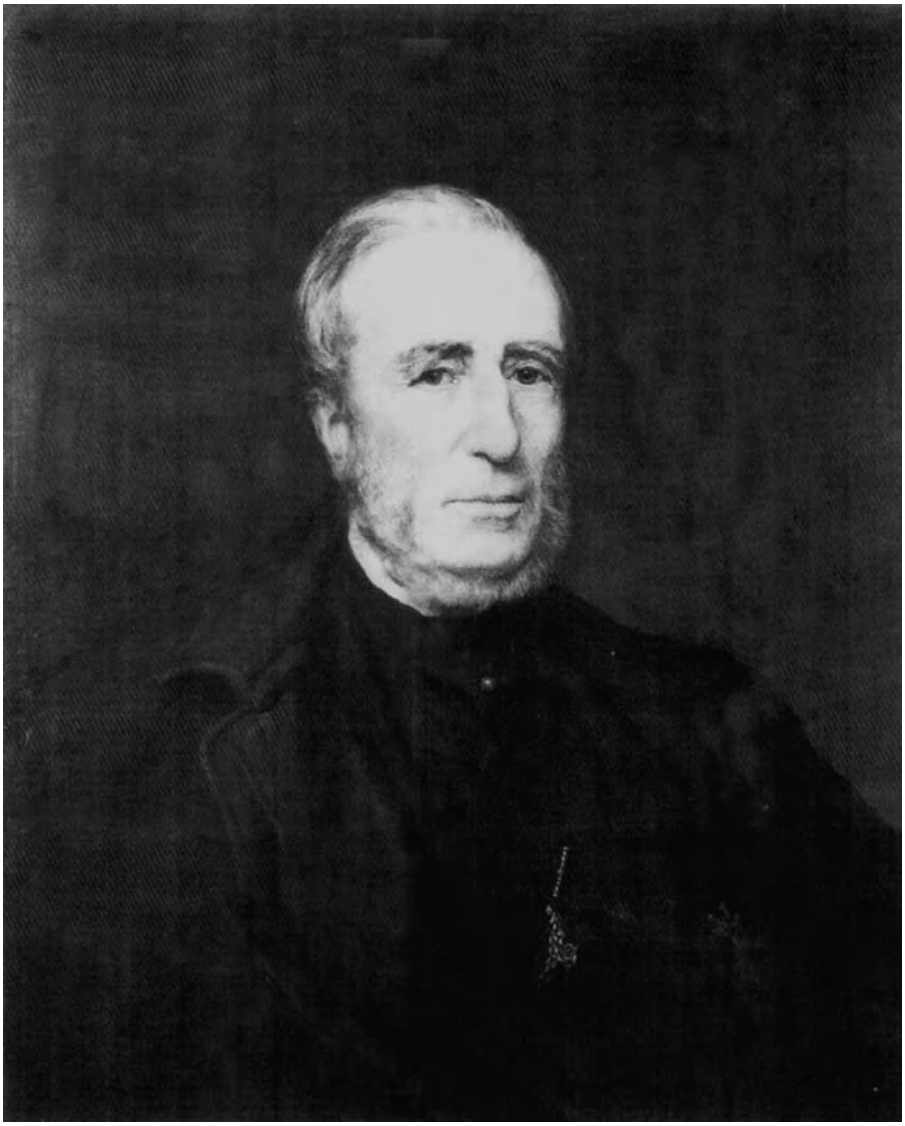
REFERENCES

SHWORTH J.H., 1936. Charles Darwin as a student in Edinburgh, 1825-1827. *Proc. Roy. Soc. Edinb.* **55:** 97-113

DESMOND A. & MOORE J., 1991. *Darwin* New York: Michael Joseph

JESPERSEN P.H. 1948-9. Charles Darwin and Dr Grant. *Lychnos* **1:** 159-167

SLOAN P.R., 1985. Darwin's invertebrate program 1826-1836: preconditions for transformism, In: *The Darwinian Heritage.* David Kohn, ed., Malcolm J. Kottler, Biblio. ass. Princeton: Princeton University Press in Ass. with Nova Pacifica xii+1138pp. [Includes the proceedings of the Charles Darwin Centre Conference, Florence 1982.]



Clue: Recognised the remains of neanderthal man in both Gibraltar and Wales?

From the Archives

Following an article on 'Observations on the properties and use of the *Virgula Divina* in the *Gentleman's Magazine* for November 1751, the editor received the following comment in February 1752:

"To what has been asserted concerning the *Virgula Divinatoria* in your *Mag.* for November 1751 you may add the following relation, as it rests upon the authority of the very eminent Dr Linnaeus, physician in ordinary to the present King of Sweden.

M. *Linnaeus*, when he was upon his voyage to *Scania*, hearing his secretary highly extol the virtues of the divining wand, was willing to convince him of its insufficiency, and for the purpose concealed a purse of one hundred ducats* under a ranunculus which grew by itself in a meadow, and bid the Secretary find it, if he could. The wand discovered nothing, and M. *Linnaeus's* mark was soon trampled down by the company who were present; so that when M. *Linnaeus* went to finish the experiment by fetching the gold himself, he was utterly at a loss where to seek it. The man with the wand assisted him, and pronounced that it could not lie the way they were going, but quite the contrary; so pursued the direction of his wand, and actually dug out the gold. M. *Linnaeus* adds, that such another experiment would be sufficient to make a proselyte of him.

I am etc. CURIOSUS

*This incident was brought to my attention by Mr. B.E. Smythies. *Ed.*

Correspondence

10 Battishill Street,
Islington, London.

16.7.98

Dear Brian,

The Origin of Life

I thoroughly enjoyed John Marsden's fascinating article on the 'Origin of Life' (*The Linnean* **14**(2): 35–43). When I was a biology student at school in the 1930s, neither of my teachers, A.G. Lowndes or Sir Francis Knowles, doubted that life had originated in the surface waters of the sea under the influence of sunlight. After the War, I enjoyed the privilege of attending lectures by Carl Pantin who, as early as 1931, had written: "the similar composition of the body fluids in different animals is related to the fact that physically similar systems which constitute protoplasm require in all cases more or less similar collections of special elements. The close relation of the composition to that of sea water is very significant..... Had sea water possessed a composition other than that required for the easy maintenance of protoplasmic systems, we, as observers, would not have existed". (*Biol. Rev.* **6**: 459–82). It came as no surprise, therefore, to learn that the composition of the 'pre-biotic soup' was similar to that of Ringer's solution, for this idea coincided neatly with Claude Bernard's (1878) famous aphorism concerning the constancy of the 'milieu interieur' (*Leçons sur les Phénomènes de la Vie communs aux Animaux et aux Végétaux.* Paris: Baillière et Fils). It is indeed, 'a shock to realize that there is absolutely no positive evidence' for the existence of this 'pre-biotic soup'.

Several years later, when he visited the University of Khartoum as External Examiner, Carl Pantin introduced me to a remarkable but neglected book, *The Fitness of the Environment* (New York: Macmillan) by L.J. Henderson (1913). In this, the author emphasised the fact that the physical properties of the environment present a unique and unexpected collection of properties essential for the maintenance of that class of systems to which living organisms belong.

A completely different idea as to the origin of life, based on studies of cryptobiosis

in *Polypedilum vanderplanki*, was proposed by another friend of mine, Howard Hinton who, in 1968, suggested that the first living systems might have originated abiogenically on land or in small ponds that dried out periodically so that chemicals in solution would have become progressively more concentrated *(Proc. Roy. Soc.* **B 171:** 43–56). Neither this, nor the hypothesis that life originated on land in colloidal clays appeals to me very much since the majority of invertebrate phyla are marine. But, has life on earth evolved more than once? One thing appears certain from John Marsden's review – there is much yet to be discovered about life's origins.

Yours sincerely,

JOHN CLOUDSLEY-THOMPSON

30.8.98

Colin Godmans, Furners Green,
Nr. Uckfield, Sussex

Dear Editor

Obituary – Ronald Keay

John Marsden, in his excellent obituary of Ronald Keay in *The Linnean* of July 1998, mentions a number of scientific organizations in which he functioned in important ways, but he did not include the International Biological Programme (1964–74) of which Ronald was Financial Secretary throughout. Without him my own problems as Scientific Director would have been a lot more difficult.

My first meeting with Ronald was at his forest research station in Nigeria in 1935 during Lord Hailey's African Survey, and that led to a mutual appreciation of the value of biological research to developing countries.

The relation between the Linnean Society and the IBP were in fact close, and the IBP surviving files are now lodged with the Society, while its main results are now synthesized in thirty volumes published by the Cambridge University Press, occupying some four feet of shelf space. The full records of its researches, some of which are still on-going, would be difficult to enumerate.

E. BARTON WORTHINGTON

25.2.98

Tulane University,
New Orleans, Louisiana, USA

Dear Sir,

As this is a Linnean question, I thought I should direct it to the Linnean Society for an opinion, to wit – what was Linnaeus's name? I had always understood (cf. Stearn and Bridson, 1978) that his name in Swedish was Carl Linnaeus, sometimes Latinized to Carolus Linnaeus, and that after knighthood (1758) he took the name Carl von Linné. Why then, do two recent botanical dictionaries (Mabberley, 1987; Brummitt and Powell, 1992) give Linnaeus's name as Carl von Linnaeus? I haven't seen this anywhere else.

Sincerely

STEVEN P. DARWIN

18.10.98

Lesney Cottage,
Middle Road, Winchester

Dear Professor Gardiner,

On p.23 of the October *Linnean* Enid Slatter referred to a publication by a particularly obscure one-time Fellow, a Dr. Aeneas McIntyre, and in providing some bare, mostly uncertain details about him asked what the letters "VPMSL" he put after his name stood for. The answer is: Vice-President of the Meteorological Society of London, an eccentric little body that was a forerunner, but not an ancestor, of today's Royal Meteorological Society.

Some years ago I had cause to try improving on the scanty information about McIntyre that had appeared up to then in print, but he obstinately remains one of the more shadowy inhabitants of the London scientific underworld in the immediately pre-Victorian years.

It emerged that he had been born about 1792, was brought up apparently in Inverness-shire and attended King's College, Aberdeen. He then came south and became proprietor of a 'gentlemen's academy' at Streatham Common by 1817. Eight years later he took advantage of Aberdeen University's policy at that period of granting the degree of LL.D merely on the recommendation of two existing holders of its doctorates and on payment of a fee. It was later that same year that he was also elected FLS. In June 1827, however, he went rather colourfully bankrupt: an unusually informative file in the Public Record Office details his library book by book and reveals that he tried to dodge the bailiffs by hiding in his garden. His *Compendium of the English Flora of Sir James Edward Smith*, which appeared two years later, was followed in quick succession by an abstruse, mathematical treatise on rating and an equally learned contribution to Classical philology – all three evidently products of his attempt at financial recovery through journalism. By 1836 he had regained respectability sufficiently to be elected to the Council of the newly-established Botanical Society of London, before which he presently read a paper on the flora of a common near Brentwood (to which he had moved) of such extreme length that it extended over three successive meetings. Mysteriously, there is no reference to this in G.S. Gibson's subsequent *Flora of Essex,* perhaps an indication that its accuracy was suspect.

Around 1840 McIntyre's involvement in London's scientific societies apparently ceased, coinciding with his moving to live in the East End. It was presumably then that he established another school, the Hackney Academy, the founding of which is credited to him in one of the histories of Aberdeen University. Perhaps that venture failed too, for after 1843 he vanishes from the records – apart from the FLS lists, in which his name continued to be printed, without an address, for another fifteen years (though, clearly, he had long since defaulted on his subscriptions). Maybe he returned to his native Scotland or emigrated to the colonies, for as far as England and Wales are concerned his name is not to be found in the register of deaths or the indexes to wills.

Yours sincerely,
DAVID ALLEN

25.10.981

Middlewood Close, Fylingthorpe,
Whitby, N. Yorkshire

Dear Sir,

Butterfly collectors?.....burn them!

