Editorial

At the British Association meeting in Plymouth a year and a half ago, Dr Hugh Torrens, President of the British Society for the History of Science, maintained that Richard Owen did not in fact mention the name Dinosauria in 1841 as everyone has been led to believe but instead only coined the term in 1842 when the account of the meeting was subsequently published.

In his oral report Owen spoke for over two and a half hours using diagrams to illustrate salient points particularly those relating to important ordinal ranks. It is difficult to believe that he could have given such a report without a classificatory framework. He noted, for example, that *Megalosaurus*, *Iguanodon* and *Hylaeosaurus* had additional peculiarities of structure (viz. they belonged in a separate taxon) adding that the very name *Iguanodon*, by conveying the idea of a gigantic *Iguana*, created an erroneus idea of its affinities (see report of Plymouth meeting in *The Athenaeum*, Aug. 1841).

According to a letter of Owen's, the report of the meeting was in press by the beginning of October and by the following May (1842) thirty quarto plates had been lithographed and 250 impressions of each printed — including one plate of the Dinosauria* (see letter to De la Beche — Geological Museum, University of Wales, Cardiff). Whether or not Owen first used the term in 1841 or 1842 we may never be certain although that great natural history biographer C. Davies Sherborn (1851-1942) cites its date of publication in the Royal Society's catalogue of scientific papers, *The Life of Richard Owen* (1894) and in *Index Animalium* (1902-1933) as 1841. What we are certain of, however, is that Owen believed the dinosaurs to be "the most advanced of all reptiles — the crown of reptilian creatures which in structure made the nearest approach to mammals (having a highly organised centre of circulation in a degree more nearly approaching that which now characterizes the warm blooded Vertebrata)".

By 1869 T. H. Huxley, searching for fossil groups to fill the evolutionary gaps he knew to be there, concluded in contradiction to Owen, that the dinosaurs were nearest to the birds and that birds probably had their ancestral roots within the dinosaurs. Today Huxley's view prevails and in cladistic terminology dinosaurs fit between the Pterosauria and the Aves. However, some dinosaurs are closer to birds than are others — thus the Dinosauria can no longer be regarded as a monophyletic group, they are stem-group birds. The Dinosauria is not a true taxon and like the Reptilia should be removed from systematic classifications.

Finally, if birds are the sister-group of the Mammalia (Gardiner, 1982) then the dinosaurs must have been warm blooded and covered in at least a pelt like the Pterosauria or plummage of down feathers.

In this issue we publish the second instalment of Clarke *et al.*'s study of the rediscovered colony of the Scarlet Tiger Moth (*Panaxia dominula*) on the Wirral Way in Cheshire. The colony was established in 1961 by Philip Sheppard with the release

* Although paid for by the British Association — these plates were never printed. However, Owen apparently had the report itself printed privately by Richard & John E. Taylor of Fleet Street, the date of publication on the title page of his own personal copy in the Natural History Museum is 1841.

of about 13 000 caterpillars bred from stock originating in the colony at Cothill, near Oxford, and with a gene frequency of the *medionigra* gene of 25%. The Wirral colony was assumed to have died out until 1989, when Sir Cyril Clarke rediscovered it. In that year, 68 moths were observed of which 36 were typical *dominula*, 27 the heterozygote *medionigra*, and five homozygote *bimacula*. The sample gave an estimate of *medionigra* gene frequency of 27 per cent, and the three genotypes were exactly in the Hardy-Weinberg proportion of 9:6:1 (Clarke *et al.*, 1990). The significance of those observations is the implication that there was no change in gene frequency over the 27 generations between 1961 and 1989, a very different outcome from the results obtained with the Cothill colony by the Oxford group including R.A.Fisher, E.B.Ford and P.M.Sheppard. They inferred strong selection against *medionigra*, which dropped rapidly (over 20 generations) from a frequency of about ten per cent to equilibrium at about three per cent, where it appeared to be maintained by a rare mating advantage.*

In his biography of Sewall Wright, Provine (1986:464) recorded that when Motoo Kimura first began work in mathematical population genetics, he was particularly interested by one controversy: "the disagreement over evolution in the moth *Panaxia dominula* . . . . . the battle of the giants" between Wright and Fisher. Fisher and Ford (1947), in their first report on the Scarlet Tiger, insisted on the importance of natural selection in explaining fluctuating gene frequencies, whereas Wright (or the caricature of his view that Fisher, Ford and others adopted; Provine, 1986:422,424) argued that random effects — genetic drift — are important, especially in small populations. Wright responded (1948) to Fisher and Ford's 1947 paper, and their 1950 rejoinder (Fisher and Ford, 1950; withdrawn from the newly-founded *Evolution* after some bitter exchanges with Ernst Mayr, that journal's editor) prompted a further reply from Wright (1951). Commenting on this debate, Provine (1986:436) wrote that the *Panaxia dominula* data from the Oxford group "were among the very best for any natural population" but "still were not good enough to discriminate clearly between the Fisherian and Wrightian views." Nevertheless, Ford's recollection of the debate (Provine, 1986:436) was that he and Fisher had provided the first data on which "a decision could be taken between selection and random drift in a wild population . . . that the change we demonstrated was selective," and that Wright's criticisms were without substance. And Wright (1978:177), although he agreed that the decline in frequency of *medionigra* over 30 years (1939-68) was best interpreted as due to selective disadvantage, continued to argue that yearly fluctuations were "largely sampling effects in a colony of small effective size."

So much for the "battle of the giants" over *Panaxia dominula*. Motoo Kimura, who has now also become one of the giants through his development of the neutral theory of molecular evolution (Kimura, 1983), was prompted by the battle to write one of his first papers in mathematical population genetics (Kimura, 1951). Given that interest, we sent Kimura a copy of Clarke *et al.*'s 1990 report on the newly discovered Wirral colony when it was first published, and asked his opinion. Predictably, it was that the data are interesting but that the sample size is too small. Clarke *et al.* have now extended

* For the following comments and resumé of 'evolution' of *Panaxia dominula* – I am indebted to my friend and colleague Colin Patterson.

their observations of the colony over a further thee years, and their intial 1989 sample of 68 moths is now increased to about 450, with the *medionigra* gene frequency estimated at 19 per cent overall, and with their annual samples showing frequencies ranging between a high of 27 per cent (1989) and a low of 15 per cent (1990).

Are the Wirral data now "good enough to discriminate clearly between the Fisherian and Wrightian (or Kimuran) views," as Provine put it (1986:436)? Probably not, but those data are now surely sufficient to imply that if explanation is needed, it is for what Clarke *et al.* call the "Oxford experience," not for the Cheshire experience, which is reminiscent of the enigmatic smile of Lewis Carroll's Cheshire cat.

This issue again breaks new ground with the publication of the Hooker Lecture.

REFERENCES

CLARKE, C.A., CLARKE, F.M.M. & COOK, L.M. (1990). Gene frequency in an artificial colony of the Scarlet Tiger Moth *Panaxia dominula* (L.) after 28 years. *The Linnean, 6(2):* 13-16

FISHER, R.A. & FORD, E.B. (1947). The spread of a gene in natural conditions in a colony of the moth *Panaxia dominula. Heredity, 1*:143-174.

FISHER, R.A. & FORD, E.B. (1950). The "Sewall Wright" effect. *Heredity, 4*:117-119.

KIMURA, M. (1951). Effect of random fluctuation of selective value on the distribution of gene frequencies in natural populations. *Annual Report of the National Institute of Genetics, 1*:45-47.

KIMURA, M. (1983). *The Neutral Theory of Molecular Evolution.* Cambridge: Cambridge University Press.

PROVINE, W.B. (1986). *Sewall Wright and Evolutionary Biology.* Chicago: University of Chicago Press.

WRIGHT, S. (1948). On the roles of directed and random changes in gene frequency in the genetics of populations. *Evolution, 2*:279-294.

WRIGHT, S. (1951). Fisher and Ford on "the Sewall Wright effect." *American Scientist, 39*:452-458.

WRIGHT, S. (1978). *Evolution and the Genetics of Populations. Volume 4: Variability within and among natural populations.* Chicago: University of Chicago Press.

Society News

Members are reminded that nominations from Fellows for office, which include a President-elect, and Council must be in the hands of the Executive Secretary by 1st March 1993. Nominations for the Society's medals, for FMLS and Fellowship *Honoris causa* will be considered by Council on 21st January 1993. Applications for the Society's grants, including the NERC Grants for Taxonomic Publication, must be received by 31st March 1993.

A new era has dawned for The Linnean. This issue, and subsequent ones, will be typeset by computer. A new cover has been put together from computer- generated images. The nervousness which this innovation has engendered has meant that the deadline for this copy is the same as last year, but when we become familiar with the new arrangements, we should be able to reduce this by around a month, giving added topicality to the various items. Other than brief news items, copy should, if at all possible, be supplied as ASCII files on disk with a hard copy. If this is not possible, please allow time for it to be retyped. We hope that despite the change *c'est la même chose!*

The Society possesses some fine furniture, and it has been a considerable pleasure to see some of it restored by Ben Clegg to its former glory during the summer. Library chairs, three old tables, Meeting Room chairs and benches, even the President's chair, whose alligator skin seat, notwithstanding a tastefully embroidered cushion, had given up the struggle with Presidential bottoms, have all been put into order. Students, who have included the Treasurer's grandson, have amongst other things, successfully cleaned carpets, curtains, paintwork and picture frames. Other Courtyard societies, who cast out their old furniture when it was fashionable to do so are now regretting it. The chairs on the platform in the Meeting Room, of which the Society has 14, mostly in the Executive Secretary's office, are by Waring & Gillow dating from the mid-19th Century. All are stamped and numbered.

On a more mundane level, the Society also has two air-conditioning systems, for the Strong Room and Meeting Room. Each summer these go wrong. In 1990, there were problems with the speed control of one of the fans; in 1991, the refrigerant, supposedly a mobile liquid, congealed to a purple jelly; this year the compressor failed entirely. We are now on our third maintenance firm, which has brought back to the Society Derek Cooper, the only person who has managed to get the systems to work. The Executive Secretary, who now takes a rather longer term view of these inadequacies, i.e. he no longer panics when the systems go down, knows of a 101 ways of what can go wrong with air-conditioning systems, which are available by prior arrangement to members. He has rather fewer solutions, some of which are not suitable for inclusion here.

Society Meetings

The Linnean Society at the Ethnobotanical Congress at Córdoba, Spain 21-26th September 1992.

This excellent Congress, the first of its kind, represented a landmark in the advancement of ethnobotanical studies on a world scale. It was conceived and organised by Esteban Hernández Bermejo, who is Director of the Córdoba Botanic Garden and Professor of Agricultural Botany at Córdoba University. Some 500 delegates from all over the world took part in the Congress, and for me it was particularly interesting to see so many from South America, Central America and Mexico. In fact, the central theme was very much concerned with the impact of Spain and other European countries on the Americas, and the extent to which, despite strong contrary influences, many of their cultures still survived. The interchange of food and other plants between the Old and New Worlds was also a recurring theme.

Because there was likely to be a large number of overseas Fellows at the Congress, I decided to attend on behalf of the Society and to ask the Executive Secretary to come with me. The Roll and Charter Book was carried to Córdoba and I provided myself with a Spanish translation of the Obligation and words of Admission. This I did because I felt that Spanish-speaking Fellows might find the somewhat archaic English hard to understand.

We were given a very nice room at the Botanic Gardens for our business meeting and some 30 people attended it. I gave a short talk on the history of our Society, the

Linnaean Collections, our Library and the active programme of meetings and discussions that take place every year. As a result I was able to admit three Fellows (one each from Spain, Colombia and Costa Rica); we also gave out about a dozen Forms of Recommendation, six of which were filled in and supported by Fellows present at the Congress. The customary refreshments were available after the meeting.

An overseas business meeting of our Society is perhaps a new departure, but it is one which we might consider repeating now and again when an appropriate opportunity arises. Fellows may not be aware that talks are in progress to hold a Society meeting in the USA in the near future and thus an opportunity to admit American Fellows could arise.

I fear that I may be asked whether the admission of Fellows outside the UK and in a foreign language is legal, to which I reply that I cannot find anything in the Bye-Laws to the contrary, unless it be thought that the Obligation should be read out in the English language. Since it seemed to me that the persons so admitted should understand the Obligation as fully as possible, a translation into their own language was the best way of ensuring this.

Professor Jack Hawkes
President

Future meetings

Members of the Society will hopefully find something to their tastes in the 1992-93 programme, which coincides with the 250th Anniversary of the birth of Sir Joseph Banks. But, as Mr. Wodehouse has noted, in the finest ointment there is to be found a fly. A number of our meetings, including the Banks' meeting (and a further scientific meeting is planned with the Royal Society on 27-28th October 1993, entitled Estimating Extinction Rates) and particularly the Brazil meeting on 6-7th May 1993, for which a budget of £19,170 has been agreed, do need sponsorship. As it happens, the Royal Society is supporting both Banks' meetings, and £10,500 has been raised for the Brazilian meeting, thanks to generous subventions from ODA, ICI PLC, RTZ Corporation PLC and Unilever PLC, but additional support is urgently needed for all these meetings. Any suggestions from members as to suitable sponsors would be gratefully received, in confidence if need be. The Society is moving into a more international arena, which is where all that biodiversity is, with meetings suggested in the USA, in India and Bulgaria, for which sponsorship will be needed if the Society's presence is to be more than a wraith. It is particularly important to encourage student participation in the Society's meetings.