Oh dear! Thoughts of the 1692 Salem witch trials and the more recent McCarthy communist purges flitted through my mind when I read the last paragraph of the review of *The Moths and Butterflies of Cornwall and the Isles of Scilly* in the October *Linnean* (**14** (3): p.58). We are told that it was strange to think that, a couple of generations ago, many of us were butterfly collectors (many of us still are) and that these days the practice is regarded as heinous (no-one ever enlightens us as to by *whom* it is so regarded!) and, very likely, illegal (ouch! Some wishful thinking here I think). We are then told (not for the first time, nor for the last I fear) that collectors were "responsible for the fatal reduction in numbers of such captivating creatures as the large copper and the large blue [butterflies]".

That these butterflies are captivating (I use the present tense deliberately, since both species occur in Europe) is beyond doubt, but the remainder of that statement is rather less certain. Informed opinion might agree that the demise of the large copper butterfly in this country (a species not mentioned in the book being reviewed by the way) was as a direct result of large scale drainage of fen habitat and that although many factors conspired to effect the demise of the large blue, there is no real evidence to suggest that collecting played other than a peripheral part. The large blue declined on sites where it was not collected and it persisted on other well-known sites, *despite* intensive collecting. The terminal decline of this species in England probably owes more to changing agricultural practices and a lack of understanding of the biological requirements of the butterfly, now well documented, than to anyone wielding a butterfly net.

Perhaps I should join 'them'. I know for a fact (well, I think it's true, and that's just as good) that my old Mum has picked a bunch of primroses each spring for the last 80 years. Maybe I should be on the lookout for a sharp sturdy stake, some nice dry brushwood, and a box of matches.

Yours truly,
JOHN TENNENT

26.10.98

18 Landseer Close,
Merton Abbey, London SW19

Dear Professor Gardiner,

The fellow on page 19 of the October *Linnean* is Robert Edmund Grant, 1793–1874, Professor of comparative anatomy and zoology at London University 1827–1874. Edinburgh-trained, he and Darwin met in Edinburgh during Darwin's medical training, and Grant taught Darwin much about microscopic technique – Grant was an authority already on various marine invertebrates including sponges. However, according to recent biographies of Darwin, the latter felt rather snubbed that Grant appropriated

some observations of Darwin's (on the motile ova of *Flustra*, I believe), without due acknowledgement. Thus their collaboration was relatively short-lived.

Professor Grant fell on hard times soon after coming to London as professor in 1827. He was a very early Lamarckian, and naturally was regarded with askance by Richard Owen and other authority figures of the times. His later years were poverty-stricken and his scientific work fell off in momentum, so that Darwin remarks in his autobiography " ... but after coming to London as Professor in University College, he did nothing more in science – a fact which has always been inexplicable to me."

Yours sincerely,
MARTIN HENDERSON

30.10.98

Botanical Institute,
University of Copenhagen, Denmark

Dear Brian,

The picture on p. 19 of October's *Linnean* is Robert Edmond Grant (1793–1874). As a devoted Lamarckian, he believed that the origin and evolution of life was governed by simple physical and chemical forces. In Edinburgh Grant worked on sponges and became a world expert on marine invertebrates. Grant presented Darwin's first original observations on natural history for the Wernerian Natural History Society in 1827: That the small black bodies found inside oyster shells were eggs of skate leeches.

While Darwin was in Edinburgh, discussion with Grant played an instrumental role in shaping Darwin's initial approach to evolution years later. Grant questioned, to Darwin's great surprise, that each species was directly created.

In 1828, Grant became Professor at London University, where he lectured on the transmutation of fossil species and the Lamarckian idea of an upward-sweeping evolution from lower to higher forms. Points of view that later put him at odds with both Darwin and Owen – though for different reasons.

Yours sincerely
OLE SEBERG

Alfred Russel Wallace

Introduction

When I discovered that during the anniversary meeting of this year the Roger Remington portrait of Alfred Russel Wallace was to be unveiled, I decided that the lecture should be given by Wallace himself. The following lecture is the text I used for Wallace to speak to deliver the address. It was illustrated by my own photographs of all the Amazonian organisms and plant uses described.

> "The intelligent minds which honour the name of Darwin, will not forget to honour that of his fellow discoverer, Alfred Russel Wallace." (G.T. Bettany, editor of 5th [1895] edition of Wallace's *Narrative of Travels on the Amazon and Rio Negro)*

Ladies and Gentlemen,

I have decided that for a few minutes I will step out of the portrait of me that you have very kindly hung on the walls of this chamber. Tyndall, Spencer and Huxley were always sceptical about my spiritualism, but Sir William Crookes FRS was always very supportive of investigations into that field.

I am most pleased after all these years to have been placed on the walls of this learned Society where our papers on the mutability of species were first presented, but I personally would never have made a fuss about such a thing. I have always hated the fuss that some people have made about priorities.[1] Charles Darwin and I did come to the same conclusions from independent evidences and I like to think that I precipitated him into print after so many years of procrastination.

It is good to be recognised by this Society where I feel the original reading of our papers fell somewhat flat. Your former President of 1858, Mr Thomas Bell, who remarked that no particularly important papers were read to the Linnean Society in 1858, has been proved wrong in many ways. Not just through the portraits of Charles and me which now hang on your walls, but by the many important meetings you have had here on evolutionary topics. I never did like dentists! Enough about me, because it really never occurs to me to talk about myself. It is natural history and natural processes which really interest me.

Tonight I want to concentrate mainly on evidences that species depart from their original type which I began to formulate on my travels on the Amazon and Rio Negro in that great country of Brazil. I understand that the current President of this Society is a specialist in the Amazon region who has travelled in many of the same places as I did.

Even before I departed for the Amazon I had begun to think about the origin of the many species I had observed. I am grateful that I had read Sir Charles Lyell's *Principles of Geology* and Robert Chambers *Vestiges of the Natural History of Creation* before I departed for the Amazon in 1848. How could one ponder such works without beginning to ask questions about the origins of species and why there were so many extinct ones. Mr Chambers had already challenged the assumption that each species of animal and plant must be fixed and immutable. I well remember long discussions, well into the night, about this with my good friend Henry Bates. In fact if I had not had the good fortune to meet Mr Bates and learn so much about collecting insects I might never have dared to venture on a journey to the Amazon. (I did always agree with Chambers that Caucasians grow the best beards!).

I am going to experiment with this new technique of lantern slides that you now have, to discuss the Amazon.

"It was on the morning of the 26th of May 1848 that after a short passage of twenty-nine days from Liverpool we came to anchor opposite the southern entrance to the River Amazon and obtained our first view of South America .... We sailed with a fair wind up the river which for fifty miles could only be distinguished from the ocean by its calmness and discoloured water, the northern shore being invisible. Early

1 see p. 9 for Darwin's opinion on priorities. Ed.

on the morning of the 28th we again anchored; and when the sun rose in a cloudless sky, the city of Pará, surrounded by the dense forest, and overtopped by palms and plantains greeted our sight appearing doubly beautiful from the presence of those luxuriant tropical productions in a state of nature which we had so often admired in the conservatories at Kew and Chatsworth." (Wallace 1895:1)

My, how things have changed. Pará contained 15,000 inhabitants then, but today its 2 million inhabitants have all but destroyed the great forests that surrounded the city.

"My previous wanderings had been confined to England and a short trip on the Continent, so that everything here had the charm of perfect novelty."(Wallace, 1895:3)

Once in the majestic forests of the Amazon the curiosity of the naturalist is aroused: "climbing and parasitic plants, with large shining leaves, run up the trunks, and often mount even to the highest branches, while others, with fantastic stems, hang like ropes and cables from their summits. Many curious seeds and fruits are seen scattered on the ground; and there is enough to engage the wonder and admiration of every lover of nature". (Wallace, 1895:7)

I began to wonder why so many seeds are necessary and compared it with the quantity of seeds I had seen in the beech forest of England in a mast year. Certainly, not all these seeds produce mature trees or the whole of nature would be overwhelmed.

"Among the shrubs near the city that immediately attracted our attention were

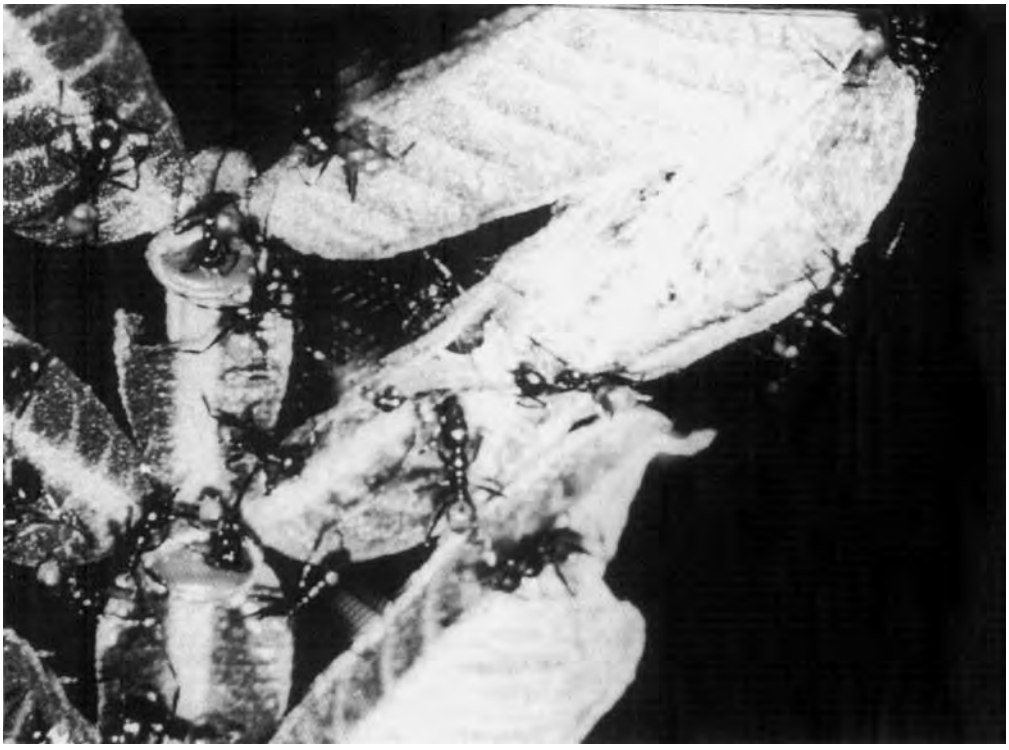


Figure 1. *Pheidole bilonstricta* visiting ant nectaries on a leaf of *Inga*.
Photographed near to Manaus.

Figure 2. A kapock or silk cotton tree (*Ceiba pentlandra*).

several *Solanums*, which are allied to our potato. One of these grows from eight to twelve feet high, has large woolly leaves, spines both on leaves and stem and handsome purple flowers larger than those of a potato. Some other species have white flowers, and much resemble our bitter-sweet (*Solanum dulcamara*)." (Wallace, 1895:7)

I began to ask myself how so many species of *Solanum* had arisen and how they are related to one another.

"The ants cannot fail to be noticed. They startled you with the apparition of scraps of paper, dead leaves and feathers, endued with locomotive powers; processions engage in some abstract engineering operations."

"Many plants have ants peculiar to them."

"In about three weeks in Brazil Mr Bates and myself had captured upwards of a hundred and fifty distinct species of butterflies. Among them were eight species of the handsome genus *Papilio* and three *Morphos* ..... Among the smaller species the exquisite colouring and variety of marking is wonderful." (Wallace 1895:9,10)

"Among the trees are various kinds that have buttresses projecting around their base are the most striking and peculiar. Some of these buttresses are much longer than they are high, springing from a distance of eight or ten feet from the base, and reaching only four or five feet high on the trunk, while others rise to the height of twenty or thirty feet, and can even be distinguished as ribs on the stem to forty or fifty. They are complete wooden walls, from six inches to a foot thick, sometimes branching into two or three, and extending straight out to such a distance as to afford room for a

Figure 3. One of Wallace's sketches (unpublished).

comfortable hut in the angle between them. Large square pieces are often cut out of them to make paddles, and for other uses, the wood being in general very light and soft." (Wallace, 1895:17)

I well remember collecting the caripé or potters tree, but "it was a young tree with neither fruit nor flowers, so we had to content ourselves with specimens of the wood and bark only". (Wallace, 1895:23). This turned out to be a species of *Licania* in the Chrysobalaneae.

My trip up the Tocantins River with Mr Bates was a fruitful one both in the number of Lepidoptera we collected and our discussion about this great variety of species. In addition, we were able to supply Mr Stevens with a shipment of some 7,000 specimens, which was essential for our meagre finances.