Members' attention is drawn to a Book Sale to be held after the evening meeting on 21st January 1993. The Librarian will be pleased to receive any books of any kind for the book sale, which last year raised over £300 towards the Library.

International Foundation for Science

Among its many schemes for the support of scientific research in developing countries, the International Foundation for Science has recently invited young scientists of merit in these countries to submit proposals for research projects in the

fields of forestry and agro-forestry. Particular consideration will be given to research dealing with forestry in dry areas. Anyone interested should write to the International Foundation for Science, Grev Turegatan 19, S-114 38 Stockholm, Sweden.

Support for Botanical Research in Tropical Africa

In 1971, Professor J. P. M. Brenan (then Deputy Director of the Royal Botanic Gardens, Kew, and Botanical Secretary of the Linnean Society) and I, and a few others, invited contributions to establish a Dennis Stanfield Memorial Fund. Stanfield, who had died earlier in 1971, had worked in Nigeria since 1926, latterly on botanical matters including joint authorship of the book Nigerian Trees which was published in two volumes (1960 and 1964). He was much loved and respected in Nigeria and among African botanists generally, and it seemed entirely fitting to establish this memorial to him. The purpose of the fund was to provide an Award to assist persons of scientific merit to under-take botanical research on tropical African plants.

Initially about £1000 was raised and subsequently his widow, Nancy Stanfield, has made generous additions to the Fund. It has also received royalties from the book Trees of Nigeria published by Oxford University Press in 1989, as a revision of Nigerian Trees. By 31 December 1991 the market value of the capital was £6157. The Fund and the Award scheme are administered by the Linnean Society.

The first Award was made in 1974 and now altogether 12 Awards have been made to scientists doing research on plants in Cameroun, Congo, Kenya, Nigeria and Uganda. The scheme is widely advertized and, in 1992, from 31 applicants three Awards were made totalling £1500 as follows:

(a) £600 to Dr. Bonaventure Sonke, University of Yaounde, Cameroun, for field and laboratory work on Rubiaceae in Cameroun as a contribution to the preparation of this family for *Flore du Cameroun*.

(b) £500 to Prof. Fidele Mialoundama, Universite Marian Ngouabi, Brazzaville, Congo, for work on indigenous edible plants with special reference to the domestication of *Gnetum africanum*.

(c) £400 to Miss Hellen A. Oketch Tambo, National Museums of Kenya, for phyto-chemical work on *Aloe secundiflora*.

With present resources it is only possible to make Awards every other year. Awards of about £500 each may be modest by international standards but in tropical Africa they are very significant. Furthermore the contacts established by the Linnean Society with the applicants have proved valuable.

In view of the undoubted value and success of this modest scheme, and the urgent need for increased support for research on the plants of tropical Africa, we are now seeking to increase the Fund considerably. By the end of September 1992 twenty-seven Fellows of the Society and other friends made personal contributions to the Fund. I hope that many others will feel able to assist in some way, for instance by commending the scheme to a charitable foundation or by a personal donation. Cheques should be made payable to the Linnean Society and sent to me with a note to indicate that the money is for the Dennis Stanfield Memorial Fund.

Professor Ronald Keay, Treasurer

Editor's Note: In June, the Society received £2000 from Mrs. Nancy Stanfield for her late husband's Memorial Fund, for which the Society is deeply grateful. The Society is also most grateful for contributions to the fund from C. M. Hutt, A. W. Exell, H. O. W. Eggins, B. Hopkins, H. J. Savory, R. M. Polhill, R. H. Kemp, J. Leonard, R. D. Meikle, A. B. Cozens, P. C. Randell, P. Rowe-Dutton, A. F. B. Bridges, P. Denny, J. Wyatt-Smith, G. S. Cansdale, J. M. Kennedy, J. E. M. Horne, Lord Ashby, G. Fryer, E. A. Bell, F. White, J. C. Okafor and E. Milne-Redhead, E. W. Russell, E. Ferguson and A. P. Levantis

---

From the Archives

Smith to McLeay

Norwich
Apr.27.1917

My dear Sir

I grieve very much to be obliged to give up my journey to town this week. By great care of some medical discipline, I have driven out the enemy at pres.^{t} completely, but I keep the house, and dare not go out this cold weather much less could I travel. By this care, I have no fear of not being able to go to London at the middle of May — my great object being our Anniversary — for this I shall prepare myself of by that time — hope to meet you quite well. Is there not some business to consult about for May 6, preparatory to the Anniv.^{y} —? As to the Council, I am only anxious to have Sir Chris.^{r} Pegge one. Sh.^{d} the Marquis of Bath be another?

Is there not room for 1 foreign member? I would propose Baron Alex.^{r} de Humbolt, if no other unless there be 2 vacancies — then Cuvier, or Decandolle.

Perhaps you will favour me with a line if you have anything to say, that I may ans.^{r} before Tuesday May 6.th — I am obliged to write 2 or 3 notes on business, w.^{ch} I trust you will pardon the trouble of sending to 2 penny post. That to Somerset place sh.^{d} go immediately —

I am mortified to miss that dinner.

Believe me
My dear friend
ever your's
J. E. Smith

It is quite necessary that we should have all Marsham's money by the Anniversary, or a consid.^{ble} part with a suffic.^{t} apology —

McLeay to Smith (2 years later)

Queen Square, Westminster
28th April 1819

My Dear Sir James

I received last night your Letter of the 26th and am very sorry to hear that you are prevented by indisposition from being in Town so soon as you had intended. I still hope that we shall have the pleasure of seeing you on the 4th but if your health should unfortunately not admit of this, you must not make yourself uneasy about the business of the Society for I hope we shall not be as we lately were unable to make a meeting of the Council for want of a Vice-President! For the next Council, in case of your absence I shall move henceforth that we shall nominate some of our best attendants especially if they have not been before on the Council.

The Candidates for the Foreign Members are DeCandolle, Lamarck, Pavon and Richard of whom 3 only are to be elected. I mentioned your desire to propose Swertius but Mr E. Foster was the only one present at the meeting that knew him and his writings and the signatures of six were required. Indeed I was obliged at that meeting to go about begging signatures to Pavon's certificate which Mr Lambert had suggested to have previously prepared — Altho' I did this honour to ease our friend's mind I confess to you that I am not by any means satisfied that Pavon should be elected. I know that the Linnean Society got no credit on the Continent for its list of Foreign Members and I cannot think that the addition of Pavon's name would help it. — For my own part I am only anxious about Lamarck. —

I cannot avoid mentioning that I have read with great pleasure your last pamphlet which is a sensible well written, cool and gentlemanly reply to the scurrilous attacks of the Greek professor and the Quarterly Reviewer. I must say however that I have never ceased to regret your not having published the Pamphlets for I foresaw before the publication that such a thing could not do you any good and might do you much harm —

All my family are well and join me in best wishes to you and Lady Smith,

Yours most faithfully
Alex.^{r} McLeay

Library Archives

Shortly after I retired as Treasurer, The Librarian, Gina Douglas suggested I enter the world of archival calligraphy, or is it calligraphic archives? Basically I would be asked to do such work as was necessary to make it easier for the librarian of the day to pass on information to those who frequently seek it. With time on my hands I found it difficult to face Gina and refuse, so experimentally I agreed — and joined the "Ladies of Kent".

My first allotted task was to take home the Society Roll Books and transcribe the names of Fellows who had signed the Rolls in the first two hundred years of the Society's existence. I was also to include with each name the date of signature and

the Roll page number. A simple task it seemed, requiring only time and patience, except that so large a percentage of signatures were difficult to decypher; before 1849 the dates when Fellows signed were almost non-existent and the Roll pages were sometimes numbered, sometimes not.

My completed list contained more than 4,800 names from 161 pages of the two Roll Books plus 49 illegible scribbles. The latter have not yet been identified; nor, without searching the Minutes of every Society meeting ever held or checking every name in the card index of Fellows, is it possible to identify those who were elected but who for some reason or another failed to sign the Roll.

The next exercise was in the shape of 676 letters written by various correspondents to Alexander or William McLeay between the years 1799 and 1859. My objective was to read and briefly summarise the contents of each letter, then type the writers' names, summaries, dates and place-names in a manner similar to that printed in Warren Dawson's *Catalogue of the Smith Papers* published by the Society in 1934. At first glance I thought there was work here for about nine months. In the event it took only six weeks. Unfortunately, the credit for making my task so comparatively easy is due, not to me, but to Spencer Savage, the Society's Librarian and Assistant Secretary from 1929 to 1951. At some stage during his term of office he read and summarized most of the letters addressed to the McLeays before 1925. More importantly, he hand-listed the writers in alphabetical and chronological order, thereby relieving me of so much time-consuming and tedious work.

In spite of Savage's help I still had to read through hundreds of letters, some in copperplate, some in almost unreadable hand-writing, all providing a most fascinating glimpse of life in those times, albeit so much the same as that of today. It is a pity, for instance, that the *Sun** newspaper did not exist in 1817 when the Rev. William Kirby complained so strongly that the Rev. Sheppard had slept with another man's wife! Or, commenting generally about French entomologists he complained that "Our Gallic neighbours always endeavour to put an extinguisher over the discoveries of naturalists of other nations." And, of course, there was the unfortunate case of Thomas Marsham, one of the three Society founders, and Treasurer from 1798 to 1816. During the latter years of his Treasurership he found himself in financial difficulties and "borrowed" £400 from the Society's coffers which he could not pay back. He was also in domestic difficulties and over a period of four years lost all his friends with the possible exception of Alexander McLeay and William Kirby. He died in 1819, still in debt to the Society.

After completion of the McLeay correspondence came the 146 letters dated from 1862 to 1885 to Henry Prestoe. These included 41 letters from Sir Joseph Hooker. There is also a letter from A. J. Lechmore Guppy who insisted that "our country has sunk deeper and deeper into the pits of degradation." Somewhat worse than our economic postion today! On the other hand, at Christmas, 1815, seventeen girls from an orphanage in Reigate all signed a letter of thanks for the fruit and vegetables that he had sent to the orphanage during the past year.

Then followed a mere 69 letters to George Newport from all and sundry, including two from Charles Darwin. Then a list of contributors for the purchase of the Linnaeus

and Smith collections, for a bust of Sir Joseph Banks, and for a portrait of Alexander McLeay. Then letters and other forms of correspondence, 312 in all, to B. B. Woodward.

So much for the work already done. Gina has now given me 255 letters from Lindsay Fleming to Warren Dawson. They are dated from 1962 to 1966. What causes any individual to write (not type or have typed) over four letters a month, every month, for four years to the same man at the same address I do not know. Nor does Gina. She wants me to read them all, summarise the contents and put the summaries to paper so that she can find out with as little trouble to her as possible.

Charles Hutt

* A U.K. tabloid — Editor.

Picture Quiz

The answers to our August Quiz were as follows:-

1. **Jamaica**, home of the endemic swallowtail *Papilio homerus*, largest true swallowtail butterfly in the world (illustrated in colour on the cover of the IUCN/SSC Action Plan).
2. The lepidopterist **Andrey Avinoff** (1884-1949). One of the greatest collectors of Jamaican butterflies and moths, he is credited with discovering the second area where *P. homerus* naturally occurs, in the notoriously difficult 'Cockpit Country'.
3. Avinoff, described as a man of great charm, was a Russian entomologist who worked for Grand Duke Romanoff, and attended the court of the Tsar. Following the communist revolution he fled to America in 1917, worked as an illustrator, and became an Associate Curator of Entomology, 1924 and then **Director of the Carnegie Museum**, Pittsburgh, 1926-1945.

Andrey had originally been a man of very considerable means at the court of the Tsar during which time he made extensive journeys in Central Asia from whence he amassed an enormous collection of Lepidoptera — said to be second only to the Romanoff collection itself. Sadly both collections were appropriated by the Communist government and sold off to a German dealer.

On his physician's advice Avinoff took early retirement in 1945 but his popularity was such that he was immediately made Emeritus Director — a position he held until his death.

Ironically the Museum of which Avinoff eventually became Director had been founded by one of the world's greatest philanthropists, Andrew Carnegie (1835-1919).

Carnegie was born at Dumfermline, Scotland to working class parents. His father was a handloom weaver and Chartist leader while his maternal grandfather (Thomas Morrison), a tanner and shoemaker, was one of the most irrepressible of agitators campaigning on issues ranging from the abolition of hereditary privilege and Catholic emancipation to new factory laws and a reformed Commons.

In 1848 the Carnegie family emigrated to Allegheny, Pennsylvania where they joined a little Scottish colony including Andrew's mother's sisters and brother. Andrew (aged 13) first worked in a cotton factory then in the Pittsburgh telegraph

office and from 1853-65 he was employed by the Pennsylvania Railroad of which he finally became Superintendent. He then founded the Keystone Bridge Company — made a small fortune in oil and finally in 1873 aged 38 he moved into steel production. The resulting Carnegie Company became the nucleus of the U. S. Steel Corporation and when he sold out to the government in 1901 — he received $250,000,000 in five per cent fifty-year gold bonds!

Who? (Clue- there is a loose connexion with the first Duke of Northumberland and a more definite one with topographic maps and forests).

Unlike his father Andrew Carnegie was not a believer in socialism. He was an out and out capitalist who nevertheless recognised the inevitable consequences of such a system led to the accumulation of enormous sums of money in the hands of a few industrial leaders and this held "great possibilities of evil". Carnegie believed that the millionaire was merely a trustee who held this surplus wealth for the benefit of his fellows and should use those talents by which he had amassed the fortune to distribute it "for the improvement of mankind" generally.

Carnegie's benefactions amounted to over $350,000,000 and he gave away not only his annual income but most of the principal as well. His largest gifts were $125,000,000 to the Carnegie Corporation of New York (which eventually became his residuary legatee), $60,000,000 to public library buildings, $29,000,000 to the Carnegie Foundation for the Advancement of Teaching and $22,000,000 each to the Carnegie Institutions in Pittsburgh and Washington. Of the $62,000,000 he allotted to the United

Kingdom, $10,000,000 went to the Scottish Universities Trust and $3,750,000 to the Dumfermline Trust.

Today the general public associates the name of Carnegie with libraries, but vertebrate palaeontologists thank him for providing the money for the excavation of the quarry east of Vernal, Utah (now part of the Dinosaur National Monument) out of which the Carnegie Museum amassed the greatest assemblage of Jurassic dinosaurs ever made and for providing (via the Carnegie Museum) the leading museums of the world with plaster casts of *Diplodocus carnegie.*

Our illustration first appeared in an article by L.I.Hewes, "Butterflies — try and get them" (*National Geographic Magazine 69:* 667-678, May, 1936). There was only one answer from Dr Niels P. Kristensen who will recieve a copy of the IUCN/SSC Action Plan, Swallowtail Butterflies (T.R.New & N.M.Collins, 1991).

Correspondence

1.10.92

Zoologisk Museum,
Universitets parken 15,
København.

Dear Professor Gardiner,

That enormous swallowtail butterfly can only be *Papilio homerus* Fab., endemic to Jamaica - so that is where the subject is. The hint about an east-west connection leads one to suspect that it is Andre Avinoff, who according to an introductory chapter in '*Jamaica and its Butterflies*' was an outstanding figure among butterfly investigators on this island. A comparison with the Avinoff portrait (pl.11) in H. Osborn's '*A Brief History of Entomology*' confirms the identification. Avinoff was on the staff of Czar Nicolas II; after 1917 his large Lepidoptera collection was confiscated by the revolutionary government, and he himself went to America. In 1926 he became Director of the Carnegie Museum — and he died in 1949. (That is if one can trust Osborn's information; according to my late boss L. L. Juxten's harsh review of his book, *Ent. News, 65:* 71-72, 1957, one cannot!)

Yours sincerely
NIELS P. KRISTENSEN

School of Life Sciences,
University of Liverpool,
L69 3BX

14.8.92

Dear Professor Gardiner,

Haldane himself, with great enjoyment, told me the story of his remark about 'an inordinate fondness for beetles' and I'm certain he used the word 'inordinate'. I recorded the story in very informal terms in response to a query, and you will find it (rather to my embarrassment) in print in the *Biological Journal of the Linnean Society* (of all places) 1988, vol.35, p.313. I'm surprised Haldane was so moderate in print (*The Linnean 8(3)*:14 (quoted)).

Yours
AUTHUR CAIN

Biological Diversity

The Society has been concerned to see action follow the two reports on systematic biology, one from the House of Lords Select Committee on Science and Technology and one from NERC, entitled *The New Taxonomy*. At the time of going to press (late September), the situation was summarised by the Officers of the Society as follows:

"At the Officers' meeting on 15th May, it was resolved to write to Mr. Waldegrave, the newly appointed Minister with responsibility for Science and Technology, to request a meeting with him to impress upon him the Society's concerns with the House of Lords' Select Committee Report on *Systematic Biology Research* and the NERC Report *The New Taxonomy*, which had not then appeared, and to encourage Mr. Waldegrave to offer at least modest support for the various initiatives suggested.

As a result of the letter, and at short notice, the President was invited to meet Professor W. D. P. Stewart FRS, Head of the Office of Science and Technology, on 30th June. He was accompanied by Dr. S. Blackmore, Professor M. F. Claridge and Dr. C. H. Stirton. The meeting was a cordial one and Professor Stewart asked the President to submit proposals to him as soon as possible. The President asked for comments from the group which met Professor Stewart, and from two former Presidents, Professors Berry FRSE and Chaloner FRS. The 10 proposals are summarised below*, and were sent during August. The Society understands that these have been well received, apart from 10, where Professor Stewart sees some difficulties. Professor Stewart also asked that the Society should submit proposals for the 1993 White Paper on Science and Technology, about which the President has written to members and received 27 replies to date.

At the Rio Conference, in June 1992, the UK Government announced the setting up of the Darwin Initiative. A number of organisations in the UK have collectively made a submission to the Department of the Environment on what such an initiative might comprise, and the Officers asked the President to contact some of those involved to see if the Society could be of any assistance".

***Summary of Proposals**

1. Strong support for both the NERC and House of Lords Reports, with a clear distinction between research in systematic biology and biodiversity conservation.
2. Strong support for training of systematic biologists.
3. ODA to recognise the importance of training in the UK in systematic biology for overseas scientists using wealth of expertise available in the UK.
4. Improvements in the career structure of systematic biologists, primarily in museums and botanic gardens.
5. More support for systematic biology research and databases and for basic taxonomy and curation.
6. Special funding for studies of complete endangered ecosystems leading to the formulation of conservation strategies for them.
7. Funding for the establishment overseas of new nature reserves and the maintenance of existing ones.
8. Support for ethnobotanical and economic botanical research in developing countries.
9. Support for seed and tissue culture conservation, especially of endangered species and crop plants.
10. The establishment of a systematic biology agency to coordinate funding.

Systematic Biology Research

There is a widespread and continuing concern over the dwindling support for taxonomy, at a time when the need for taxonomy is more urgent than ever before (e.g. Ingrouille, 1989, Cranston, 1990, Schminke, 1990, Claridge, 1991, Harvey, 1991, Feldmann & Manning, 1992). Indeed, new evidence suggests the situation is worse than is commonly perceived (e.g. Gaston & May, 1992). The recent report of the House of Lords Select Committee on Science and Technology on the subject of *Systematic Biology Research* (Dainton, 1992) is therefore both timely and greatly to be welcomed. It presents an admirable distillation, and acceptance of, the principal messages contained in the two volumes of written and oral evidence considered by Lord Dainton's Committee (HMSO, 1991, 1992). Accepting the vital importance of taxonomy to society and to pure and applied biology, the Committee takes on board that there has been a decline in support for taxonomic research; that the decline is especially marked in institutions of higher education; that it has been aggravated by the reduction in the numbers of taxonomists employed by museums (especially by the Natural History Museum in London); that the magnitude of the task confronting taxonomy is probably an order of magnitude greater than was considered to be the case twenty years ago; and that the urgency of the task of documenting the world's flora and fauna is now accepted (in view of the rate of habitat destruction, especially in the tropics). Furthermore the report recognises that the bulk of funding for taxonomy must continue to come from Government sources. The report comes to very similar

conclusions to that published in America, which was directed to the United States National Science Board by the Committee on International Science's Task Force on Global Diversity (Black, 1989).

The remedies suggested by Lord Dainton's Committee are, in their own words, "these modest measures". As far as funds for systematic biology research are concerned, they recommend an extra £1m per annum for five years should be made available exclusively for this type of research. This is indeed a "modest" measure. It contrasts sharply with the, more than an order of magnitude greater, recommendations of the U.S. report (Black, 1989), which many considered to be inadequate. It seems that the modesty of the proposals offered by Lord Dainton's Committee derive from a sense of reality with regard to what was considered to be politically acceptable in Britain in 1992. It is tantamount to an admission that the study of the world's biodiversity is something that currently attracts political rhetoric but not hard cash. Sadly, I must conclude that Lord Dainton's Committee was correct in this perception of the political realities in Britain today. Therefore, despite the Committee's contention that Government must remain the mainstay of funding for taxonomy in Britain, the modesty of their proposals forces upon us the necessity of looking elsewhere for the additional funds required to cope with the taxonomic task.

The cause of taxonomy does not have an obvious appeal to commercial sponsors, especially as the greatest taxonomic task remaining to be accomplished is the description and classification of the majority of the world's insects. Furthermore, because of the sheer numbers of species involved in the study of even a modest-sized family of insects, it can take years to become a competent specialist on a particular group. Also there is a long tradition (of which I am an example) of taxonomists, and of insect taxonomists in particular, starting their careers in some other field of biology, such as pest entomology or behaviourial ecology. Indeed many a distinguished insect taxonomist has had an earlier career in field biology and, I would contend, has greatly benefitted as a taxonomist from this other, field-based, experience. The dilemma confronting taxonomists in this tradition today is compounded by the fact, which emerges from the study of the history of taxonomy, that the quality of a taxonomist's work improves with experience to the extent that typically their best work tends to be accomplished when they are in their sixties. However, the current trend is against appointments to permanent posts and the funding bodies (in the words of a communication I have on file from NERC) do not consider it is their business to fund "a proposal which in essence amounts to an established taxonomist requesting funds to continue his work".

My own situation has come to be seen by many as epitomising the problem confronting several experienced taxonomists in Britain today, partly because I have struggled on against the odds where others are now out of work and/or have turned amateur. I followed one of the traditional routes into insect taxonomy. I left university suffering from the prevalent delusion that taxonomy was a yesterday's science. However, I soon discovered as a medical entomologist in the tropics (first in Belize and then in Cameroon) that much applied ecology kept running aground on the reefs of taxonomic ignorance. Furthermore, through subsequently teaching ecology for many

years at a field centre, I discovered that even in Britain our taxonomic ignorance was impeding ecological studies. In particular identification keys, let alone user-friendly keys, were lacking for many groups of organisms (see Tilling, 1987). The result of this perception was that I turned my attention to taxonomy (e.g. Disney, 1975, 1983). The upshot was that the Field Studies Council procured funding from a charitable trust in 1984 and, through the cooperation of the Department of Zoology of Cambridge University, I was set up as the first ever FSC Research Fellow in order to allow me to work on the taxonomy of Phoridae (scuttle flies) full time. The expectation was that funding would be forthcoming from some other source in due course. In the event this expectation proved ill-founded. Eventually, after repeatedly being advised that all an established taxonomist needed to do to obtain funding was to appeal to commercial and charitable organisations and individuals, in March 1989 the FSC authorised me to give it a try. The hypothesis was put to the test and was largely refuted. The disappointing results have been widely reported elsewhere (Disney, 1989a, b, 1990a, b, Ehrenfeld, 1989). The total sum raised allowed the FSC to purchase a computer for me (on which I word-processed this article) and no more. I subsequently summarised the advice offered by the establishment as "either to get lost, to change to some other field or to emigrate" (Disney, 1991). Only at the eleventh hour did I secure short-term funding from the Isaac Newton Trust (Trinity College, Cambridge) and the Harold Hyam Wingate Foundation (London). I would merely add that the recommendations of Lord Dainton's Committee provide nothing that alters the message for an established taxonomist like myself who, in the present economic and political climate, is unable to secure a permanent post in taxonomy but has to stagger from one short-term grant to another.

My own experience serves to emphasise that a more satisfactory solution is required if the problems highlighted by Lord Dainton's Committee are to be adequately addressed. The suggestion has been advanced that individual appeals, such as my own, are no real solution in the long term, even if they were successful. The alternative solution is to appeal for funds for Systematic Biology Research as a whole. The money raised should then be invested in endowment funds, whose interest would be used to support senior and junior research fellowships in perpetuity. This idea was floated prior to the publication of Lord Dainton's report (e.g. Disney & Erzinclioglu, 1988, Erzinclioglu & Fraser, 1990, Disney, 1992) but was received with limited enthusiasm, probably because it was assumed that funding was (or should be) forthcoming from elsewhere. Lord Dainton's report should, at least, serve to disabuse anyone who still believes that. It is time, therefore, that the idea of endowment funds to support taxonomy was taken seriously. A senior research fellowship requires a sum of around £250,000 to be invested to generate the interest to fund the salary, overhead and support costs. A junior research fellowship requires a smaller sum invested, largely determined by the difference in the salary required.

As part of the celebrations of the first 50 years of the Field Studies Council in 1993, the FSC is considering the establishment of an endowment fund to support research in the environmental disciplines by its staff. Where the FSC leads perhaps other bodies might follow, by pushing for similar endowment funds to support systematic biology research. These could be either a general fund administered by a body like the Linnean

Society and an insect taxonomy fund administered by the Royal Entomological Society, or a single fund administered by one body.