After spending some time at Santarém, on the Tapajós River and at Montealegre I proceeded up river to Barra (which I believe is now named Manaus).

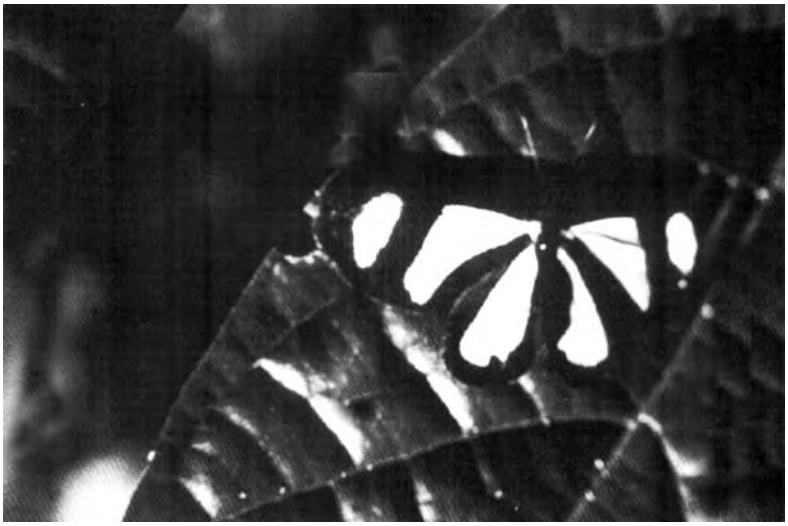


Figure 4. *Cartea vitula* (Riodinae).

"After sending off a box of specimens from Santarém I was delayed a fortnight waiting for men to go up the river. After great difficulty I obtained, but to Obidos only, a distance of about eighty miles (three days); there I was delayed four days, and

Figure 5. The Anivalhanas archipelago on the Rio Negro above Manaus.

then got another stage of four days on to Villa Nova. There I was delayed a week, and was there indebted to the kindness of a trader, who lent me some of his men to get on to Barra. Now however the rains and head winds had set in, so that after rather an unpleasant journey owing to wet and mosquitoes, we arrived at Barra on the 30th of Dec. in thirty-four days from Santarém. I was so anxious to reach here before the wet season had regularly set in, that I never wasted an hour to go on shore but once a day to cook, so that I literally collected nothing on the road except at Villa Nova, where we had tolerably fine weather. After the muddy, monotonous, mosquite-swarming Amazon, it was with great pleasure we found ourselves in the black waters – *black as ink* they are, and well deserve their name; the shores are rugged and picturesque – and greatest luxury of all, mosquitoes are unknown except in the islands. Our voyage, however, was not near so bad as it might have been, for Mr Spruce, who left Santarém for Obidos exactly a week before us, arrived there only the evening before, having taken *nine* days owing to the want of wind, without which it is impossible to stem the current. We are here staying with Sir Henrique Anthony, in the same house Edwards occupied; he is a most hospitable fellow, and his house is the general receptacle of strangers. I soon found that insects were exceedingly scarce here at this season, it being almost impossible to get half a dozen in a day worth bring home. Birds too are equally scarce, so I resolved on a short trip up the Rio Negro to where the *Umbrella chatterers* are found. I spent a month there, and being fortunate in finding a good hunter, have got a small but pretty good collection of birds, considering the season." (Wallace, 1850 from Brooks, 1984).

To my delight Mr Bates also arrived in Barra on 23rd January 1850 just as two months of incessant rain were beginning and collecting was well nigh impossible for the three of us. This left us ample time to examine our collections and to discuss the relevance of our material to the hypothesis of species transmutations. In particular we were both impressed by the forms of *Heliconius* butterflies, which I had collected around Santarém, in relation to the dynamics of species formation. I became even more convinced that Lyell was wrong when he "argued that one species could not change into another by a change of external circumstances because while the change was taking place other species already accustomed to those circumstances would displace them. But this must always be on the supposition of a rapid not a gradual change". (Wallace, 1855a:51).

My evaluation of the Santarém heliconids which was later published in the *Transactions of the Entomological Society of London* in 1853 led me to seek evidence for the transmutation of species from other organisms, especially umbrella birds and palms.

"During my residence in the Amazon district I took every opportunity of determining the limits of species, and I soon found that the Amazon, the Rio Negro and the Madeira formed the limits beyond which certain species never passed. The native hunters are perfectly acquainted with this fact, and always cross over the river when they want to procure particular animals, which are found even on the river's bank on one side, but never by any chance on the other. On approaching the sources of the rivers they cease to be a boundary, and most of the species are found on both sides of them. Thus several Guiana species come up to the Rio Negro and Amazon, but do not pass them;

Figure 6. *Heliconius*.

Brazilian species on the contrary reach but do not pass the Amazon to the north. Several Ecuador species from the east of the Andes reach down into the tongue of land between the Rio Negro and Upper Amazon, but pass neither of those rivers, and others from Peru are bounded on the north by the Upper Amazon, and on the east by the Madeira. Thus there are four districts, the Guiana, the Ecuador, the Peru and the Brazil districts, whose boundaries on one side are determined by the rivers I have mentioned." (Wallace, 1852: 109–110).

On my next trip up the Rio Negro, where I became so ill and nearly died of yellow

fever, I particularly studied the palms both because of their variety of species and genera and because of the most interesting way in which the native peoples used them. In fact this quite reminded me of the wealth of ethnobotanical information I had learned from the Welsh hill farmers in my youth.

It is not easy to make decent specimens of palms and so I resolved to sketch them in my own untalented way. Most fortunately I was able to rescue these sketches when the brig *Helen* caught fire and Mr Fitch greatly improved them for publication in my humble booklet on the palm trees of the Amazon. Nevertheless, I was able to describe forty-three species which could be assigned to seventeen genera. But what really struck me most was their distribution patterns and the groups of closely related species.

One of my greatest satisfactions was to discover for the first time the palm referred to as chíquichíqui by the great explorer Baron von Humboldt. In Brazil the local name is piassaba, and so I named it as *Leopoldinia piassaba.*

"The marginal processes of the petioles are interlaced and are produced into long riband-like strips, which afterwards split into fine fibres and hang down five or six feet entirely concealing the stem, and giving the tree a most curious and unique

Figure 7. Flooded Igapó forest beside the Rio Negro above Manaus.

Figure 8. The piassaba palm, *Leopoldina piassaba*.

Figure 9. *Leopoldina pulchra*.

appearance. The leaves form an excellent thatch, and are almost universally used in that portion of Venezuela situated on the upper Rio Negro, and the adjacent tributaries of the Orinoco. The fruit is said to resemble that of the Jará in colour, but it is globose and eatable, being used principally to form a thick drink by washing off the outer coating of pulp.

The fibrous or hairy covering of the stem is an extensive article of commerce in the countries in which it grows. It seems to have been used by the Brazilians from a very early period to form cables for the canoes navigating the Amazon. It is well adapted for this purpose, as it is light (the cables made of it not sinking in water) and very durable. It twists readily and firmly into cordage from the fibres being rough-edged, and as it is very abundant, and is procured and manufactured by the Indians, piassaba ropes are much cheaper than any other kind of cordage.....

Till within these few years the fibre was all manufactured into cordage on the spot, but it is now taken down in long conical bundles for exportation from Pará to England, where it is generally used for street sweeping and house brooms, and will probably soon be applied to many other purposes. It is cut with knives by men, women and children, from the upper part of the younger trees, so as to secure the freshest fibres, the taller trees which have only the old and half-rotten portion within reach, being left untouched. It is said to grow again in five or six years, the fibres being produced at

the bases of the new leaves. The trees are much infested by venomous snakes, a species of *Craspedocephalus*, and the Indians are not infrequently bitten by them when at work, and some times with fatal consequences.

The distribution of this tree is very peculiar. It grows in swampy or partially flooded lands on the banks of the black-water rivers. It is first found on the river Padauarí, a tributary of the Rio Negro on its northern side, about 400 miles above Barra, but whose waters are not so black as those of the Rio Negro. The Piassaba is found from near the mouth to more than a hundred miles up, where it ceases. On the banks of the Rio Negro itself not a tree is to be seen. The next river, the Darahá, also contains some. The next two, the Marvihá and Cababurís, are white-water rivers and have no Piassaba. On the S. bank, though all the rivers are black water, there is no Piassaba till we reach the Marié, not far below St. Gabriel. Here it is extensively cut for about a hundred miles up, but there is still none immediately at the mouth or on the banks of the Rio Negro. The next rivers, the Curicuríarí, the great river Uaupés, and the Isánna, though all black-water, have none; while further on, in the Xié, it again appears. On entering Venezuela it is found near the banks of the Rio Negro, and is abundant all up to its sources, and in the Témi and Atabápo, black-water tributaries of the Orinoco. This seems to be its northern limit, and I cannot hear of its again appearing in any part of the Amazon or Orinoco or their tributaries. It is thus entirely restricted to a district about 300 miles from N. to S. and an equal distance from E. to W. I am enabled so exactly to mark out its range, from having resided more than two years in various parts of the Rio Negro, among people whose principal occupation consisted in obtaining the fibrous covering of this tree, and from whom no locality for it can have remained undiscovered, assisted as they are by the Indians, whose home is the forest, and who are almost as well acquainted with its trackless depths as we are with the well-beaten roads of our own island." (Wallace, 1853: 18–20).

In marked contrast the jará palm, another species of *Leopoldinia*, *L. pulchra* is "found on the banks of the Rio Negro and some of its tributaries, from its mouth up to its source, and on the black-water tributaries of the Orinoco. It never grows far from the water's edge, though generally out of reach of the floods in the wet season. It is not known to occur beyond this very limited district.

The stem of this tree being very smooth and cylindrical, and of a convenient length, it is much used for fencing round yards and gardens, and in the city of Barra do Rio Negro is universally employed for such purposes. .....The reticulate covering of the stem of this (and the next) species offers a fine station for the epiphytal Orchideae to attach themselves, and the Jará palms are accordingly often adorned with their curious and ornamental flowers." (Wallace, 1893: 13–19).

My observations on the fine species of the genus *Mauritia*, three of which I had the privilege of describing for the first time also helped me to test a hypothesis which I was contemplating about the derivation of lowland species from those of the adjacent highlands. The Miritî palm, *Mauritia flexuosa* "is one of the most noble and majestic of the American Palms. It grows to a height of eighty or a hundred feet. The stem is straight and smooth, about five feet in circumference, often perfectly cylindrical, but sometimes swollen near the middle or towards the top, so that the bottom is the thinnest part.

The leaves spread out in every direction from the top of the stem. They are very large and fan-shaped, the leaflets spreading out rigidly on all sides and only drooping at the tips and at the midrib or elongation of the petiole. The leaves stand on long stalks which are very straight and thick, and much swollen at the base which clasps the stem. A full-grown fallen leaf of this tree is a grand sight. The expanded sheathing base is a foot in diameter; the petiole is a solid beam ten or twelve feet long, and the leaf itself is nine or ten in diameter. An entire leaf is a load for a man.....

The leaves, fruit and stem of this tree are all useful to the natives of the interior. The epidermis of the leaves furnishes the material of which the string for hammocks, and cordage for a variety of purposes is made. The unopened leaves form a thick-pointed column rising from the very centre of the crown of foliage. This is cut down, and by a little shaking the tender leaflets fall apart. Each one is then skilfully stripped of its outer covering, a thin riband-like pellicle of a pale yellow colour which shrivels up almost into a thread. These are then tied in bundles and dried, and are afterwards twisted by rolling on the breast or thigh into string, or with the fingers into thicker cords. The article most commonly made from it is the 'réde', or netted hammock, which is the almost universal bed of the native tribes of the Amazon..... and in this open net the naked Indian sleeps beside his fire as comfortably as we do in our beds of down.....

Figure 10. Wallace's sketch of *Mauritia flexuosa.*

They also dye the string of many brilliant colours which they work in symmetrical patterns, making the rédes or 'maqueiras' as they are there called, among the gayest articles of furniture to be seen in a Brazilian house on the Amazon.

From the fruits a favourite Indian beverage is produced. They are soaked in water till they begin to ferment, and the scales and pulpy matter soften and can be easily rubbed off in water. When strained through a sieve it is ready for use, and has a slight acid taste and a peculiar flavour of the fruit at first rather disagreeable to European palates.....

The Miriti is a social palm, covering large tracts of tide-flooded lands on the Lower Amazon. In these places there is no underwood to break the view among

Figure 11. *Oenocarpus bacaba*, a common Amazonian palm with edible fruit.

interminable ranges of hugh columnar stems rising undisturbed by branch or leaf to the height of eighty or a hundred feet, – a vast natural temple which does not yield in grandeur and sublimity to those of Palmyra or Athens." (Wallace, 1853: 47–50).

I was able to observe the striking difference between the distribution of the widespread miritĭ and its four congeners. These could be explained by the ecological requirements of each species. For example, *Mauritia carana* is restricted to dry scrubby forest or to sandy margins of streams well out of reach of the highest flood. It was obvious to me that this species was able to extend its geographical range only to those small infrequent elevations of the lowlands which present a dry soil to which *Mauritia carana* is adapted on the Guiana uplands. As I reflected upon the distribution of the species of this and other palms it reminded me of the observations of Lyell on the

colonisation of new situations. Only one *Mauritia* species of the Guiana uplands occupied an ecological station that the lowlands offered in abundance and that was the miritĩ and so it alone invaded the newly formed lowlands as they formed.

And so after many more adventures in the Amazon, worn down by fits of ague and still very weak and quite unable to make any exertion I resolve to return to England on the brig *Helen* which left the port of Pará on the 12th of July 1852. "Since I was very weak and suffered much from sea-sickness, I spent most of my time in the cabin". (Wallace, 1895:271). I will never forget the morning of the 6th of August "On that morning after breakfast, I was reading in the cabin when the Captain came down and said to me 'I'm afraid the ship's on fire'". (Wallace, 1895:271). The rest I have recorded in my books. All I rescued was my watch, and a small tin box containing some shirts and a couple of old note-books, with some drawings of plants and animals and I scrambled up on deck with them. The loss of my specimens was a severe financial blow, but I feel myself lucky to have escaped with my life to continue my work and develop my ideas on the mutability of species.

During my short stay in England I was able to attend many interesting meetings of the Zoological Society, the Entomological Society, and the Linnean Society but even though "fifty times since I left Pará I vowed, if I once reached England, never to trust myself more on the ocean" I was soon underway again because "good resolutions soon fade" (Wallace, 1905:56). I was fortunate to have £200 insured by Mr Stevens' foresight, so I must be contented, but I soon needed to get more collections to support myself and so in February 1854 I found myself aboard the *Euxine* bound for Alexandria and then on the Bengal steamer to Penang island in the straits of Malacca which I reached on 20th April 1854.

During my first year in Malaya many things began to strike me. Firstly the way in which "the *Euploea* butterflies here quite take the place of the Heliconidae of the Amazons, and exactly resemble them in their habitats..... However, the *Euploeas*, though very beautiful, cannot compete with the exquisite Heliconidae to which they are so closely allied". (Wallace, 1854a, b).

Secondly, on entering the Malayan forests, I was immediately struck by "the lovely Eastern trogons, with their rich brown backs, beautifully pencilled wings, and crimson breasts". (Wallace, 1869). These birds behaved just as I had observed the green backed Amazonian trogons.

"It was at my earliest station (Malacca) that I first fell in with the magnificent *Ornithoptera Amphrisius*, but for a long time I despaired of getting a specimen, as they sailed along at great height, often without moving the wings for a considerable distance, in a manner quite distinct from that of any other of the Papilionidae with which I am acquainted. To see these and the great *Ideas* on the wing is certainly one of the finest sights an entomologist can behold." (Wallace, 1854b: from Brooks, 1984).

I found a most magnificent insect which turned out to be

"[a] most interesting addition to the genus *Ornithoptera*. The green-marked species have hitherto been found only in N. Australia, New Guinea and the Moluccas, and all those yet known so much resemble each other in their style of marking, that most of them have been considered as varieties of the original *Papilio Priamus* of Linnaeus.

Figure 12. *Onithoptera brookiana.*

Our new species is therefore remarkable on two accounts; first, as offering a quite new style of colouring in the genus to which it belongs; and secondly, by extending the range of the green-marked Ornithopterae to the N.W. extremity of Borneo. As it has not been met with by the Dutch naturalists, who have explored much of the S. and S.W. of the island, it is probably confined to the N.W. coast. My specimen (kindly given to me by Captain Brooke Brooke) came from the Rejang river; but I have myself once seen it on the wing near Sarawak. I have named it after Sir J. Brooke, whose benevolent government of the country in which it was discovered every true Englishman must admire." (Wallace, 1855b: 104–105; Brooks, 1984:88).

There was such a large distribution gap between this Sarawak population of *Ornithoptera brookiana* and the Celebesian and Moluccan population of *O. priamus*-like forms yet I could not bring myself to accept Lyell's, idea that a separate creation was necessary to explain this. *O. brookiana* could have arisen only from a contiguous pre-existing species.

The wet season of 1855 in Sarawak was particularly bad, and like my time in Manaus, I was unable to collect and had time to think. I had also read the absurd polarity hypothesis of Edward Forbes (1854) and it was the promulgation of Forbes' theory which led me to write and publish, for I was annoyed to see such an ideal absurdity put forth when such a simple hypothesis will explain all the facts.

And so I wrote my paper 'On the law which has regulated the introduction of new species' which I sent to the *Annals and Magazine of Natural History*. (Wallace, 1855c)

"It was written during the wet season, while I was staying in a little house at the

NATIVES OF ARU SHOOTING THE GREAT BIRD OF PARADISE.

Figure 13. From The Malay Archipelago (after Sarawak Wallace visited Singapore, Bali, Lombok, Celebes etc. and in 1857 Macassar, Ké and Aru.

mouth of the Sarawak river, at the foot of the Santubong mountain. I was quite alone, with one Malay boy as cook, and during the evenings and wet days I had nothing to do but to look over my books and ponder over the problem which was rarely absent from my thoughts. Having always been interested in the geographical distribution of animals and plants, having studied Swainson and Humboldt, and having now myself

a vivid impression of the fundamental differences between the Eastern and Western tropics: and having also read through such books as Bonaparte's "Conspectus," and several catalogues of insects and reptiles in the British Museum (which I almost knew by heart), giving a mass of facts as to the distribution of animals over the whole world, it occurred to me that these facts had never been properly utilized as indications of the way in which species had come into existence. The great work of Lyell had furnished me with the main features of the succession of species in time, and by combining the two I thought that some valuable conclusions might be reached. I accordingly put my facts and ideas on paper." (Wallace, 1905, Vol.1: 354–355).

I thought that this was an important paper. At last geology had thrown a great light on the oddities of the distribution of organisms, for it had proved that the present state of the earth and the organisms now inhabiting it was only the latest stage in long series. However, at that stage I must admit I was still puzzled about why evolution should be adaptive which I felt it manifestly was. I was also most disappointed with the response of British entomologists who reacted by saying it was a pity that Mr Wallace should theorize rather than collect specimens. While the collection of specimens was my livelihood it was the theorizing that truly excited me. Indeed, I might have spent the best years of my life in the comparatively profitless work of collecting specimens for sale but for the fact that I realised the value of the additions I was making to classification knowledge. I spent the next three years travelling and collecting around the Malay Archipelago and accumulating more evidences especially about the geography of species.

"In February, 1858, I was living at Ternate, one of the Moluccas Islands and was suffering from a sharp attack of intermittent fever, which obliged me to lie down every afternoon during the cold and subsequent hot fits which lasted together two or three hours. It was during one of these fits, which I was thinking over the possible mode of origin of new species, that somehow my thought turned to the 'positive checks' to increase among savages and others described in much detail in the celebrated *Essay on Population* by Malthus, a work I had read a dozen years before. These checks – disease, famine, accidents, wars. &c. – are what keep down the population, and it suddenly occurred to me that in the case of wild animals these checks would act with much more severity, and as the lower animals all tended to increase more rapidly than man, while their population remained on the average constant, there suddenly flashed upon the idea of the survival of the fittest – that those individuals which every year are removed by these causes – termed collectively the 'struggle for existence' – must on the average and in the long run be inferior in some one or more ways to those which managed to survive.

The more I thought of this the more certain it appeared to be; while the only alternative theory – that those who succumbed to enemies, or want of food, or disease, drought, or cold, were in every way and always as well constituted as those that survived – seemed to me impossible and unthinkable." (Wallace, 1903:78)

"Then it suddenly flashed upon me that this self-acting process would necessarily *improve the race*, because in every generation the inferior would inevitably be killed off and the superior would remain – that is, the *fittest would survive*. Then at once I

Figure 14. Ternate: "a small conical volcanic island"

seemed to see the whole effect of this, that when changes of land and sea, or of climate, or of food supply, or of enemies occurred – and we know that such changes have always been taking place – and considering the amount of individual variation that my experiences as a collector has shown me to exist, then it followed that all the changes necessary for the adaptation of the species to the changing conditions would be brought about, and as great changes in the environment are always slow, there would be ample time for the change to be effected by the survival of the best fitted in every generation. In this way every part of an animal's organisation could be modified exactly as required, and in the very process of this modification the unmodified would die out, and thus the *definite* characters and the clear *isolation* of each new species would be explained. The more I thought it over the more I became convinced that I had at length found the long-sought-for law of nature that solved the problem of the origin of species. For the next hour I thought over the deficiencies in the theories of Lamarck and of the author of the 'Vestiges', and I saw that my new theory supplemented these views and obviated every important difficulty. I waited anxiously for the termination of my fit so that I might at once make notes for a paper on the subject. The same evening I did this pretty fully, and on the two succeeding evenings wrote it carefully in order to send it to Darwin by the next post, which would leave in a day or two." (Wallace, 1905, Vol. 1: 361–63)

The rest is history and I have never been someone to argue about priorities.

G.T. PRANCE

REFERENCES

BROOKS, J.L. 1984. *Just before the origin: Alfred Russel Wallace's theory of evolution.* New York: Columbia University Press.

CHAMBERS, R. 1844. *Vestiges of the Natural History of Creation.* Churchill. Reprint, Leicester University Press, Victorian Library, 1969.

FORBES, E. 1854. Anniversary address of the President (delivered Feb. 17, 1854). *Quart. J. Geol. Soc. London* **10**(1): *Proc. Geol. Soc. London*: xxii–xxxi.

LYELL, C. 1830–1833. *Principles of Geology: Being an attempt to explain former changes of the Earth's surface by reference to causes now in operation.* 3 Vols. London, Murray, Facsimile, Johnson Reprint, New York 1970.

WALLACE, A.R. 1850. Letter to S. Stevens, Nov. 15, 1849, from Santarém; March 20, 1850 from Barra de Rio Negro. *Ann. Mag. Nat. Hist.* Ser 2. **6**: 494–96.

WALLACE, A.R. 1852. On the monkeys of the Amazon. *Proc. Zool. Soc. London* **20**: 107–110.

WALLACE, A.R. 1853. *Palm trees of the Amazon and their uses.* London: John van Voorst.

WALLACE, A.R. 1854a. Letter, May 9 1854, from Singapore. *Zoologist* **12**: 4395–4396.

WALLACE, A.R. 1854b. The entomology of Malacca. *Zoologist* **13**: 4636–37.

WALLACE, A.R. 1855a. Species Notebook 1855. Field Notebook in Library, Linnean Society of London.

WALLACE, A.R. 1855b. Description of a new species of Ornithoptera. *Trans. Ent. Soc. London* n.s. **3**: 104–105.

WALLACE, A.R. 1855c. On the law which has regulated the introduction of new species. *Ann. Mag. Nat. Hist. Ser 2.* **16**: 184–196. (Facsimile Reprint *Proc. Linn. Soc. London* **171**: 141–153, 1960).

WALLACE, A.R. 1869. *The Malay Archipelago.* London, Macmillan Reprint Dover Publications, New York 1962.

WALLACE, A.R. 1895. *A narrative of travels on the Amazon and Rio Negro.* First edn 1853, Fifth edn 1895, Ward, Lock & Bowden, London

WALLACE, A.R. 1903. The dawn of a great discovery. My relations with Darwin in reference to the theory of natural selection. *Black & White* Jan 17, 1903; 78–79.