REFERENCES

BLACK, C.C. (Chairman) (1989) *Loss of biological diversity: a global crisis requiring international solutions.* A report to the National Science Board, 89-171, I-VII+ 1–19.

CLARIDGE, M. F. (1991) Biodiversity, systematic research and the Linnean Society. *The Linnean 7(3)*: 22–24.

CRANSTON, P.S. (1990) Biomonitoring and invertebrate taxonomy. *Environmental Monitoring and Assessment 14:* 265–273.

DAINTON, Lord (Chairman) (1992) Select Committee on Science and Technology *Systematic Biology Research.* Volume I Report. HL Paper 22-1. London: HMSO.

DISNEY, R.H.L. (1975) *A key to British Dixidae.* Freshwater Biological Association Scientific Publication, 31: 1–78.

DISNEY, R.H.L. (1983) A synopsis of the taxonomist's tasks with particular attention to phylogenetic cladism. *Field Studies, 5:* 841–865.

DISNEY, R.H.L. (1989a) Who funds insect taxonomy? *Antenna, 13:* 161–162.

DISNEY, R.H.L. (1989b) Diversity — Does anyone care? *Conservation Biology, 3:* 414.

DISNEY, R.H.L. (1990a) Who funds taxonomy? *The Linnean, 6(1):* 12–14.

DISNEY, R.H.L. (1990b) FSC Research Fellowship. *Field Studies Council Annual Report*, 1989, 33–34.

DISNEY, R.H.L. (1991) Evidence. In HMSO (1991) pp.71–73.

DISNEY, R.H.L. (1992) Evidence. In HMSO (1992) p.305.

DISNEY, R.H.L. & ERZINCLIOGLU, Y.Z. (1988) The encouragement of comparative biology. *The Linnean, 4(3)*: 22–23.

EHRENFELD, D. (1989) Diversity — is anyone listening? *Conservation Biology*, 3, 415.

ERZINCLIOGLU, Y.Z. & FRASER, N.C. (1990) Correspondence. *The Linnean., 6(2)*: 9–10.

FELDMANN, R.M. & MANNING, R.B. (1992) Crisis in systematic biology in the "age of biodiversity". *Journal of Palaeontology* 66: 157–158.

GASTON, J. & MAY, R.M. (1992) Taxonomy of taxonomists. *Nature* 356: 281–282.

HARVEY, P.H. (1991) The state of systematics. *Trends in Ecology and Evolution* 6: 345–346.

HMSO (1991) House of Lords Select Committee on Science and Technolgy *Systematic Biology Research*, written evidence received up to 21st May 1991. HL Paper 41. London: HMSO.

HMSO (1991) House of Lords Select Committee on Science and Technology *Systematic Biology Research*, Volume II — Oral evidence and written evidence received after 21st May 1991. HL Paper 22–II. London: HMSO

INGROUILLE, M. (1989) The decline and fall of British taxonomy. *New Scientist* 7 Jan.: 64.

SCHMINKE, H.K. (1990) Bedeutung und Probleme praxisorientierter Taxonomie. *Verhandlungen der Gesellschaft für Ökologie (Osnabrück) 19*: 236–244.

TILLING, S. (1987) Education and taxonomy: the role of the Field Studies Council and AIDGAP. *Biological Journal of the Linnean Society, 32*: 87–96.

R.H.L.DISNEY

Gene frequencies in an artificial Wirral colony of the Scarlet Tiger Moth, (*Panaxia dominula* L.) in the four years after its rediscovery: 1989–1992.

CYRIL A. CLARKE

Department of Genetics and Microbiology, University of Liverpool

F. M. M. CLARKE

43 Caldy Road, West Kirby, Wirral, Merseyside

AND

D. F. OWEN

School of Biological and Molecular Sciences, Oxford Polytechnic, Headington, Oxford.

In the original paper in this journal (Clarke, Clarke and Cook, 1990) we reported that the *medionigra* gene frequency was 27% compared with an initial one of 25%, the put-down situation in 1961. Various suggestions were made for this, but several experts thought that chance was the most likely explanation.

The colony has continued to flourish (see Clarke, Clarke and Owen, 1991) and we now have detailed information on the frequencies up to 1992. Our method of study is as follows:

Early each May we collect up to 50 last instar caterpillars scattered about the colony and breed them in our West Kirby home to find out the frequency of the various adult forms. We then visit the colony periodically throughout the flying season capturing and releasing a sample of the insects and scoring their patterns. The interval between visits is such that it is considered unlikely that the same moths are scored twice. On dull days the scoring is particularly easy as the moths were not difficult to see when settled.

The results are shown in the table, and it will be seen that the proportions of the three forms are similar to our original finding, with *medionigra* running at about 20%. This is most unexpected in relation to the large Oxford colonies at Cothill and Hinksey, which have been extensively reported elsewhere (Ford, 1975) and where *medionigra* is at a disadvantage until it drops to about 3%. However, at this level a courtship advantage apparently appears and the numbers rise (Ford, 1975).

The interesting point is why in the Wirral Way the Hardy-Weinberg equilibrium has remained virtually unchanged; the reasons are perhaps obscured because we do not know anything of the frequencies of the forms between 1961 and 1989. Philip Sheppard, who put the colony down, died in 1976 but we have no record of his findings,

and nor can any of his friends and colleagues remember the trend of the frequencies. We know however that he continued searching the colony until at least 1969 and possibly longer (W. W. Macdonald, personal communication, 1992).

Two possibilities have been suggested. The classical one, that of Ford (1975) and Sheppard (1951) is that during the intervening years the *medionigra* had declined but was now in the process of increasing — but the figures are remarkably stationary and the percentages large.

The second explanation is that the findings in the Oxford region are due to migration between the various colonies there — small ones as well as large — and that this was mainly the result of assembling by virgin females — potenially altering the gene frequencies. This could not have taken place in the Wirral because there were no other colonies with which genes could have been exchanged. We have some evidence that *dominula* females do assemble. We have had two males from the Wirral colony attracted at night by virgin females to an assembly trap in our garden about 1/3 mile away. On the other hand, virgins in cages in our garden, put with males for mating

The Wirral Way *dominula* colony: some data on the first four years, following re-discovery in 1989

	Random sample – i.e. up to about 50 fully grown caterpillars collected each year in the last instar, and emergences recorded (all moths kept)				
Year	Dates collected(n)	Emergences			
		typical	*medionigra*	*bimacula*	total
1989	1.5-13.5 (30)	14	12	2	28
1990	1.5-9.5 (26)	16	7	1	24
1991	1.5-9.5 (51)	32	19	0	51
1992	1.5-13.5 (45)	32	11	0	43
	Moths accurately identified in colony on visits every few days, each year. (Moths only caught temporarily; none kept)				
	Dates of flying season	typical	*medionigra*	*bimacula*	total
1989	16.6-11.7	22	15	3	40
1990	2.6-11.7	96	28	4	128
1991	21.6-18.7	44	33	1	78
1992	6.6-5.7	39	19	2	60

The frequencies among emergences from larvae and in wild moths observed in each year are similar so it is reasonable to combine them. If that is done there are fewer *bimacula* than expected in 1991 but otherwise the genotype frequencies are in Hardy-Weinberg equilibrium.
The estimated composition of the colony is now between 600 and 1000 moths in the season.

by day, have not attracted wild males from the colony, whereas in the colony itself males soon respond to the virgins which we take down there. In the Oxford region, population sizes in 1991/2 were by far the highest since records began more than 50 years ago. Many moths left the main populations and individuals were reported in places where they had not been seen before. We think that from time to time (especially in years like 1991/2) there is widespread inter-population contamination, enhanced by the ability of the females to assemble males, and that this is a major factor contributing to the low but variable frequency of the *medionigra* gene in the Oxford region. Further work is necessary but we prefer this simple hypothesis to the more complicated one of natrual selection affecting gene frequency described by Sheppard (1951).

Another anti-Oxford finding seems worth reporting — it will be seen from the table that the larval loss in our last instar larval sample is small. This is in stark contrast to what Ford (1975) reported: "The caterpillars were often present at Cothill in vast numbers . . . but very curiously they are principally eliminated when nearly full fed and during the pupal period. This death seems to be due to some unkown factor such as bacterial or virus disease, not to insect parasites." Sheppard (1951) demonstrated the important fact that there is no differential viability between the typical and *medionigra* forms. This leads to an interesting conclusion when considering the Wirral Way colony. Here the last instar larval mortality is very low and we know the proportions of the moths they produce. These are paralleled by the proportions of the wild moths during the flying season, suggesting that they too have a low last instar mortality, otherwise the proportions of the various forms of the moth would differ between the two groups. The Oxford experience seems to be confined to that centre of learning and may be something to do with the way the caterpillars were bred.

So the Wirral Way is still full of interest and controversy, and it has the great advantage that it is only three minutes drive from our West Kirby home.

ACKNOWLEDGEMENTS

We are grateful to Professor W. H. Dowdeswell and Dr L. M. Cook for many useful discussions, to the Nuffield Foundation for financial support and to Mrs Sally Thompson for technical help.

REFERENCES

CLARKE, C. A., CLARKE, F. M. M. and COOK, L. M. (1990). *The Linnean, 6(2):* 13-16
CLARKE, C. A., CLARKE, F. M. M. and OWEN, D. F., (1991). *Proc. R. Soc. Lond. B, 244:* 203-5
FORD, E. B. (1975). *Ecological Genetics*, 4th ed. Chapman and Hall
SHEPPARD, P. M. (1951). *Heredity, 5:*349-378

Coats of Himalayan Ruminants Elucidated by Study of a "Yeti" Skin

M. L. RYDER

4 Osprey Close, Southampton, SO1 8EX, U.K.

Gross and microscopic observations of the coat of a supposed "yeti" akin from Tibet led to its identification as tahr (*Hemitragus jemlahicus*), a species intermediate between sheep and goats. Details of coat structure and hair measurements are recorded and compared with those of other little-known Himalayan Ruminants: wild and domestic yak (*Bos mutus* and *grunniens*), serow (*Capricornis sumatrensis*), goral (*Nemorhaedus goral*) and ibex (*Capra ibex*).

Introduction

A supposed yeti skin brought back from Nepal by the mountaineer Alan Hinkes in the spring of 1990 was made available for study by Iain Walker of the *Mail on Sunday*. It was said to be from an animal preserved in a glacier in Tibet. Shackley (1983) indicated that sightings of yeti in this region are ape-like, so the hair of primates was compared. Eventual identification as tahr (*Hemitragus jemlahicus*) was of particular interest as it extended my study of the goat-antelopes of the Himalayas as sources of the textile fibre "shah-tus", and of the ibex as a possible ancestor of the domestic cashmere goat, the underwool of which forms cashmere fibre (Ryder, 1987). The findings add to our meagre knowledge of these species (Schaller, 1977).

Methods

Since animal hair in general lacks striking features enabling the species to be readily identified, a process of elimination was followed. A small tuft of the "yeti" coat was taken and a short length was cut from the base of this sample to make a whole mount preparation. A projection microscope was used to measure the diameter of 100 fibres from the coat. These measurements are made in microns and expressed as a histogram, which shows the distribution of hair diameter and in turn defines coat structure and type. Hair measurements for comparison were made of one sample from wild yak (*Bos mutus*) and five from domestic yak (*Bos grunniens*), two samples of ibex (*Capra ibex*) coat and three of tahr (*Hemitragus jemlahicus*) plus one each of serow (*Capricornis sumatrensis*) and goral (*Nemorhaedus goral*). When I asked to see the "yeti" material that McNeely *et al.* (1973) had seen at the Natural History Museum, London, the only item located was an imitation scalp made from cattle skin.

Observations

Gross features

The skin was a strip from over the shoulders, the parting of the hair along the backbone being evident (Plate 1). It measured 38cm anterior-posteriorly and 46cm from side to side, but with a taper to about 30cm wide at the anterior side of the strip. No inguinal region was evident. The skin was 2mm thick, which is greater than in

Plate 1.The "yeti" skin held by the Nepalese couple who passed it to Alan Hinkes. (Photo Alan Hinkes)

sheep or goats, but not as thick as in yak.

The hair was particularly long and straight, and was mostly dark brown in colour. There was no paler (agouti) band near the tip of the hairs (associated with a white-belly). The hairs had a paler base (caused by a reduction in pigment formation at the end of the hair growth cycle in winter, Ryder, 1973). This indicates death in winter and that the coat length is the maximum. The hairs were 20cm long and formed an outer coat, obscuring a very fine, white underwool only 2cm in length. Such coat structure, with underwool lacking pigment, is not found in bears and primates, but is typical of many species of the Ruminant (*Pecora*) Sub-order.

Towards the anterior side of the strip the coat had a mixture of white hairs. This part of the coat sloped away from the edge of the skin, but where the coat colour changed to brown one quarter of the way across the strip, the hair slope changed direction, so that the hair tips of the two colours pointed towards one another and in places overlapped. The white part apparently formed a ruff, and the same change in hair slope was later seen in tahr skins.

Microscopic details

Microscopic examination confirmed the big difference in thickness between the outer hairs (forming 20% of the coat) and the underwool (Table 1). Burns (1962) did

not mention the underwool of the Khumjung "yeti" scalp, but estimated the coarsest hairs to be 100-200 microns in diameter, a common thickness in goats, but greater than any in the present study.

The medulla (usual in coarse hairs) had a latticed structure, which again is not found in bears or primates, but is typical of wild sheep and goats. (The hairs of the Khumjung scalp, likened to the serow by Burns (1962), had non-latticed medullae). These observations also exclude fur-bearing mammals, which have less difference in size between the outer hair and underwool, and also commonly have a "ladder" medulla. The lattices of the medulla in this "yeti" hair were of a size and shape I have previously associated with goats rather than with sheep. On the other hand, the margins of the scales of the cuticle of the underwool had a "near" distance apart and so were comparable with sheep and different from the "distant" margins of goat underwool and the "close" margins of human hair. I had previously noted that tahr underwool had a cuticular

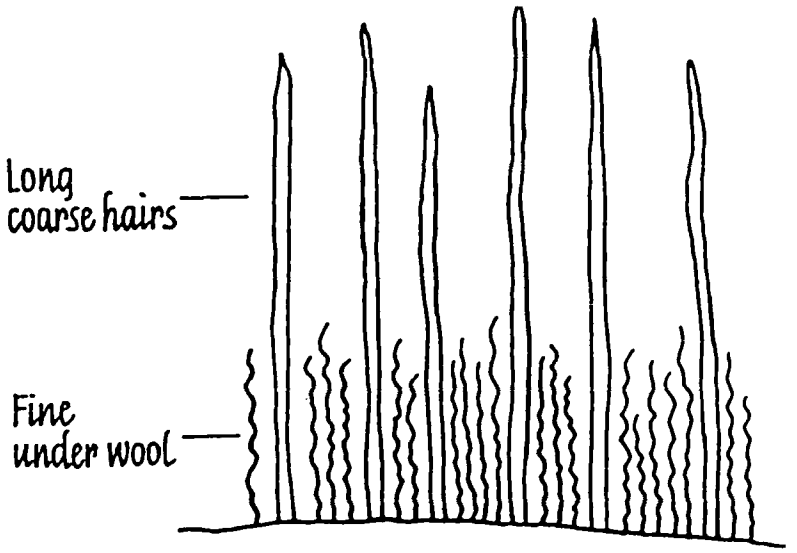
Table 1. Hair diameter measurements in microns

Sample	Wool range	Mean ±S.D	Mode	Hair range	Mean ±S.D.
Yak					
wild (NHM) (1)	36–96,124	64.2±16.5	60	fine lacking	
domestic (NHM) (2a)	18, 44–112	76.3±18.6	79	fine lacking	
(2b)	10–30	19.4±3.0	19	34–80	50.6±14.9
(3)	16–84	32.0±15.6	20	continuous distribution	
commercial samples					
(BTTG)	10–54	25.9±10.3	20	continuous distribution	
(Nina)	15–34	24.2±5.3	26	36–118	62.0±24.1
Serow					
NHM 24.5.29.1 belly	18–34	25.5±3.9	26	38–110	56.6±21.8
Goral					
NHM 45.1.8.325	8–28	12.5±4.4	12	40–62	51.2±9.2
Tahr					
NHM 96.11.21.1 ? belly	8–34	15.2±4.1	15	36–96	61.5±15.6
NHM 96.11.21.1 back	12–28	15.4±3.5	14	34–78	54.8±14.9
NHM no no. shoulder	10–26	18.0±2.7	18	28–88	48.3±19.0
"Yeti"	12–28	16.9±2.7	16	70–180	140.9±36.6
Ibex					
NHM 41.596	10–24	15.8±3.3	15	34–140	71.4±28.3
NHM 75.10.9.2	8–26	15.2±3.5	14	39–106	65±16.8

NHM = Natural History Museum
Hairs outside the main range are listed separately

scale pattern more like that of sheep than goats.

The hair diameter measurements are shown in Table 1 with other hair measurements for comparison. In the "yeti" sample, 20% of the underwool fibres had slight natural pigmentation, while 96% of the outer hairs were densely pigmented. The pigment in the underwool was concentrated towards one side of the fibres, which is a feature of ruminants, and was noted in the Khumjung scalp by Burns (1962). She also noted diffuse pigmentation, which I had earlier noted in the tahr.



(from the book *HAIR* by M.L. Ryder, published by Edward Arnold in 1973)

Fig.1.Coat structure of the goat-antelopes (from Ryder, 1973)

Elimination sequence and descriptions of comparative material

If one goes through the different families of the Ruminants (in the area) as follows: this "yeti" skin is not from deer (Cervidae) because deer have a shorter, bristly outer coat (Ryder & Kay, 1973). Within the Bovidae it is not cattle (Bovinae) because these do not have a double coat, nor is it yak because of the different coat structure evident by eye (Table 1). To the eye, the coat structure of the wild yak appeared more like that of a hairy domestic sheep or a goat than that of an ox, with wavy heterotype hairs up to 23cm long and a dense underwool of medium, as well as fine fibres. What appeared to be different coat types, like the different fleece types of domestic sheep (Ryder, 1987), were shown by the hair measurements (Table 1) to be due to seasonal variation like that seen in goats (Ryder, 1970). Samples 2b and Nina have the typical bimodal winter distribution of coarse, outer hairs and fine underwool. The wild and 2a samples had mainly outer hair, the lack of underwool perhaps indicating the late summer coat before the underwool has grown. Samples 3 and BTTG, with a continuous fibre diameter distribution, represent the early summer coat in which the hairs have not yet become as coarse as in winter. The yak hairs were distinctly bovine under the microscope — straight with pigment in the cortex but not in the cuticle — giving the hair a characteristic, pale "rind". The medulla was non-latticed.

Of the remaining Sub-family, the Caprinae, it is not Tribe Saiga because these have a sandy colour. Considering Tribe Rupicaprini in detail: Serow (*Capricornis sumatrensis*), although an animal of the sub-tropics (Schaller, 1977), its description suggests this skin and the serow were implicated in the Khumjung scalp. The serow is dark and self-coloured with long, coarse hair and a long (40cm) white or brown mane (Macdonald, 1984).

Goral. Schaller (1977) placed this animal south of the Himalayas, but according to Macdonald (1984) it ranges from north India to south east Siberia. Although it has long body hair and a short mane, its variable colour does not correspond with this "yeti" skin.

Tribe Ovibovini: Takin (*Budorcas taxicolor*), can be excluded because of its tan colour.

Tribe Caprini (sheep and goats): Tahr. This is a Himalayan animal which Schaller (1977) shows as being restricted to Nepal. It had a thick skin, copper to black, self-colour hair and a long white ruff (Macdonald 1984). The hair diameter range corresponds to that of this skin (Table 1). The Khumjung scalp could well have been made from tahr skin rather than serow.

Blue sheep (*Pseudovis nayaur*). This Himalayan animal can be excluded because of its (grey) colour.

Ibex. Although distributed more to the west and north of Tibet (Schaller, 1977), this wild goat has a similar colour and coat structure to this "yeti" skin, but the hair is much shorter.

Argali (*Ovis ammon*). This Tibetan wild sheep can be excluded because of its light brown colour and coat structure.

The process of elimination and detailed examination narrowed the possibilities to the Rupicaprids: mainland serow and goral; and the Caprinid tahr. An examination of skins of these showed that the latter had most in common with the "yeti" skin. The hair of five tahr skins was particularly long (15cm), the 2cm underwool was noticeably dense and the skin exceptionally thick (2-3mm). The hair was dark brown with a white base, with a change to white on the shoulder, the key here being a change of hair slope to form a whorl, which created the ruff, and which was not seen in the serow and goral.Despite the apparent lack of agouti banding on the hairs, all the tahr reference skins had a white belly.

Discussion

Descriptions of previous "yeti" skins have placed too much reliance on individual hairs (McNeely *et al.* 1973; Shackley, 1983). This ignores the existence of more than one type of hair in the coat, and the need to define its structure by hair measurement. Despite this it is difficult to distinguish closely related species. They "clutch at straws" by emphasising a casual reference to monkey-like features and the Khumjung scalp mites being different from serow mites (Hill, 1961). Shortly after the paper of Hill (1961) appeared it was known that the mites were "a common pest of stored products" (Burns, 1990). Since this investigation began as a study of a "yeti" skin, this note should end by saying that despite the review of "yeti" sightings by Shackley (1983),

skin or hair remains are still lacking.

REFERENCES

BURNS, M. (1962). Report on a Sample of Skin and hair from the Khumjung Yeti Scalp. *Genus, XVIII (1)*:3-11.

BURNS, M. (1990). Personal communication.

HILL, W.C. Osman (1961). The Abominable Snowman. *Oryx, 6:* 86-98.

MACDONALD, D. (Ed.) (1984). *Hoofed Mammals.* New York: Torstar.

MCNEELY, J.A., CRONIN, E.W., & EMERY, H.B. (1973). The Yeti - not a Snowman. *Oryx, 12:* 65-73.

RYDER, M.L. (1970). Structure and Seasonal Change in the Coat of Scottish "Wild" Goats. *Journal of Zoology, London, 161:* 355-362.

RYDER, M.L. (1973). *Hair.* Studies in Biology (41) London: Arnold.

RYDER, M.L. (1987). Evolution of the Fleece. *Scientific American 255 (1):* 112-119.

RYDER, M.L. & KAY, R.N.B. (1973). Structure of, and Seasonal Change in, the Coat of Red Deer (*Cervus Elaphus*). *Journal of Zoology, London, 170:* 69-77.

SCHALLER, G.B. (1977). *Mountain Monarchs - Wild sheep and goats of the Himalaya.* Chicago: University Press.

SHACKLEY, M. (1983). *Wildmen - Yeti, Sasquatch and the Neanderthal Man Enigma.* London: Thames and Hudson.

Sir Joseph Hooker and India

RAY DESMOND
25 Alexandra Road, Twickenham, London TW1 2HE

The Hooker Memorial Lectures originated from a bequest by Sir Joseph Hooker to the Linnean Society. Henry John Elwes, naturalist and sportsman, whose desire to visit the Indian subcontinent had been aroused by reading Hooker's *Himalayan Journals*, offered himself in 1913 as the first speaker in the series. Having travelled in the footsteps of Hooker in Sikkim during the 1870s he, most appropriately, talked on "The travels of Sir Joseph Hooker in the Sikkim Himalaya". Unfortunately Elwes never submitted his paper for publication. For whatever reason, it was decided by Council that it did not qualify as the first Memorial Lecture — this honour went to Professor F.O.Bower with a paper on "The natural classification of plants" in 1917. I was surprised to discover that not one of the subsequent lecturers chose to speak about Sir Joseph's connections with India, a country for which he had an abiding affection and to the elucidation of whose flora he devoted so much of his attention. That omission I hope to put right today.

I think we will be better able to appreciate the extent of Hooker's contributions if, first of all, we consider briefly some earlier botanical observations and investigations in the subcontinent.

Europe's awareness of the Indian flora gradually evolved through reports of travellers and soldiers and of merchants engaged in the profitable spice trade. Herodotus mentions cinnamon and provides possibly the earliest reference to Indian cotton. Theophrastus describes some of the plants observed by the troops of Alexander the Great who invaded northern India in 326BC: the jack-fruit, *Artocarpus heterophyllus*, for instance, bamboos, and the banyan, *Ficus benghalensis*, whose canopy of aerial roots made it an object of curiosity and comment for all travellers. Strabo's *Geography* and Pliny the Elder's *Natural History* added to the growing corpus of knowledge on Indian plants, the latter paying particular attention to spices and aromatics, much coveted by Roman society. When Marco Polo passed through India on his way home from China in the late thirteenth century, he noted approvingly the abundance of pepper and displayed a merchant's perception of the manufacture of indigo. The multifarious uses of the coconut palm impressed the missionaries Friar John of Montecorvino and Jordanus of Séverac. But these were casual and superficial observations made by travellers without any botanical expertise, whose curiosity was stimulated solely by the novelty of the vegetation. The opportunity and the desire to make a more intensive investigation of the flora came only after the establishment of the Portuguese on the western seaboard of India at the beginning of the sixteenth century.

Garcia da Orta (*c*1501–1568), a surgeon in Portuguese Goa, enjoys the distinction of being the first European to study Indian plants with the critical eye of a botanist, even growing them in his garden. His *Coloquios dos simples e drogas he cousas mediçinais da India*, published in Goa in 1563, concentrated, as the title indicates, on

plants of medicinal value. Fifteen years later another physician in the Portuguese settlement, Christobal Acosta (*c*1525—*c*1594), also published an account of some of India's medicinal plants: *Tractado de las drogas, y medicinas de las Indias Orientalis.* In Latin translations, the botanist Clusius introduced both works to a wider European audience.