WALLACE, A.R. 1905. *My life.* 2 vols. Chapman & Hall.

About Butterflies

[An address read by Miss Dulcie Gray FLS, the well known actress, at an evening meeting of the Linnean Society on 27th January 1998.]

Butterflies existed before man. I sometimes hope they will still be here, long after we have gone.

I have been interested in Natural History ever since I remember, and passionate about butterflies, but my chief interest is in British butterflies and their conservation. I was born in Malaysia, where, as in all tropical countries, the butterflies are larger and more colourful than they are here, so why British butterflies appeal more I have no idea, especially as Maurice Pendlebury, co-author with Corbet, of the classic *The Butterflies of the Malay Peninsula* (first published in 1934) was a friend of my parents.

I became interested in butterflies at the age of four, and I can remember almost the exact moment. I had been brought to England to be left at boarding school at Wallingford, near Oxford, during one of my parents' leaves, and just before I was sent there, my parents, my brother and sister, an Uncle and Aunt, and two girl cousins had a holiday at Cooden, near Bexhill on the South Coast. The house had a long

narrow garden in which grew a large mauve bush (which I now realize must have been a buddleia) and the four older children were catching butterflies from it, and putting them into 'stink' bottles (laurel leaves in jam jars) to die. Watching these beautiful creatures in their death struggles utterly outraged me, and from that moment on I resolved to befriend them.

Coming to England, with its greyish white skies and cold summers must have been a shock to me after the blue skies and constantly hot weather of the tropics, and perhaps those butterflies were a reminder of the vivid colours I had known, since buddleia attracts Red Admirals, Peacocks, Commas, Painted Ladies and Small Tortoiseshells, as well as the Whites.

At my boarding school, the cook, Mrs Quainton, shared my passion for nature, and we made friends. She took care of the tadpoles I took from the ponds and we watched them become little frogs. I took snails back in my pockets from the school walks to let them loose on the cloakroom walls where they left lovely multi-coloured trails of slime, and she never told anyone who was the culprit, and she and I found a big toad in the drain in the school garden, and befriended him. My human best friend's father was E.G. Boulenger who was in charge of the reptile house and the aquarium at the London Zoo. I stayed with the Boulengers at 1 St Mark's Square where they lived in a flat above Dr Vevers, who was the Zoo doctor then. Jane and I were allowed to visit the Zoo on Sundays, to see the invalids and to touch the snakes – not slimy but dry, and to play with the chimpanzees.

Mr Boulenger would invite Johnnie, a pet chimpanzee (who belonged to Joan Proctor who had decorated the snake cages and aquarium) to tea. Was this, I wonder, the forerunner of the Chimpanzees' tea parties at the zoo, and the Typhoo commercials?

When Johnnie was coming, Mr Boulenger would blow up a balloon, paint a face on it, put a hat on it, tie it to a coat hanger on which he had hung a jacket, and arrange this 'scarecrow' in a chair. Johnnie would chatter with excitement when he saw it, but before he was allowed to play with it he had to sit at a table, with a bib tied round his neck, and have his tea, which consisted of a banana. When he was allowed down he made little clicking noises, grinned, circled the room, and drew closer and ever closer to the 'balloon man'. At last he reached it, and with extreme caution jabbed at it with his finger and leapt back as it exploded. He seemed to love the joke.

Joan Proctor also kept a cat and a snake and we were told that all three spent the night on her bed. Sadly, when she went on a long visit to America, Johnnie died of a broken heart.

At my second school I was given a translation of Fabre's *Book of Insects*, and fell in love with the dung beetle. From there I went to a holiday home in Norfolk, surrounded by fields and summer butterflies, and found a severed hen's claw, which had a tendon that you could pull, which opened and shut the claw. This I took to bed with me instead of a teddy bear. I then went out to Malaya, as it was then called, as my parents had lost their money in the rubber slump, and at sixteen taught in St. Margaret's School at Fraser's Hill, in the jungle – a lot of butterflies there!

Mr President, it is a tremendous honour to be allowed to talk to such a learned gathering and I am fully conscious of this fact. The talk will have no elements of a

field guide as I can't offer any new insights to any lepidopterists present, but perhaps my enthusiasm for butterflies in general may touch a chord. Oddly enough, amateurs have played a large part in gaining some knowledge of butterflies, and how unlikely the life cycles of some butterflies are! Because of all the work that scientists have done before us we take it for granted that an egg becomes a caterpillar, sometimes called a larva, which hatches into a chrysalis, which comes from the Latin word meaning a mask – (Linnaeus considered that the real insect in that state was under a mask) – and sometimes called a pupa meaning a girl or doll, from which emerges the butterfly. If this had never been proved, imagine our amazement and disbelief when faced with the suggestion that one single creature should undergo such drastic changes.

There is evidence that metamorphosis was recognised by some Greeks and Romans, though they were without benefit of scientific research. The ancients made many allusions to the wonderful changes that insects would undergo, and built a number of myths around them. In the story of Cupid/Eros, Psyche is an allegory of the human soul and of love, sexual and spiritual. The ancient Greek word for butterfly was in fact Psyche. Psyche in Greek signifies the soul and is frequently represented as a butterfly, not only because of the beauty of the insect, but because of its resurrection from seeming death at the chrysalis stage, a parallel surprisingly picked up by earnest Anglican 19th century clergymen.

Until the 17th century, when a usable type of microscope was invented, the study of insects was very rudimentary. Of the millions of animals known to exist, about two million are insects, and these have only been classified (and not all yet) during the past two hundred years. Before the end of the 15th century, the great voyages of discovery had begun, and ever since expeditions have returned with examples of flora and fauna. After the fall of Constantinople in 1453 the learning of the ancients, which had so long been a guarded secret, was brought to the west by the scholars who had managed to escape the destruction of the city. Simultaneously, the invention of printing gave an enormous impetus to the study of Greek science and natural history. Until the microscope was invented, however, most scientists thought that insects and grubs arose spontaneously from any pile of dirt, or from rotting animal flesh in any dark corner. Aristotle (394–322 BC) was particularly ill informed about butterflies. He believed that they "laid little worms", and that "they take their colour from the worm they are bred of ". Albertus Magnus (1206–80), one of the most learned men of the Middle Ages, believed that caterpillars, which he supposed laid eggs, and butterflies which he called "winged worms, various coloured", were entirely unrelated. He was often called Dr Universalis! [A digression: Virgil imagined that a swarm of honey bees might be generated from a piece of putrid flesh, and Kircher that a crop of serpents might be reared from cut pieces of snakes roasted and sown in an oleaginous soil!]

Isaak Walton (1593–1683) approved the theory of Pliny the Younger (the historian who gave such a vivid eye witness account of the eruption of Vesuvius) "that many caterpillars have their birth or being from a dew that in the Spring falls upon the leaves of trees". Eleazar Albin, writing in 1720 about Francisco Redi (1626–98), a celebrated naturalist, says: "I have not met with one instance that gave me reason to doubt of Insects in general being produced by animal parents of the same species .....I cannot help admiring how he, an ingenious Italian who wrote a treatise on the subject, and

Figure 1. Swallowtails and brimstones (sloe, wild carrot and buckthorn).
From Humphreys and Westwood 1841. *British Butterflies and their Transformations.*

so exact an observer of nature, could be led into so great a mistake that some Insects were the product of those vegetables in whose Excrescences they had been nursed up." Marcello Malpighi (1628–91) made discoveries so important in the realm of animal and vegetable structure that he may be considered to be the founder of microscopic anatomy. However, he didn't work on butterflies, so it was left to Johannis

Jacob Swammerdam (1637–80), a Dutchman from a wealthy background, to discover by dissection "that the skins of the caterpillar and the chrysalis are enveloped in each other, as is also the butterfly with all its organs, but those in a fluid stage".

Swammerdam had started by studying medicine, specialising in anatomy, but became so obsessed with insects that his health suffered. In Hill's *The Book of Nature or the History of Insects* (1758) the scientist Boerhaave who wrote the introduction, gave the following description of Swammerdam's obsession: "He ransacked with this view the air, the land, the water, fields, meadows, pastures corn grown, downs, wastes, sandhills, rivers, ponds, wells, lakes, seas, and their shores and banks, trees, plants, ruins, caves, uninhabited places and even boghouses in search of Eggs, Worms and Butterflies!"

At the same time Swammerdam quarrelled with his parents, who cut off his allowance, leaving him penniless. Some of his works were published during his lifetime, but for others he didn't have enough money to pay for the printers. Later he developed religious mania, and though on his father's death he became comfortably off through selling his father's 'curiosities' (in effect a Natural History Museum) he lived the rest of his life in religious contemplation. Due to his breakdown and religious mania, his great work *Historia Insectorum Generalis* (1669) was not believed. He was a true man of science, using specially designed scissors and knives, so tiny that they had to be sharpened under a microscope.

The first person to be believed on the subject of metamorphosis was a woman, Maria Sybilla Merian. She was born in Frankfurt-am-Main in 1647, the only daughter of two German artists. Her father, an engraver, died when she was four, and her mother then married a second artist, Jacob Marrel, a well known painter of the 'School of Utrecht', one of the schools of German and Dutch flower painters which flourished at the time. The Utrecht School was chiefly distinguished for its use of insects in flower pictures. Maria worked in her stepfather's studio as a child, and was taught not only how to paint flowers, but miniatures, because miniatures were very commercial at that time. When she was sent to collect the flowers for Marrel to paint, she would also collect caterpillars, and this was frowned on as very unladylike. Her mother also disapproved of her doing fieldwork with Marrel! Perhaps she was jealous?

When she was 18 Maria married a painter called Johann, and had two daughters, but the marriage was unhappy, and like Swammerdam she became intensely religious. She left her husband and took her daughters to live in one of the communes of a sect called the Labadists, at Castle Bosch in Friesland. Her husband tried to persuade her to come back to him in 1686, but she refused and never lived with him again, resuming the name of Merian. She even made a will calling herself a widow, although Johann didn't die until 1701. She was an extraordinary woman.

In order to earn a living for herself and her daughters, she did embroidery, and invented a way of painting flowers directly on to tablecloths, and became so well known for it that it is said that she decorated the inside of a tent for an army general in this manner.

Like many of the intellectuals of her day, she was fascinated by what she heard about the beauties of Surinam in South America and eventually went to see for herself.

Figure 2. Camberwell Beauty and Peacock butterflies (on willow and stinging nettles). From Humphreys and Westwood, 1841 *British Butterflies and their Transformations.*

The fame of her travels there was such that English entomologists were still including butterflies from Surinam in their books in the 19th century! She published a book called *The New Flower Book* (*Neues Blumenbuch*, 1680), which had such a great success, that she wrote another called *Wonderous Transformations of Caterpillars* (re-issued in 1718 with a text in Latin and with the title *Erucarum Ortus, Alimentum*

et paradoxa Metamorphosis)[1]. In her introduction she says: "From my earliest childhood I studied insects. I began in Frankfurt by observing silkworms, and then having noted that all beautiful butterflies grew out of caterpillars, I collected as many as I could find, and learned to draw them so faithfully that I hope it will satisfy the Natural Philosophers. I do this for the glory of God, as without him I would never have undertaken the work, much less allowed myself to print it, especially as being a woman, with litle time left over after taking care of my household, this work might be mistaken as unseemly ambition". She described the chrysalis of the Swallowtail in this charming way. "They have a form very much like a child in swaddling clothes".

She died almost destitute. Both Carl Linné – who was very nearly her contemporary – and Goethe, who as well as being Germany's most famous poet, was a scientist and natural philosopher of some repute, thought very highly of her work. Goethe was also born in Frankfurt-am-Main, albeit nearly a hundred years later.

It is now widely recognised that the presence or absence of butterflies and moths is a reliable barometer of the general environmental health of an area.

"Butterfly is a word which suggests fluttering activity" said Thomas Hardy.

"And what is a butterfly? At best He's but a caterpillar drest" said Gay, in his *Beggar's Opera.*

Why is a butterfly called a butterfly in Britain? According to the *Oxford English Dictionary*, the reason is unknown! However, two possible derivations are offered:
(1) from the Anglo-Saxon *butterfleoge* (literally butterfly) so called after the yellow species, and/or from the Old Dutch *boterschijte* (butter-shit) from the colour of the excretion of the Cabbage White!
(2) The German word for butterfly is *Schmetterling*. It derives from the Czech *smetana* ('what floats on top' or 'butter'). There were many different dialect names including *Krautscheisser* ('cabbage shitter') and *Milchendieb* ('milk thief') a name the butterfly shared with witches. In the 18th century due to French influence it was for a while known as *papillon* but *Schmetterling* was restored to favour, and Goethe was a leading advocate of the change back.

So is butterfly literally 'butterfly' in other languages? By no means, although the English name has links with the more complicated German story. The French word *papillon* is derived from the Latin *papilio*, itself a derivative of *palpito* from the Greek *pallo* meaning to brandish.

Thereafter things became more complicated. There is a theory that *pil* is a Sanskrit root suggesting 'hesitant movement' and Corneille in his great *Dictionary* offers *papo* ('to suck') as a rival explanation for the first syllable. Papilles, nipples or small sensitive scales on the surface of the skin, is surely another possible explanation. Finally, there was an early period when the *papillon* became *pavillon* (a tent or small flag) but, like *Schmetterling*, *papillon* reasserted itself.

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1 The original text was in German. The family eventually sold all the copperplates to an Amsterdam publisher who re-issued them in 1718. Later these plates passed to another Amsterdam publisher, J.F. Bernard, who used them for a French edition, *Histoire des Insectes de l'Europe*, 1730. It is this edition that is cited by Linnaeus in 1768. Ed.

The ancient Greeks made no attempt to describe the insect's movements, colours or habit. As I've already said, they called it *psyche*, a word embracing the human soul both in life and after life, thus linking up with much Eastern folklore, and providing a bridge for it into parts of Europe. The modern Greeks more pragmatically call it *petalouda*, literally a 'small leaf' or 'flower bud'.

In Russian it is *babochka*, a little soul living in butterfly form, after death. In Hungarian, it is *pillango*, a 'creature of the movement'. In Spanish it is *mariposa*, a female-seeming creature 'which alights' (and also a slang word for a homosexual). In one of the northern Nigerian languages it is *Mallam-Bude-Talifa*, which means 'wise man open the book'.

Butterflies are more truly 'sunflies' since they are so dependent on the sun. The sun is yellow and butter is yellow, as good a reason as any to call them 'butterflies'. The peak of their activity in a temperate climate is under the midday sun.

Butterflies have affected many people very strongly down the ages. Luther said that "a butterfly is an emblem of the devil in its crawling walk". In Hindu mythology it is said that Bramah watched a voracious caterpillar in his garden turn into a pupa, and finally a butterfly, and his heart was filled with a great calm, and from then on he looked forward to his own perfection and reincarnation.

Chuang Tzu, an eminent Taoist philosopher who lived in the 4th century BC, was known as the 'Butterfly Philosopher'. The following is an extract from his thoughts on death, in his *Three Ways of Thought in Ancient China* translated from the Chinese by Arthur Waley:

> ".....How do I know that wanting to be alive is not a great mistake? How do I know that hating to die is not like thinking one has lost one's way, when all the time one is on the path that leads to home?.....While a man is dreaming he does not know that he is dreaming, nor can he interpret a dream until the dream is done....Once Chuang Chou dreamt that he was a butterfly, and was content to hover from flower to flower. Suddenly, he woke and found, to his astonishment, that he was Chou. But it was hard to be sure whether he was really Chou, and had only dreamt that he was a butterfly, or whether he was really a butterfly, and was only dreaming that he was Chou".

In Malaysia where I was born, and where Islam is the main religion, there is a belief that migrating butterflies are making a pilgrimage to Mecca. (A butterfly there is called *Rama-rama* or *Cupa-cupa*, both onomatopoeic names, though Rama in fact is an Indian God). Virgin and Child paintings often show a butterfly in the hand of the Child – a symbol of resurrection. Belief in the butterfly as the soul of man was once general in Europe, Japan, many of the Pacific Islands and among many North American tribes. The Maoris believe that the butterfly soul returns to earth after death, and a tribe in Sumatra (which I visited in 1936 in an astonishing little river steamer whose Somerset Maugham-like captain never got out of his soiled pyjamas, but pinned on his epaulettes with safety pins during the day) believes that the first three men ever to be born came from eggs laid by giant butterflies, and their wives were sent down later from above, to join them, fully grown!

The Serbians looked on the butterfly as the soul of a witch, and believed that if they could find her body and turn it round while she slept, the soul wouldn't be able

Figure 3. The Primrose Fairy.
From *The Book of the Flower Fairies* by Cicely M. Barker.

to find her mouth to re-enter, and she would die. Furt and Wagnall's *Standard Dictionary of Folklore, Mythology and Legend*, where I found many of these myths, goes on to say that this concept of the soul possibly explains why in mediaeval art many angels have butterfly wings rather than those of a bird. The Mexicans had butterfly insignia for both the Earth Mother and the Five Gods, and in Hawaii there is a story very like the Greek Myth of Orpheus and Eurydice, the story of Hiku and Kaweli. Hiku's beloved wife Kaweli died. Hiku went to the Underworld to fetch her, and found her spirit turned into a butterfly. He returned to her dead body, made a hole in her left foot, forced the spirit to enter, and she returned to life.

The Ancient Greeks sometimes portrayed the soul as a diminutive person with butterfly wings, before they simply portrayed it as a butterfly. In southern Germany it was believed that the dead are reborn as children who fly about as butterflies (hence the belief that they bring children). The Slavs sometimes open a door wide to let the butterfly soul escape from a dead man. In the Solomon Islands the dying man has a choice as to what he will become when he dies, and he often chooses a butterfly. Among the Nayas of Assam the dead are believed to be going through a series of transformations in the Underworld, and are finally reborn as butterflies. When the butterfly dies, that is the end of the soul forever. In Burma, rice has a butterfly soul, and a trail of rice husks and unthreshed rice is put down between the field and the granary so that the soul can find the grain, because if it doesn't, none will grow the following year.

Among some peoples the butterfly is worshipped as a god, sometimes the only god. A North American Pima Indian myth says that the Creator, Chiowotmalki, took the form of a butterfly and flew all over the world until he found a suitable place for Man. Among some Mexican tribes a butterfly is a symbol for fertility.

Not all butterflies, as we have seen, are looked on as gods, though in Scotland it is unlucky to kill or keep one, and in the West of Scotland the white ones are fed. In Serbia and Westphalia they are regarded with horror, and in some parts of Germany they are thought to be fairies in disguise who steal butter and milk. So we come back full circle.

There is a strange and apparently ineradicable myth in this country that butterflies only live for a day. This is nonsense. No species lives for such a short time: in fact, the shortest-lived survive for at least 10 days even in unfavourable weather – for instance the Chequered Skipper, Essex Skipper, Grizzled Skipper, Mountain Ringlet, Small Blue and Small White. The Large Blue, Red Admiral, Green Veined White, White Admiral, and Wood White, which also have unusually short lives in the imago form, are likely to live for about 2 weeks, the Orange Tip 18 days, and several of the other Skippers, and the Small Copper, from 18–20 days. The Small Tortoiseshell, which hibernates as a butterfly, sometimes lives for as long as 11 months to a year, while the Monarch has been known to survive for a whole year in its natural habitats. The Brimstone also lives as a butterfly for 10–11 months. How the myth became prevalent, and why it still manages to keep such a hold on the collective imagination, I have no idea, but then myths are often believed more passionately than the truth.

Incidentally, the Ching dynasty which lasted in China from 1644 until 1911 considered the butterfly a symbol of longevity. The name had the same sound as the word meaning 60 years.

One of the many things which amazes me about butterflies is that in spite of the fact that they go through such a complicated metamorphosis, they always deposit their eggs on the correct plant that the caterpillar will feed on.

"Butterflies are strictly oviparous" said Brown writing in 1833. "There is an unerring foresight possessed by the female, that of depositing her eggs on the precise place where food suitable to the caterpillar after extrusion is found. With very few exceptions the eggs are enclosed in an adhesive cement, which fixes them to the spot

on which they are deposited. When the eggs are extruded singly, this cement generally envelopes each individual egg with a coating, as in the case of the Admiral butterfly".

There is a great diversity in the arrangement of the eggs after extrusion. Sometimes they are deposited in confused masses, but in general they are arranged in the most orderly and systematic manner. The Common Cabbage, with various other insects, places its eggs upon one end, ranked together in perfect order: by this arrangement, the larvae, which on hatching emerge from the upper end, cannot disturb the adjoining eggs.

Eleazar Albin, writing on the subject of laying eggs said: "To this end they (the butterflies) do not lay their eggs loosely, so as to be driven from Place to Place, (much less from Country to Country) by the Winds; but fix them on plants which will be the proper food for their Worms while in a growing state, and those that are laid only superficially on Plants, are fastened by a Glew so tenacious that Rain can't wash them off. And for those that are laid contiguous, they are not laid in a heap but in exact order, and so disposed that one may not hinder the Worm of the others from coming forth".

Dr Miriam Rothschild claims that the female Large White has a way of assessing the amount of eggs it has laid. She described this in an extremely interesting article in *Nature* in March 1977.

Oliver Wendell Holmes in *The Poet at the Breakfast Table* has this charming little exchange:

> "I suppose you are an entomologist?"
> "Not quite as ambitious as that, Sir. No man can truly be called an entomologist, Sir: the subject is too vast for any intelligence to grasp".

One of the invariable lessons Nature has taught us all down the long ages, is that to survive, you must, unless you are extraordinarily lucky, be adaptable, and butterflies are no exception. Butterflies have found several ways of outwitting their enemies. Some are drab and inconspicuous while resting, but if they see a bird coming towards them they open their wings suddenly to reveal brilliant colouring. Some adopt uneven ways of flight.

Here is a charming poem about the Cabbage White by Robert Graves. It is called *Flying Crooked.*

> The butterfly, a cabbage white,
> Its honest idiocy of flight
> Has never yet, it is too late,
> Mastered the art of flying straight;
> Yet has, who knows as well as I,
> The just art of how not to fly.
> He lurches here and there by guess.
> By love and hope and hopelessness;
> Even the aerobatic swift
> Has not his flying crooked gift.

Brimstones sitting on buckthorn leaves are almost invisible. Peacocks which overwinter as butterflies rub the hairs on their wings together to make a hissing noise

if disturbed. Some caterpillars are furry or spiny to discourage predators. The Brown's (Satyridae) caterpillars live on grass and are long and thin and pointed at both ends, striped in various shades of green, to blend in with their surroundings. The Orange Tip caterpillar is also green and shaded to match the seed pod of its food plant (Cruciferae – hedge mustard and cuckoo flower). The Small Copper looks like a small green bump on the leaf on which it feeds, and some of the Hair Streaks lie on the underside of their food plants. The Large Skipper hides itself in a grass tent held together with silk, and so that it won't be detected through its dropping (or 'frass' as they are called) it has found a way of catapulting them sometimes several inches away! The Heath Fritillary caterpillars are small and black with grey and brown spines to look like a plantain flower, (their food plant) and the caterpillars of the Comma, with their own individual markings, curl on their leaves in such a way as to resemble bird droppings.

Chrysalids also use camouflage to protect themselves. Those of the Black Hairstreak look like bird droppings. The Orange Tip not only looks like the seed pod of its food plant but changes its colour from green to brown in the Autumn. The Hesperidae (Skippers) roll up hidden in tubes of grass. The Satyridae sometimes hang themselves on a plant, remaining green, and sometimes pupate on the ground, forming a loose network of leaves to cover them almost like a cocoon. Many chrysalides have to withstand the rigours of winter, often in fairly exposed conditions so they have to be strongly joined to their supporting plants, and well able to support the climate changes. They can survive buried in snow if need be, in temperatures as low as –15°C.