The Dutch, who had supplanted the Portuguese in much of southern India by the mid-seventeenth century, produced the first regional floristic survey. Hendrik Adriaan Van Reede tot Drakenstein (1636–1691), soldier and administrator in the service of the Dutch East India Company, engaged Indian scholars and physicians to supervise the collection of plants in Malabar on the west coast (now part of the State of Kerala). Artists, at least two of whom had been recruited from the Dutch garrison at Cochin, drew the plants which were engraved for the twelve magnificent volumes of the *Hortus Malabaricus* (1678–1692), published in Amsterdam. Linnaeus based many of his new names on its plates and descriptions and its dominance in the literature of the flora of South Asia remained unchallenged until the publications of Roxburgh and Wallich.

Nicolaus Burman's *Flora Indica* (1768) pioneered the application of Linnaeus's binomials in Indian floristic studies. One of Linnaeus's students, Johann Gerhard Koenig (1728–1785), introduced his master's methodology to the missionary botanists at the Danish settlement of Tranquebar in South India. Koenig transferred to the British East India Company in 1778 as Naturalist in the Madras Presidency; his premature death seven years later was a setback to the advancement of Indian botany and a grievous personal loss to William Roxburgh who sometimes joined him on botanical forays.

Roxburgh was a surgeon in the service of the British East India Company which by the close of the eighteenth century was the dominant European power in the subcontinent. Being a commercial body dedicated to the interests of its shareholders, it encouraged its officials in India to develop the country's natural resources. Its surgeons who had acquired some botanical knowledge during their medical training were obviously the best qualified personnel to investigate the vegetation; many of the great names in Indian botany — Roxburgh, Wallich, Buchanan, Griffith and Wight —— had joined the Company's medical service. William Roxburgh (1751–1815), the first salaried Superintendent of the Calcutta Botanic Garden, founded by the Company in 1787, supervised the collection of plants and their delineation by native artists for *Plants of the Coast of Coromandel* (1795–1820), the first work to rival Van Reede's *Hortus Malabaricus*. The Asiatic Society of Bengal, formed in 1784 by the polymath, Sir William Jones, gave encouragement and direction to an earnest coterie of botanists, many of them amateurs.

Roxburgh's *Flora Indica*, posthumously published in 1820–24, included Nepalese plants contributed by Nathaniel Wallich (1786–1854), the next Superintendent of the Botanic Garden. An impetus was given to Indian studies in Europe through the distribution of Wallich's vast herbarium and the accumulated collections languishing in the East India Company's Museum in London, undertaken while he was on leave in England from 1828 to 1832. The Linnean Society of London received the type set of specimens in 1832 (transferred to Kew Gardens in 1913). Wallich's *Plantae*

Asiaticae Rariores (1829–1832) emulated Roxburgh's *Plants of the Coast of Coromandel* in the grandeur of its conception and the opulence of its plates.

With Wallich on sick leave at the Cape in the 1840s, William Griffith (1810–1845) took temporary charge of the Calcutta Botanic Garden. Like Koenig he died before the maturity of his promise; his journals, posthumously published but inadequately edited, reveal an original mind that encompassed systematics, phytogeography and ecology. His friend Robert Wight (1796–1872) matched him in ambition, energy and productivity. His *Prodromus Florae Peninsulae Indiae Orientalis* of which only the first volume appeared in 1834 with G.A.Walker-Arnott as co-author, abandoned Linnaean classification for De Candolle's natural system. His *Illustrations of Indian Botany* ceased publication in 1850 while Joseph Hooker was botanizing in northern India.

Through his father's connections and influence, Joseph Dalton Hooker (1817–1911) obtained the post of Assistant Surgeon and Naturalist on the voyages of HMS *Erebus* and *Terror* to Antarctica in 1839. Advised by friends, after his return in 1843, that he should seriously consider himself a contender for the chair at Edinburgh should Robert Graham retire through ill-health, he gave a course of botanical lectures there in May 1845, but when Graham died a few months later it was John Hutton Balfour and not Hooker who succeeded to the post. Again his father stepped in by recommending his son for the appointment as botanist to the Geological Survey in 1846. By this time Hooker was well into writing his *Flora Antarctica* but the urge to travel once more became irresistible. Even while serving on HMS *Erebus* he had contemplated future expeditions. He confided his liking for botanical exploration in a letter to George Bentham in November 1842. "If entirely my own master, I would not object to embark once more for a distant climate for the purpose of Botany, and to explore the Islands of the South Seas, especially the Society and Sandwich groups. I might prefer the Himalaya regions; but these ought to be investigated and are in progress, by the officers of the Hon. E. India Company; besides the expense of travelling there is dreadful". (1) He tells his grandfather in July 1847 that he was ready "to make any sacrifice to get to the tropics for a year, so convinced am I that it will give me the lift I want, in acquiring a knowledge of exotic Botany". (2)

An expedition to the Andes seemed a possibility; accompanying his friend, Hugh Falconer, about to take up the post of Superintendent at the Calcutta Botanic Garden, was another. Thomas Thomson, an old friend from student days at Glasgow, and already in India, had been detailed to join a boundary commission in Kashmir. Would there be a chance of meeting up with him? Although prepared to travel anywhere, India, and in particular the Himalayan mountains, attracted him the most. One of the travel books that had impressed him as a young man had been Samuel Turner's *Account of an Embassy to the Court of the Teshoo Lama in Tibet* (1800). But there were more compelling reasons for going to India. Kew Gardens where his father was Director had forged links with India as far back as the late eighteenth century when Sir Joseph Banks was in charge. Joseph Hooker's first contribution to botanical literature in 1837 had described three new Himalayan mosses in his father's *Icones Plantarum*. His father had also published his son's identification of some mosses collected in the East Indies and in northern India in his *Journal of Botany* in 1840.

Lord Auckland, First Lord of the Admiralty and former Governor General of India, authorized Joseph Hooker to proceed to India on reduced naval pay for two years collecting plants for Kew with a third year in Borneo assessing the agricultural prospects of the island of Labuan. When the Borneo project was cancelled after Lord Auckland's death, he was allowed a third year in India. Before his departure in November 1847 on the ship taking the new Governor General, Lord Dalhousie, to India, Hooker received a letter from Charles Darwin wishing him well. "It will be a noble voyage and journey, but I wish it was over, I shall miss you selfishly, and always to a dreadful extent". Another warm farewell came from Alexander von Humboldt who nearly thirty years earlier had planned an ambitious trip to India and the East Indies, scheduled to last five year, but had been prevented by a bureaucratic and suspicious East India Company. He suggested some of the observations and records Hooker might usefully make in the Himalayas.

In January 1848 Hooker reached Calcutta where Hugh Falconer was repairing the damage to the Botanic Garden inflicted upon it by William Griffith and John McClelland during their brief management. Hooker was appalled by "the indiscriminate destruction of the useful and ornamental which had attended the well-meant but ill-judged attempt to render a garden a botanical class-book". (3) During his temporary superintendency, Griffith's plant collectors had briefly visited Sikkim in 1843 but since its flora was still virtually unknown both Falconer and Lord Auckland independently recommended its exploration to Hooker. "No part of the snowy Himalaya eastward of the north-west extremity of the British possessions had been visited since Turner's embassy to Tibet in 1789". (4)

Delayed by the monsoons, Hooker acclimatized himself with short botanical excursions in the hills of south western Bengal and along the Soane river before proceeding to Darjeeling which had been ceded to the British by Sikkim in 1835. At this hill station he became the guest of the reclusive naturalist and former British Resident at Khatmandu, Brian Hodgson. During local excursions he encountered his first Asiatic rhododendrons and magnolias. He mounted, labelled and drew the plants which local Lepchas brought to Hodgson's bungalow. He taught these independent and resourceful hill people how to collect and dry plants; when he went to Nepal his chief plant collector was a Lepcha. While delicate negotiations were under way for Hooker's entry into Sikkim, Hodgson through his contacts with the Nepalese government, enabled Hooker in the autumn of 1848 to spend three months in eastern Nepal — the first European allowed to botanize beyond the limits of the Khatmandu valley.

Accompanied by an escort of Nepalese soldiers, an interpreter, "three Lepcha lads to climb trees and change the plant papers", more Lepchas to carry stores and scientific equipment (in all a party of 56), Hooker marched as far as the sub-alpine region of Wallanchoon, crossing briefly into Sikkim by the Islumbo Pass, eventually returning to Darjeeling in mid-January 1849 with plants, geological specimens and also native artifacts for the Kew Museum. He dressed, so he informed his mother, as he always did in Scotland, carrying in addition an umbrella as protection against the sun. He liberally dusted all his clothing with snuff in a vain attempt to deter leeches. A couple of thick blankets thrown over the branch of a tree served as a tent where, at the end of

each day, he wrote his journal by candle light, added data to his meterological register and labelled and put away the plants collected. A constant worry was the availability of suitable drying paper for pressing his plants. He found sugar-refining paper purchased in Calcutta the best for his purpose, and by changing and drying the paper every day, was able to re-use it.

A notebook recorded not only the day's collection but also instant sketches made on the trek. "I always carried my notebook and pencil tied to my jacket pocket, and generally walked with them in my hand. It is impossible to begin observing too soon, or to observe too much: if the excursion is long, little is ever done on the way home". (5) It soon became a habit to make rapid pencil sketches of topography and plants, adding a touch of watercolour whenever necessary. Modestly, he considered them to be no more than an *aide-mémoire*; an apology, for example, accompanied a drawing of a rhododendron which he sent to his father: "I wish it were better, but my rough life of late has spoiled my touch in drawing, and my eyes are not as good as they used to be". (6)

His first batch of seeds to Kew Gardens, received about September 1848, contained little that was new; *Rubus* and orchids arrived the following month. Another consignment of orchids reached Kew in December, many still alive, but few of the seeds from East Nepal received the following August were viable. Then in November 1849 the first gathering of seeds from Sikkim was delivered to Kew.

Since Hooker's second expedition would take him to the high mountain ranges of Sikkim, he added snow boots, 'blanket dresses', and a tarpaulin to throw over his blanket tent to the equipment he was assembling. Archibald Campbell, Superintendent of Darjeeling and Political Agent to Sikkim, promised to despatch fresh supplies of food every fourteen days. In May 1849 Hooker and his retinue of soldiers, Lepchas and Bhutanese entered Sikkim with the north-eastern frontier bordering Tibet as their goal. When his progress was hindered by Sikkimese officials blocking paths, destroying bamboo bridges and holding up food supplies, Campbell intervened, demanding an end to their harassment. He joined Hooker's party and briefly they crossed into Tibet, an imprudent act which the Rajah of Sikkim feared might antagonize the Chinese. Both men were forcibly detained by the Sikkimese in an attempt to put pressure on the Government of India to repeal or relax certain restrictions imposed upon their country by the British. As the Government representative, Campbell was singled out for rough treatment and although Hooker remained a captive he was not molested. Punitive action by British troops secured their release but Hooker had lost all his scientific instruments and the greater part of his collections. Despite this loss, he had no doubts that this Himalayan expedition "in a botanical geographical point of view had answered my purposes beyond my most sanguine expectations". (7)

Safely back in Darjeeling, he now considered other territories for exploration. The hostility of the Bhutanese discouraged any expedition to their country: "I would not go there for the world, without 500 men in front of me and as many in the rear". (8) Lord Dalhousie recommended another trek in Nepal but the absence in England of its ruler, who alone could guarantee his safety, ruled out that option. His friend Thomas Thomson who had just completed his mission in the western Himalayas arrived in

Darjeeling in 1850, and so they agreed to explore together the Khasia Hills in eastern Bengal, concluding with a brief visit to Sylhet and Chittagong. There they discovered that the rain forests supported a richer, more diverse flora than that of Sikkim —- an abundance of orchids, balsams and bamboos, for instance. Hooker could not have chosen a better companion than Thomson. "He is really an excellent botanist, and enthusiastic too, our ways of going about our work too appear to have always been carried out on one plan, and so the meeting and joining work entails less small

Pencil sketch of Wallanchoon Village by J. D. Hooker, 1848.

inconveniences than it could between almost any two other persons with similar pursuits". (9) They never had fewer than twelve natives collecting plants which were dried in front of large fires. They brought over 3000 flowering plants and several hundred ferns to Calcutta and Hooker, well content with the results of his Indian

venture, sailed for England on 7 February 1851. While he was in India, consignments of seeds, roots and bulbs had arrived almost monthly at Kew and he brought home with him more than a thousand drawings and sketches of places and plants, especially rhododendrons.