Eggs too, can stand an astonishing amount of cold. The 18th century entomologist Boerhaave, whom I mentioned earlier, and who was responsible for publishing much of Swammerdam's work, tried this experiment:

> "I subjected eggs of several insects to a more severe trial than the winter of 1709 [one of the coldest winters ever to have been experienced in Europe]. Among others were those of the Silk Worm, and the Elm Butterfly [the Large Tortoiseshell] which I enclosed in a glass vessel, and buried for five hours in a mixture of ice and rock salt, when the thermometer fell 6 degrees below zero; notwithstanding which caterpillars were extruded from all the eggs, and at exactly the same time with those which had not been subjected to the experiment. In the succeeding year I subjected them to a still greater degree of cold. I prepared a mixture of rock salt and nitrate of ammonia, and reduced the thermometer to 22°, lower than the cold of 1709. They suffered nothing from this rigorous treatment, as they were hatched in due season."

Kirby and Spence, who published a monograph together in the early 19th century, came to the conclusion that it was impossible to retard the hatching of eggs by cold, but that it was possible to hurry it along with heat. (Spanish women used to hasten the hatching of silkworm eggs by keeping them warm in their bosoms). Alas, as we know, in spite of all this ingenuity the butterfly population in nearly all parts of the world is dwindling, due to the destruction of their habitat.

Here are a few snippets of information that have amused me:

A picture of Marrel (Maria Merian's stepfather) was sold at Christies in 1977 for £10,000. How I wish I had had the money to buy it!

Eleazar Albin, in his introduction to *A Natural History of English Insects* wrote "For this curious lady [a Mrs How, his patroness] Widow of the late Physician of that name, I painted a great number of both Caterpillars and Flies [by flies he meant butterflies and moths] and likewise several things relating to Natural History for Sir Hans Sloane". More importantly, Sir Hans Sloane's collection was the basis of the Natural History Museum, London. Sir Hans Sloane's daughter married Charles, later the 2nd Baron Cadogan, and commemorated her father on the Cadogan property in London, by Sloane Street and Sloane Square.

J.J. Joicey (1871–1932) whose large and valuable collection of Lepidoptera is also at the Natural History Museum was encouraged by his mother to start collecting them, in the hope that it would deflect him from chasing the human variety at the time!

Butterflies only fly with the sun's help – and also mate in the sun.

The first person to give formal protection to a butterfly (the Apollo, not found here) was the Kaiser who was largely responsible for the First World War which destroyed, as did the second, millions of butterflies.

In *A Nest of Tigers* (1968) John Lehman quotes a letter from Edith Sitwell in which she wrote "I have just been violently slapped in the face by two butterflies. They were exceedingly drunk poor boys and couldn't see properly. Eventually they went back to their buddleia (if that's how it's spelt) the cause of their moral downfall..... They were Peacocks..... there were about fifty of them there, simply carousing as if governments didn't exist".

In fact certain butterflies, the Peacocks among them, feed on the nectar from buddleia. Red Admirals, Commas and Peacocks can and do get drunk on fermenting apples and with other butterflies on other fermenting fruit as well.

The late Sir Terence Rattigan, when he heard I was going to write a book on butterflies, remembered with affection and enthusiasm the day he and his father caught a Camberwell Beauty (in earlier times called the Grand Surprise, the Willow Beauty, the White Petticoat, and in North Africa, the Mourning Cloak) when they were on holiday in Germany, describing the occasion as the beginning of his love affair with them. Mr N.D. Riley, when he was a child, lived next door to the great entomologist Richard South, and became interested in lepidoptera on seeing a Tiger Moth for the first time. Nabakov, who wrote *Lolita* among other things, said in an interview, "My loathings are simple: stupidity, oppression, crime, cruelty and soft music. My pleasures are the most intense known to man: writing and butterfly hunting".

And now to one of the great wonders for me about butterflies – migration. Students of bird migration have for many years objected to the use of 'migration' as a word to describe the movements of insects on the grounds that a true migration must include a to and fro movement of the population between certain areas, but now it is generally accepted that it can be used about butterflies after all.

The Monarch is the only butterfly about which it is known that the same individuals make the autumn flight south in one year, and north again in the spring of the following year, in North America. Nearly 400 are recorded as having been seen over here. It is not yet certain how they came across the Atlantic, but it is known that they have been found in the holds of ships (have their pupae). On the other hand, they do fly quite

Figure 4. Monarch butterfly.

enormous distances overland in America, and most butterflies can rest on the sea if it is calm, so it is *just* possible that some of them fly here.

Professor Urquhart, the great Canadian expert on the Monarch, maintains that they can neither fly in the dark, nor at very high altitudes so he feels it would be an impossibility. He wrote a letter to me saying, "From our research we have, I hope, definitely shown that Monarch butterflies do not fly to England. There is no question that they reach England on board ship, same as we do". A.H.H. Harbottle disagrees vehemently. He estimates that if they did fly here it would take them 6 days and 6 nights, using thermal currents, to get into the area where the prevailing winds would help them. Roy French, of Rothampstead Experimental Station, thinks they would take considerably less. John Heath in a letter (not to me) said "Almost all records of the Monarch in Britain are in September or later, when the insect is migrating south from Canada and the northern United States to its overwintering sites in Florida and Central America. Therefore as this coincides with the hurricane season in the Caribbean some individuals are likely to be blown out to sea when they encounter the northern edge of the circulating winds, and will then be picked up by the westerly winds in the Atlantic and carried to Britain".

Incidentally, the flight of the Monarchs has been timed and it has been found that they can fly at 25 miles an hour which is four times faster than the Large White. When the time comes for migration, they all rise at a given and as yet unknown signal to start on their long, long flight. Professor Urquhart thinks the signal might involve the angle of light from the ascending sun.

When Michael and I were acting on Broadway in 1996, we went to the Cloisters,

just outside New York – that extraordinary Rockefeller collection of cloisters and doorways from Mediaeval Europe – and we found in one of the courtyards about 50 or 60 Monarchs feeding enthusiastically on Michaelmas daisies. It was our first sight of live Monarchs, and gave us a feeling of great delight.

The idea of migration in the sense generally accepted by the public has always fascinated me – why certain fish travel so many miles to spawn, why birds fly hundreds of miles to breed, why the Norwegian lemming behaves as it does, and why butterflies also travel hundreds of miles to come to these or any other shores. The Red Admiral comes here yearly in large numbers (in 1938 an assembly point for the Red Admiral immigration was the sea-frontage of the Imperial Hotel at Exmouth!) and the Painted Lady comes every year from North Africa. In 1996 there was an absolute invasion. The main influx was in late May and June, and it was estimated that there were 'millions' on the wing. In Sussex the Painted Ladies occupied sites usually used by the Pearl Bordered Fritillaries. The Silvery moth which migrated with them came in even vaster quantities.

C.B. Williams, who wrote two splendid books on migration, has some very interesting records of migration from the 12th century. According to Schnürrer, he says: "in the year 1100, there was seen passing from the direction of Saxony to Bavaria swarms of which from the resemblance of their outspread wings to tents were called Papilloren".

In 1104 there was another great flight. He quotes Moufet (believed to be the father of 'Little Miss Muffet' of the nursery rhyme and co-authored *The History of Animals, Serpents* etc. with Topsel): "Wert thou as strong as Milo and wert fenced and guarded about with a host of giants for force and for valour, remember such an army was put to worst by an army of butterflies, flying like troops in the air, in the year 1104, and they hid the light of the sun like a cloud ....."

From Turpyn's Chronicles in the Reigns of Henry VII and Henry VIII he quotes "1508, the 23rd year of Henry the 7, the 9 of July being relyke Sonday, there was seen at Calleys [Calais], an innumerable swarm of whit butterflies coming out of the north este, and flying south-estewards, so thicke as flake of snowe, that men being a shutynge in St Petar's fields without the town of Calleys could not see the town at foure of the clock in the afternone, they flew so high and so thicke". Williams goes on to say: "There is no doubt that this refers to the Large Cabbage White Butterfly (Pieris brassicae L.) as the date, allowing for the alteration in his calender and his direction of flight, are quite in agreement with our modern observations on this species".

In June 1493/4, Christopher Columbus, on his second voyage of exploration wrote, "Bearing up close to Cuba, they saw turtles of vast bigness... and the next day such immense swarms of butterflies as even to darken the sky".

And one last quote from Williams' *Migration of Butterflies:* "A thick cloud which in its extreme form may hold up motor cars, cast a shadow on the ground, cause turkeys to gobble in consternation or necessitate natives walking with their heads bent to the storm." Finally, and perhaps most interestingly for this audience this evening, this is from Darwin's Voyage of HMS *Beagle*. He says he saw vast numbers of butterflies; ("in bands, so that it was not possible to see the space above the snowing

butterflies"). He said the column flying 600 feet above the ocean was a mile wide, and, he believed, several miles long.

This is from a letter from Richard Vane-Wright, now Keeper of Entomology at the Natural History Museum. "Man is interfering with the ecology of the Earth on a massive scale, mainly in blind ignorance and with total disregard for the consequences. Some people would like to stop this and return to the simple life. I simply don't think this will happen. Scientists should, I feel, devote themselves to studying the origins and dynamics of life in all its manifestations, in the hope that this understanding will help us to co-exist with nature in any intelligent way".

Butterflies, butterflies, butterflies – so beautiful, so clever, so brave, such good pollinators, and such excellent barometers of a healthy environment. How sad it would be to lose them! As Lebrun said:

"The butterfly is a flower which flies.
The flower a butterfly fixed".

These creatures from a world not yet dominated by man should be cherished. Beauty lifts the spirits and fires the imagination. Both attributes are vital in an increasingly grim world. Long live butterflies.

DULCIE GRAY

Nightly conversations with Linnaeus

Those of us who have been so fortunate to have stayed in the guestroom at Linnaeus' old house in Uppsala have had the pleasure of seeing a portrait of him at the foot of the bed, the Master watching over you as you go to sleep.

One evening, when I got to the room after midnight as a result of a hard struggle with a complex lichenological problem, he looked so sadly at me that I said: "Sorry, Sir, that I have proven you wrong. You obviously had no interest in lichens."

To my great surprise he replied: "Naturally, as I was unable to do something sensible with these creatures, since they had no flowers and could not be classified according to my new principles. Maybe I should just have left them out, but I felt forced to include them as part of my plan to make a survey of God's creation – these days you call it biodiversity studies and pretend that it is something novel. I wrote down everything I knew, and had a bad struggle with the lichens. I also had to leave something for the coming generations, and my last pupil Erik Acharius took up the challenge and improved the system considerably, don't you agree?"

"Undoubtedly, Sir, but you should not forget your own son."

"Has that boy deceived you too? Believe me, he had no original thoughts in his head, but as a father it was my duty at least to secure him a good job – as my successor. After my death, he had the good luck to be scientifically supported by his eminent student Olof Swartz. Don't forget, young man, before you criticize me further that you have much better equipment these days than was available to me, and science has also luckily moved forward!"

"Certainly, Sir, I'll bear that in mind. Incidentally, which of our new tools would

you best have liked to have had available?"

"You disappoint me! A stupid question. Undoubtedly, a personal computer would have saved me from the tedious, time-consuming work with goosefeather pen in candle-light in late evenings, so I could have had more time and energy to study the plants themselves more carefully. Please, tell Gina Douglas that she should have accepted the offer I recently had of a PC, on my behalf. It's getting late. You'd better go to bed; late evening work killed me, don't repeat that mistake!"

PER M. JØRGENSEN

Library

As outlined in the last issue, with the help of the summer student labour force we managed to bring together the evolutionary biology books into one corner of the Reading Room, as well as cleaning some journals and tidying up sections rearranged in previous years to make room for new accessions. Inevitably we again have a section of 'displaced books' in a temporary bookcase so please be patient if we cannot immediately find what you are after. It always helps if we know what you might need a little beforehand especially in the case of journals which all live in basement stores.

With more and more users having access to e-mail this can always be used to forewarn us of your needs or ask questions on our holdings. Please just write to us on: gina@linnean.demon.co.uk. There should now be pictures of both the Library and the Librarian (surrounded by piles of books and papers!) on the Society's web page if you feel you want to see who you are writing to: www.linnean.org

Library donations

The following list is for donations recorded in September and October 1998. Anything received after this will not be listed until the July 1999 issue as the Annual Report in April does not have room for accessions lists. We continue to be grateful to all who give us journals or other serial publications which there is not room to list separately.

Academic Press	Gould, Edwin & McKay, George, eds., *Encyclopedia of mammals*, 2nd ed. 240 pp., col. illustr., Academic Press, San Diego, 1998.
Alan Armstrong	Bell, Whitfield J., *Patriot-improvers, biographical sketches of members of the American Philosophical Society*, Vol.1 1743–1768 (Memoirs, Vol. 226). 531 pp., illustr., American Philosophical Society, Philadelphia, 1997.
J.A. Burton	Uribe, Andres C., *Brown gold, the amazing story of coffee.* 255 pp., illustr. some col., Random House, New York, 1952.
Cambridge Univ. Press	Solomon, Nancy G., & French, Jeffrey A. eds., *Co-operative breeding in mammals*. 390 pp., figs., CUP, Cambridge, 1997.
Rémy Claire	Claire, Rémy, David Douglas (1799–1834) Naturaliste écossais, explorateur de l'Ouest americain. 335 pp., illustr. some col., maps, Scheur, Drulingen, 1998.
R.J. Cleevely	Small, David & Small, Anne, *Handy guide to heathers*. 168 pp., col. illustr., maps, Heather Society, Ipswich, 1998.
Errol Fuller	Fuller, Errol, *The Great Auk*, 448 pp., illustr., some col., Southborough, privately, 1998.
O. Hagelin	STOCKHOLM, Swedish Pharmaceutical Society, *Old and rare books on Materia Medica in the library of the Swedish Pharmaceutical Society.* compiled by Ove Hagelin. 224 pp., illustr. some col., Swedish Pharmaceutical Society, Stockholm, 1997.
Jill, Duchess of Hamilton	Aldridge, Alan & Plomer, William, *The butterfly ball and the grasshoppers' feast*. unpaged, col. illustr., Jonathan Cape, London, 1975.
	Brookes, John, *Planting the countryside, a hands-on approach.* 192 pp., col. illustr., BBC Books, London, 1994.
	Gee, Helen & Fenton, Jane, *The South West book, a Tasmanian wilderness.* 307 pp., illustr. some col., maps, Australian Conservation Foundation, Melbourne, 1978.
	Hamilton, Jill Duchess of, Hart, Penny and Simmonds, John,

	The gardens of William Morris. 160 pp., col. illustr., Frances Lincoln, London, 1998.
	Hobbs, Anne Stevenson, *Beatrix Potter's art, paintings and drawings...* 192 pp., col. illustr. , Frederick Warne, London, 1989.
	Mabey, Richard, *Flora Britannica.* 480 pp., col. illustr., Sinclair-Stevenson, London, 1997.
	Taylor, Judy, *Beatrix Potter: artist, storyteller and countrywoman.* 224 pp., illustr. some col., Frederick Warne, London, 1986.
	Wilson, William H.W., *Landscaping with wildflowers and native plants.* 93 pp., col. illustr., Chevron Chemical Co., San Ramon, CA., 1984.
P. Holliday	Holliday, Paul, *A dictionary of plant pathology*, 2nd ed. 536 pp., Cambridge, Cambridge University Press, 1998.
Dr J.D. Holloway	Hall, Robert, Holloway, J.D. & Jarem, D., *Biogeography and geological evolution of S.E.Asia.* 417 pp., col. maps, Dr W. Backhuys, Leiden, 1998.
Theo S. Jones	Strong, Richard P. ed., *The African republic of Liberia and the Belgium Congo... (results of) the Harvard African Expedition 1926–1927* , 2 vols, 1064 pp., illustr. some col., maps, Harvard University Press, Cambridge, Mass., 1930.
P. Leith-Ross	Leith-Ross, Prudence, *The John Tradescants, gardeners to the Rose and Lily Queen.* (Paperback edition). 336 pp., illustr., Peter Owen, London, 1998.
Dr.A. Machado	Machado, A. *Biodiversidad, un pasco por el concepto y las islas Canarias.*67 pp., illustr,. Cabildo Insular de Tenerife, Santa Cruz de Tenerife, 1998.
National Mus. Nat Sci.	Chiu, Shan-Ting & Peng, Ching I. eds., *Proceedings of the cross-straits symposium on floristic diversity and conservation.* 327 pp., illustr. some col., Nat. Mus. Nat. Sci., Taichung, 1998.
Nature Conservation Bureau	Killick, John, Perry, Roy and Woodell, Stan, *The flora of Oxfordshire.* 386 pp., illustr. some col., Pisces Press, Newbury, 1998.
Dr E.C. Nelson	Barnhart, John Hedley, Collected reprints *"American Botanists".* various pagination, illustr., 1909–1925
	Nelson, E. Charles & Grills, Alan, *Daisy Hill nursery, Newry, a history of "the most interesting nursery probably in the world".* 161 pp., illustr. some col., N. Ireland Heritage Gardens Committee, Belfast, 1998.
	Penhallurick, R.D., *Turtles off Cornwall, the Isles of Scilly and Devonshire.* 95 pp., illustr. maps, Dyllansow Pengwella,

	Truro, 1990.
Dr. R. Pethiyagoda	d'Abrera, Bernard, *The butterflies of Ceylon.* 224 pp., col. illustr., map, Wildlife Heritage Trust, Colombo, 1998.
	Spix, J.B. & Agassiz, L. *Fishes of Brazil*, translated by V.L. Wirasingha edited by R.Pethiyagoda and Maurice Kottelat. 396 pp., illustr. (76 col. pl.), Wildlife Heritage Trust, Colombo, 1998.
Prof. Sir Ghillean Prance	Hopkins, H.C.F. (and others), *The biological monograph... festschrift for Frank White.* 236 pp., illustr. some col., maps, Royal Botanic Gardens, Kew, 1998.
	Prance, Ghillean T., *Rainforests of the world: water, fire, earth, air.* illustrated by Art Wolf. 304 pp. col. illustrations, Crown Publishers, New York, 1998.
Royal Botanical Gardens, Kew	Farjon, Aljos, *World checklist and bibliography of conifers.* 298 pp., illustr., Royal Botanic Gardens, Kew, 1998.
	Lewis, G.P., *Caesalpinia, a revision of the Poincianella-Erythrostemon group.* 233 pp., illustr. some col., Royal Botanic Gardens, Kew, 1998.
	Polhill, Roger & Wiens, Delbert, *Mistletoes of Africa...* 370 pp., illustr. some col., maps, Royal Botanic Gardens, Kew, 1998.
Dr O. Seberg	Frederiksen, Signe, Rasmussen, Finn N. & Seberg, O. *De hojere planters: evolution og klassifikation.* 326 pp., illustr., Gads Forlag, Copenhagen, 1997.
Wageningen University	Knijlens, J, Oldenburger-Ebbers, C.S. & Wijnands, D.O., *Paradisus Batavius, bibliografie van plantencatalogi... Nederlands (1550–1839).* 232 pp., illustr., PUDOC. Wageningen, 1983.
Dr A.J. Walker	Laurie, E.M.O. & Hill, J.E., *List of land mammals of New Guinea, Celebes and adjacent islands, 1758–1952.* 175 pp., illustr. map, BM(NH), London, 1954.
Dr A. Wörz	Sebald, Oscar, Seybold, Siegmund, Philippi, Georg & Wörz, A., *Farn-und Blütenpflanzen Baden-Wurttembergs*, Bds. 7 & 8. 595 pp & 540 pp., col. illustr., maps, E.Ulmer, Stuttgart, 1998.

Book Reviews

The Crucible of Creation. The Burgess Shale and the Rise of Animals, by Simon Conway Morris, publ. Oxford University Press, Oxford, UK. (1998) xxiii + 242pp., line drawings, monotones, colour plates, H/B ISBN 0-19-850256-7, £18.99.

The fossils of the Middle Cambrian Burgess Shales of Canada shed a bright light on early metazoan life. They have also attracted a boxful of literature: this is the fourth book on the subject to have appeared in recent years. One too many? No, because this

is the first to emerge from Simon Conway Morris, whose task has been to describe some of the stranger fossils from an already eye-opening assemblage. As such, Conway Morris's perspective is as welcome as it is arguably overdue.

But *Crucible of Creation* treads in the shadow of the third Burgess Shales book, Stephen Jay Gould's *Wonderful Life* (Norton, 1991). Although Gould's story of the Shales is fuller, Conway Morris's is better because it comes from a protagonist rather than an onlooker. Conway Morris also brings the story up to date, with an account of Middle Cambrian faunas from elsewhere in the world, such as Greenland and China. And, it has to be said, his prose is often crisper than Gould's admittedly enjoyable exuberance.

But it is in his attempted demolition of Gould that Conway Morris goes astray. Something about Gould has made Conway Morris angry – so angry, that he does not take a breath to guide us through the arguments behind his concerns. My guess is that Conway Morris objects mainly to Gould's espousal of the idea of contingency in evolution. But unless one had read Gould, one would have no idea what Conway Morris was on about...

Now, I *have* read Gould, so I can pick up the thread, but I *haven't* read the philosophers that make Conway Morris equally cross. Who *is* Saussure whose views the author so deplores? Who *is* Derrida, and why are his or her views so 'poisonous'? Why mention them at all if they are to remain unexplained? Why does the author repeatedly hint at some possible transcendant insight, if only to drop it? Why did the editor at Oxford University Press let Conway Morris get away with such obvious inconsistencies (and many less obvious ones)?

As a result of these frustrations, *Crucible* is ultimately a disappointment. This is a shame, when it could have been the definitive work on the Burgess Shales, from a participant in the story who is also one of the most powerful and fearlessly imaginative intellects in evolutionary biology.

HENRY GEE

Biology by Numbers. An encouragement to quantitative thinking, by Richard F. Burton, publ. Cambridge University Press, Cambridge, UK, 1998, xvi + 238, line drawings, P/B ISBN 0-521-57698.9, £13.95/$US 19.95; H/B ISBN 0-521-57156-1, £37.50/$US 59.95.

Biology students at universities often have a mental trip mechanism which causes them to switch off when a mathematical concept is mentioned. This may be because at school it is still possible to see biology as the innumerate science. It isn't, but the path to realizing that can be a difficult one. Richard Burton is an enthusiast, and has written a book designed to spread the word that mathematical thinking underpins biological sciences, and that common ideas are to be found in widely differing branches. The book starts with simple arithmetic in biology, goes on to units of measurement and approximations, and develops ideas relating to magnitudes, geometric series, exponents, logarithms and allometry. Examples come from plants and animals, the physiology of metabolism, energy flow in ecology, functional morphology and population dynamics. The author's intention was not to write a book of mathematical

methods or of data analysis, but to develop a sense of the fundamental importance, and interest, of a mathematical approach. As such, I found it a great success, and became much more immersed than duty as a reviewer might require. I thoroughly recommend it. The cover says it has been written primarily for undergraduates, but, mindful of the switch in the student's brain, it is not quite clear where it would fit into a curriculum – perhaps into a course unit on biomechanics or functional constraints. Otherwise, students might pick it up in a library or bookshop and become captivated by the examples and the clarity with which they are presented. I hope they do.

LAURENCE COOK

The New Oxford Book of Food Plants, by J.G. Vaughan and C.A. Geissler, illustr. by B.E. Nicholson, E. Dowle & E. Rice., publ. Oxford Univ. Press, Oxford, UK, 1997, xx + 230pp. many colour illust., H/B ISBN 0-19-854825-7, £25.

This is a new version of the *Oxford Book of Food Plants* of 1959. The sequence is the same with the same clear illustrations. New species have been added and the text enhanced and updated with an excellent much longer introduction. The book ends with a new 14 page chapter on nutrition and health, followed by a series of tables summarising composition and calorific value of major food plants. The book is well weighted with such information, although the terms used should have had their own glossary. The index has been expanded but too often fails to include many local names used in the text, thus burying useful facts.

The coverage is very comprehensive – but then plants account for 63% of our diet, 93% in Bangladesh. The wide sweep of very different sorts is impressive, used as flowers, fruits, leaves, stems or underground parts world-wide. The text is full of fascinating information, including history, harvesting, markets, treatments, chemical constituents, culinary and other uses. It should interest many more than botanists and nutritionists.

Some accounts might have been amplified. The story of strawberries should at least have mentioned Duchesne's seminal book published when he was only 19. Judge Logan gets less than his deserts for hybridising *Rubus vitifolius (ursinus)* and a red raspberry. 'American Winter Green' celery retains its picture, but the reference to it in the text has disappeared. And what would Thanksgiving be without Cranberries?

D. McCLINTOCK