A few Himalayan rhododendrons — *Rhododendron arboreum*, *campanulatum* and *barbatum* — were already known to the West when Hooker departed for India. The greatest concentration of this genus is found in the Sino-Himalayas, and in Sikkim

Wood engraving of Hooker's sketch of Wallanchoon Village redrawn by W. H. Fitch for Hooker's *Himalayan Journals* 1854.

alone there are about 30 species. Hooker welcomed it as "the traveller's constant companion throughout every day's march; on the right hand and on the left of the devious paths. The old bushes are seen breast high or branching overhead, whilst the seedlings cover every mossy bank". But collecting specimens and seeds was no easy matter. "If your shins were bruised like mine with tearing through the interminable *Rhododendron* scrubs of 10–13ft you would be sick of the sight of these glories". (10) He encountered his first specimens in the vicinity of Darjeeling; his first trip to Sikkim

yielded three species, the harbingers of a harvest of more than 20 new species which he named after friends and distinguished Indian botanists: *Rhododendron aucklandii*, *campbellii*, *hodgsonii*, *madenii* and *thomsonii* etc. Of the 25 rhododendrons described in *Curtis's Botanical Magazine* between 1852 and 1866, 14 were acknowledged to Hooker. So thorough was his collecting that nothing of significance has been found since in this region of the eastern Himalayas.

Some of his introductions were planted in the Hollow Walk in Kew Gardens, now appropriately known as Rhododendron Dell. He distributed seeds among his friends, and nurseries produced sturdy hybrids — *R. griffithianum*, for instance, is the parent of nearly a hundred hybrids. Their successful planting in the west of Scotland, Cornwall and Sussex introduced the woodland garden as a new fashion in British gardening. A holiday spent in Cornwall in 1888 reminded Hooker of his collecting days in India — "*many many* plants of the *Rhod. Hodgsoni* in the open air, 6 feet across and more, and with leaves a foot long. . . . There were also noble plants of *Falconeri*, *Aucklandii*, *argentum*, *barbatum* and others — together with *Hodgsonii* forming regular shrubberies, as if natives of the soil". (11) English gardens were also indebted to Hooker for a number of alpines: *Primula sikkimensis*, one of his most popular introductions. *P. capitata*, *Meconopsis simplicifolia*, the first of the Himalayan poppies to be discovered, and *Meconopsis napaulensis*.

His Indian accomplishments were not confined to plant collecting; he examined geological strata, studied glaciers, calculated the height of mountains with only a pocket sextant and a compass, and kept a meticulous record of the climate. He took immense pride in the fact that the Surveyor General's Office in India had lithographed his map of Sikkim for official use. "As a topographical map I hope it will do me credit, it is as full as I could make it with accuracy & I have the materials for working the elevations of 5 or 600 places over the surface, as also full ones for making it Geological, Botanical & Meteorological from the plains to 19,000 feet of elevation in one direction, & to 16,000 along the Northern, N.E. and N.W. frontiers". (12) Baron von Humboldt to whom Hooker conscientiously sent data expressed his gratitude to Sir William Hooker. "What a noble traveller is Joseph Hooker! What an extent of acquired knowledge does he bring to bear on the observations he makes, and how marked with sagacity and moderation are the views that he puts forward". (13)

The second part of his *Rhododendrons of Sikkim-Himalaya* had just been published when Hooker returned to Kew in March 1851 with no immediate prospects and uncertain where his future lay. While he was in India he had declined the opportunity to take charge of the botanical garden at Peradeniya in Ceylon following the death of its Superintendent, George Gardner, in 1849, hopeful of an appointment under his father at Kew Gardens. His constant concern was the eventual disposal of his Indian collections and drawings, and with this in mind he had written from East Bengal to his father in August 1850. "I should much like that the [Commissioners of] Woods and Forests would give me Aiton's house [in Kew Gardens] for the purpose [*i.e.* the sorting of his collections], *as it is*, and then there would be good grounds for petitioning Government to grant me support while engaged in the publication. So, unless Government assists me, the results of my Indian expedition (except for the plants grown at Kew and the Museum specimens there) might be almost as well flung into

the sea . . . Remember that I shall have numerically, more species than all the combined Indian collections, distributed by Wallich, and certainly far better specimens". (14) Sir William Hooker sought permission for his son to be employed at Kew, sorting his Indian plants and artefacts, based in Descanso House which had been empty since the death of the late Director, W.T.Aiton, and which offered adequate accommodation for the operation. In this request he was supported by a petition from eminent scientists to the Chief Commissioner of Woods and Forests emphasizing "the importance of securing to Her Majesty's Botanical Establishment at Kew, his future services in following up the investigations so ably commenced". In the event the Admiralty agreed to retain his services on half-pay as a naval surgeon until 1860 to enable him to complete his botanical record of the Antarctic voyage and to write up the results of his Indian expedition. The arrangements for moving into Descanso House having fallen through, his plant collection was temporarily stored in the Temple of the Sun and in a shed behind the Orangery while his drawings and sketches were deposited in the Museum.

The third and final part of *Rhododendrons of Sikkim-Himalaya* was published in December 1851. The first part which had appeared while he was in India had been edited by his father from notes, drawings and specimens sent home by his son. The botanical artist, Walter Hood Fitch, depicted 30 flamboyant blooms from Hooker's sketches and dried plants in characteristically bold and confident lines for a work which described many of the best species for cultivation in this country.

Regardless of the fact that Joseph Hooker had assured Nathaniel Wallich in June 1850 that he had no intention of writing an account of his Indian travels, nevertheless he was persuaded to do so, presumably by friends who had enjoyed the Indian letters his father had selected for publication in the *London Journal of Botany* between 1848 and 1850. His letters, particularly those to his family, reveal an alert curiosity and shrewd observation on the culture and customs of the people of northern India. Charles Darwin, constantly seeking scientific data, was especially interested in Hooker's remarks on plant species of Europe and elsewhere being present in the Himalayas. It was to Darwin that Hooker dedicated his *Himalayan Journals*, published in 1854. "The idea of the dedication has been present to me from a very early date — it was formed during the Antarctic voyage out of love for your own 'Journal'". (15) Hooker's wife also deserves some credit for the book's appearance since it was she, according to her daughter, Harriet, "who slaved at it, my Father supplied the material from his diaries and notes".(16)

During his stay in Darjeeling, Hooker met John Ferguson Cathcart, a civil servant convalescing at the hill station. Cathcart had Lepchas collecting specimens of the local flora and five native artists drawing them for a book to be similar in presentation to Hooker's *Rhododendrons of Sikkim-Himalaya*, the first issue of which he had just seen. After his death in 1851, his sister donated almost a thousand drawings to Joseph Hooker at Kew, and from these he selected a small number which he considered of horticultural interest, adding a few alpines from his own drawings. Fitch reworked them for the plates in *Illustrations of Himalayan plants* (1855), correcting the "stiffness and want of botanical knowledge" which Hooker usually detected in Indian drawings.

In February 1849 Hooker had assured his father that he had no desire to write an Indian flora. "The *Flora Antarctica* nearly broke my back; and except the Flora of New Zealand and Van Dieman's Land, I do not contemplate any other such great work. My present notion is to publish in the form of *Icones* confining any large and costly illustrations to a few Natural Orders or Genera". (17) But within six months he had changed his mind, unable to resist the challenge of compiling some sort of a flora "in the cheapest form that is compatible with being good", the drawings going to periodicals. (18) His collaborator was to be Thomas Thomson, a surgeon in the service of the East India Company since 1840. He had served in the First Afghan and Second Sikh Wars; in 1847 he had been one of three commissioners appointed to determine the border between Ladakh and Tibet. While the two men botanized together in East Bengal, their mutual regard for the Indian flora — "no flora in the world is more interesting than that of India", enthused Thomson — led inevitably to plans for a systematic survey. "It is easy to talk of a *Flora Indica* and Thomson and I do talk of it to imbecility". (19) Hooker still envisaged "extreme simplicity of form & mode of publication & such an arrangement as shall effectually counteract the possibility of an abrupt imperfect termination". (20)

When their intentions became known, offers of help came from all quarters. Hooker readily accepted assistance from Wallich, now in retirement in London. "Such a work could not be done without your help in any proper manner, and the revisal with you of the Indian Herbarium at the Linnean Society would be a preliminary of the first interest and importance". (21) Botanists in India offered collections, and the Jardin des Plantes in Paris presented a set of the late Victor Jacquemont's specimens.

However the uncertainty of official backing and any financial support from the East India Company threatened the feasibility of the project. Hooker was fortunately assured of a salary from the Admiralty. Thomson asked the permission of the Court of Directors of the Company to describe and distribute the specimens deposited in its India Museum: "It has occurred to both of us that there are now very good materials in this country for a general work on the botany of British India". (22) While the Court of Directors raised no objection to Thomson's access to their plant collections, they rejected his application for a salary during his leave in England. A resolution passed at the July 1851 meeting at Ipswich of the British Association for the Advancement of Science urged Her Majesty's Government and the East India Company "to give the aid essential for the speedy publication of such a work, which the Committee conceive would be a most valuable addition to our Botanical knowledge, but which is manifestly beyond the means of private individuals". The Court of Directors relented to the extent of promising to consider some financial reimbursement on the completion of the work. A final appeal was made by the President of the British Association in June 1852, proposing £400 a year for about three years for Thomson and about £400–£500 for printing the flora. In fairness to the East India Company which was censured for its parsimony, it must be remembered that it was on the brink of bankruptcy. Help came to Thomson in the form of a legacy on the death of his father in July 1852 which subsidized the publication of the flora.

Meanwhile Hooker and Thomson continued sorting and arranging some 150,000 specimens, representing 6,000–7,000 species, in the Orangery shed at Kew. When

Robert Wight returned to England in 1853 some of his South Indian plants were added to the duplicates which were distributed to public and private herbaria — an operation which matched Wallich's great dispersal of specimens a quarter of a century earlier.

Before this task had been completed, Hooker and Thomson had begun the projected flora, tackling first Ranunculaceae with a promise from George Bentham to undertake Leguminoseae. William Munro was asked whether he would take on Gramineae. "Great progress might thus be made towards a Flora Indica, by the serial publication of large Nat. Ords. and groups of smaller do. complete in themselves". (23)

However, differences in temperament were soon straining relations between the two collaborators. Thomson was frequently absent through ill-health and a desperate Hooker complained to Bentham about "Thomson's excessive scrupulosity, his natural slowness and his matchless procrastination . . ." I "have dropped Flora Indica altogether as hopeless under present circumstances . . . Thomson has been at the Flora Indica for now a year, and arranged nothing". (24) It was therefore a highly relieved Hooker who informed Bentham in July 1855 that the first volume of *Flora Indica* was at last out. The descriptions of species of fifteen families occupy half of its 565 pages; the rest is devoted to the Introductory Essay which was also available separately.

During its compilation they had encountered problems they had not fully anticipated: the bewildering confusion of synonymy, for example, or the need to consult other floras through the presence of so many species also found in China, Japan, Europe and elsewhere — the authors identified seven "geographical alliances or affinities". These difficulties are discussed in the Introductory Essay which, as Hooker acknowledged years later, owed much to Thomson, "the only man who has given us a sketch of the Upper Indian vegetation". (25) They divided their very broad concept of 'India' into four divisions: Hindustan, Himalayas, Eastern India which embraced Burma and the Malayan Peninsula, and Afghanistan; these were, in turn, subdivided into 'Provinces'. They considered the role of climate in the distribution of the flora, gave a cautious appraisal of the species concept, and added an excellent historical survey of Indian botany. The work was well received although judged by some as too ambitious; it was calculated that if it proceeded with the same wealth of data it would eventually amount to some 12,000 pages. Sir William recommended that the authors dealt with future volumes "on a less comprehensive plan . . . . a careful Prodromus of the whole Flora, far more than a learned study of a few Natural Orders". (26)

Even though the East India Company bought a hundred copies, of which 60 went to India, money was lost on the venture. There was little prospect of its continuation although during the euphoria of publication Hooker talked of getting down to the next volume. Thomson had returned to India to succeed Falconer as Superintendent of the Botanic Garden at Calcutta, and Sir William Hooker had at last managed to get his son appointed Assistant Director at Kew. Their partnership survived in the occasional article — descriptions of new Indian genera in *Hooker's Journal of Botany* — and the series of *Praecursores ad Floram Indicam* in the *Journal of the Linnean Society, Botany* between 1858 and 1861.

Hooker still kept in touch with botanists in South Asia, offering advice or, as in the case of Thwaites, positive help. It was the ambition of George Henry Thwaites

(1812–1882), Director of Ceylon's botanical garden at Peradeniya, to consolidate scattered references to the island's flora, mainly in periodical literature, adding his own modest contribution, as a precursor to a popular flora. In 1857 he gladly accepted Hooker's help in identification and synonymy, and his *Enumeratio plantarum Zeylaniae* appeared in five parts between 1858 and 1864.

Both Sir William and Joseph Hooker shared the concern of the botanical fraternity regarding the future of the vast collections of Indian plants in the East India Company's India Museum in Leadenhall Street, at that time unquestionably the richest repository of the Indian flora in Europe but largely unsorted and difficult of access. John Forbes Royle, the Company's Correspondent relating to the Vegetable Productions of India since 1838, was actively considering the disposal of the plant collections of Griffith, Cantor, Helfer and Falconer. It would not have been the first time that the India Museum solved pressing space problems by disposing of some of its collections. Wallich obliged by despatching many of its specimens to eager recipients in Britain and Europe during his leave in London, 1828-32. In 1836 the Linnean Society were given Royle's herbarium of between 40,000 and 50,000 specimens, Wallich's collection of 172 bottles of fruits and flowers preserved in spirits, and the plants gathered by Captain W.H.Sykes during his statistical survey of the Deccan. Royle had already sent Kew a selection of William Griffith's plants before his involvement in setting up the Indian section of the 1851 Great Exhibition and the Paris Exhibition in 1855 postponed the dispersal of the remainder which lay tantalizingly inaccessible in the India Museum's cellars. Within a month of Royle's death in January 1858, Joseph Hooker obtained permission to examine them with a view to sorting them. Much had been destroyed by years of neglect, damp and vermin or were in a chaotic state. He found, for instance, Griffith's Indian material mixed with Abyssinian and other collections; boxes often bore no label of provenance or collector. Hooker, although primarily interested in the Griffith and Falconer herbaria, rashly offered to take the entire contents of this notorious cellar to Kew provided the Company gave some financial assistance. He calculated it would take him about two years to identify and list the contents of all the cases and bundles. "The ultimate destination of the collections, after arrangement, I leave wholly to the discretion of the Court. My sole purposes are to make their contents accessible to scientific men, and to give the Honble Company's officers the credit of their labours, & to supply a key to Dr Griffith's posthumous works. There will probably be a few among the many thousand specimens duplicates that I should desire to retain for the Hookerian Herbm at Kew . . . As for the drawings of Hardwicke, Roxburgh, Wallich, etc., I have to request that they may be entrusted to me, with the collections (as they were to Sir Joseph Banks, under somewhat similar circumstances) — not so much for the service I could render in naming & arranging them, for this would be a real pleasure; but because the loan of them wd materially facilitate my labours". (27)

The Company's Court of Directors readily agreed to this overture and in July 1858 the plant collection at India House, amounting to eleven waggon loads, arrived at Kew Gardens. After eleven years' intermittent labour on the collections, Hooker, now Director at Kew, announced in his *Annual Report* for 1869 that the "incorporation of the great East Indian Herbaria, including those of the late East India Company is completed and the best sets of specimens are about to be distributed". Sixty British

and continental herbaria and museums were the grateful recipients of more than 380,000 specimens.

The Indian Mutiny was the death-knell of the East India Company now ignominiously stripped of its residual powers in the subcontinent. The Government of India Act of 1858 created a new government department, the India Office, to administer British India. The Secretary of State for India saw no useful role for the India Museum which was moved from one temporary abode to another, much of its collections inaccessible to researchers, until 1879 when it was dispersed to the British Museum, the South Kensington Museum (now the Victoria and Albert Museum) and to Kew Gardens which received twelve vanloads of economic material, duplicates of which were presented to 25 institutions at home and abroad. "I cannot tell you how many tons we have already disposed of", Hooker informed Asa Gray, "the accumulation of 30 years' extravagant collecting in India without judgment or regard to cost, and of utter mismanagement, indolence, and caprice on the part of the India Museum authorities here". (28) In addition over 3,000 botanical drawings, principally by Indian artists, joined the Roxburgh icones which Hooker had borrowed in 1858.

With Sir William Hooker as its energetic and persuasive Director, Kew Gardens attracted herbarium specimens not only from India but also from other countries in the British Empire. Having such resources at his disposal, Sir William in May 1857 proposed to the Colonial Office the publication of a series of colonial floras — cheap octavo volumes, small enough to slip into the pocket of any field botanist. With the floras of the West Indies, South Africa, Australia and New Zealand agreed, he submitted another memorandum in 1863, recommending the coverage of further territories including Ceylon and British India. George Thwaites, with his *Enumeratio Plantarum Zeylaniae* almost finished, could, no doubt, be induced to contribute the flora of Ceylon while the unrivalled resources of Kew's herbarium would facilitate the compilation of the flora of British India.

The return of Thomas Thomson from India in 1861 had prompted Hooker to consider the likelihood of resurrecting *Flora Indica*. He had the support in India of such influential officials as the Conservator of Forests in Madras, Hugh Cleghorn, and Sir William Denison, the Governor of the Madras Presidency — the latter approving Hooker's plan that each of the three Presidencies of British India should contribute £100 towards the cost of each volume and pledge themselves to purchase a hundred copies of the work. To ensure its completion, Hooker was prepared to concentrate on the project for eight years. "I have now been 14 years working at the Indian Flora continually, and I must confess I feel loth to leave the work to others now that the way is all cleared by myself", he told Thomas Anderson, Superintendent of the Calcutta Botanic Garden. (29) The recent presentation of Robert Wight's collection of South Indian plants made Thomson eager to participate. So in October 1863 Sir William Hooker negotiated with the India Office a ten-volume flora of India, describing at least 12,000 species, and incorporating a slimmed-down revision of the *Flora Indica* (1855). Sir William naturally nominated his son and Thomson as joint authors; the India Office sanctioned the payment of £150 a volume to the authors and agreed to purchase a hundred copies at a price not exceeding one pound a volume.

Hooker and Thomson resumed their partnership in a field in which they had now adopted a proprietorial attitude, easily offended whenever they assumed their contributions to Indian botany were not being appropriately recognized. Anderson was mildly rebuked by Hooker for such an omission in a paper he had submitted for possible publication in the *Journal of the Linnean Society*. "I have given your paper on Sikkim Palms to Thomson who will see to it. Neither of us feels very complimented by there being no notice of his or my being the discoverers of most of the species, and no allusion to 'Herb. Ind', of which the best set went to Calcutta". (30) The paper eventually appeared (*Journal of the Linnean Society* vol. 11, 1869, 4-14), suitably amended by its contrite author.

Thomson's constant moving of residence for reasons of health and his habitual dilatoriness delayed progress on the flora. In despair in 1868, Hooker was prepared to withdraw, almost reconciled to seeing his contribution confined to the arranging and naming of the Indian collections transferred to Kew and the *Praecursores*. Thomson's opposition to Hooker's desire to extend the geographical limits of the flora, led to a confrontation in January 1870. He refused to accept Hooker's proposal to include Burma, Malaya and Ceylon, arguing, not unreasonably, that this would prolong the work's completion. In a fit of pique he announced his intention of publishing his own input separately under the title of *Contributions*. (31) Hooker sadly accepted this final rupture in their working relations. "Where I feel myself most to blame is, in not writing to the Board years ago, & calling off the work, feeling sure as I long have, that you never wd be up to it. But you continued buoying up your own hopes at intervals though you never could mine, & I really did not like to dispel an illusion that gave you pleasure . . . . . If you had been publishing elsewhere there would be something to be said or to show, but you have not since you went to India published even a contribution to the work, all intentions & all promises not withstanding. After years with no published results, under our circumstances, it is clearly hopeless to expect anything from our joint action". (32)

Hooker was anxious to consult George Bentham and Daniel Oliver about the flora's future but not before he had decided to make Thomson's ill-health the official pretext for his withdrawal. Thomson's response was predictably bitter. "As to the tone of your letter I cannot say I think it friendly but as you say there can be no thought of any personal quarrel between you and me. At the same time if your course of action be such as to deprive me of my only source of active interest in life I shall undoubtedly be much distressed." (33) Hooker, completely depressed by this acrimonious correspondence, contemplated giving up the editorship. "I can only say in conclusion that in the matters of taking up the original Flora Indica & abandoning the Praecursores for the second Flora of India, I have acted in deference to your wishes, with loyalty to you, & against my own judgment." (34)

Still reluctant, however, to abandon a project sponsored by Kew, Hooker was persuaded by Bentham to carry on with the assistance of other botanists. He informed the India Office of Thomson's retirement, ostensibly through ill-health, and also of his own willingness to be editor, and of the necessity to recruit other contributors. He anticipated a work of about four volumes, each of about 800 pages (35). On 26 April 1872 a contract between Hooker and the publisher, Lovell Reeve, confirmed an imprint of 500 copies of the flora with an undertaking from the British Government to purchase

a hundred copies.

Hooker had hoped that when Thomas Anderson left Calcutta on health grounds in 1868, he would be able to work on the flora but he died after only two years in retirement. During the 25 years it took to publish the *Flora of British India*, Hooker received contributions from twelve botanists; the most productive, Charles Baron Clarke (1832–1906), wrote up 52 families. Through official tours as an Inspector of Schools in Bengal, Clarke had acquired an intimate knowledge of the State's flora and he had botanized in Sikkim. He had also taken temporary charge of the Calcutta Botanic Garden on Anderson's retirement. When he came home on leave in 1877 he generously presented his herbarium of 25,000 specimens to Kew to which he was seconded by the India Office from 1879 to 1883 to work on the *Flora of British India*.

After the appearance of the first part in May 1872, progress was slow until Clarke's participation. Checking excessive synonymy "due to the double & even triple naming of Indian plants by authors competent & incompetent, working in England, the Continent, & India, without access to named collections, or concert with one another," (36) inevitably slowed down output. In May 1885, with the publication of four volumes, Hooker apologized to the India Office for having under-estimated the size of the work; he calculated another two volumes would be required. Six months later he retired from the directorship at Kew and moved to Sunningdale where, freed from the burden of official administration, he devoted much of his time to India botany. The final family Gramineae, gave him particular trouble — "the most difficult and unsatisfactory part of the whole work" (37) — but in December 1897 the publication of the general index to the seven volumes completed the work.

No-one was more aware than Hooker of its limitations and imperfections. "That work is a hurried sweeping up of nearly a century of undigested material and is in no sense a Flora like Bentham's Australian. It had to be carried out in a reasonable time, and except myself and Clarke, none of my coadjutors was really well up in Indian botany, or authorities, or works of geography. It is merely a crude guide to the extent and variety of the native vegetation of India." (38) He saw it as a pioneer work with two primary goals: to assist the compilation of monographs and local floras and to "enable the phytographer to discuss the problems of the distribution of plants from the point of view of what is perhaps the richest and is certainly the most varied botanical area on the surface of the globe". (39) It still remains the only floristic survey of the entire Indian subcontinent, a classic among tropical floras.

When his son-in-law, William Thiselton-Dyer, now Director at Kew, informed the India Office of its imminent completion, he judged it to be Hooker's greatest achievement, certainly "the most cherished object of his life." (40) Hooker's services to Indian botany had already been acknowledged by the Crown with his investiture in 1877 as a Knight Commander of the Order of the Star of India; now he was elevated to a Grand Commander of the Star of India. The Linnean Society struck a special gold medal in 1898 in recognition of his outstanding services over half a century to science, and to India in particular.

The Calcutta Botanic Garden had lent Hooker its orchid drawings while he was revising Orchidaceae for the *Flora of British India*. From these he selected a hundred

to which he appended ampler descriptions and comments than he could give in the *Flora*. *A century of Indian orchids* appeared in the *Annals of the Royal Botanic Garden Calcutta* in 1895.

Henry Trimen's death in 1896 had left his *Handbook to the Flora of Ceylon* unfinished at volume 3. At the instigation of Thiselton-Dyer, Hooker, now in his eightieth year, was invited to complete it. He accepted, confident that many of the plants had already been described in the *Flora of British India*. As the island has a large number of endemics, this proved an over-optimistic prediction; instead of the 18 months to two years he had anticipated, the fifth and final volume did not appear until 1900.

During the summer of 1901 the Government of India asked him to contribute a succinct account of Indian botany to the forthcoming third edition of the *Imperial Gazetteer of India*. He welcomed this opportunity to summarize the accumulated knowledge of many years research and to revise some of the observations and conclusions in the Introductory Essay to the *Flora Indica*. He amended, for example, the number of phytogeographical regions; he reduced the former 64 'provinces' to nine, subsumed under three regions — Western, Eastern and Himalayan — on the basis of the number of species in the ten largest families. His survey extended beyond India to Nepal, Bhutan, Ceylon, Burma and the Malay Peninsula. He identified the Malayan element as the most dominant in the Indian flora; European, African, Tibetan-Siberian, and Sino-Japanese were also strongly represented. Since few endemic genera had been discovered he concluded that there was no "Indian flora proper". The essay appeared as *A Sketch of the Flora of British India* in 1904 (a draft version had been printed and circulated for comment the previous year) before its inclusion in the first volume of the *Gazetteer* in 1907. It represented, in the words of Professor F.O.Bower, "the natural close to the most remarkable study of a vast and varied Flora that has ever been carried through by one ruling mind". (41)

Foremost among the numerous scientists who benefited from Hooker's Indian researches were Charles Darwin and Charles Lyell, the geologist. Hooker, who had been privileged to read Lyell's copy of the proofs of Darwin's *Journal of Researches into the Geology and Natural History of Various Countries visited by HMS 'Beagle'* (1839) while still a student, years later recalled that "they stimulated me to enthusiasm in the desire to travel and observe". He met Darwin briefly before his departure on HMS Erebus. On his return, Darwin generously put at his disposal the plants he had collected in the Galapagos, Tierra del Fuego, and Patagonia, thus establishing a friendship that was terminated only by Darwin's death.

This enduring relationship, based initially on mutual respect, fostered a frank and generous exchange of opinion and scientific data. Hooker's letters from India gave Darwin "crude gleanings" on the behaviour of cheetahs, elephants, dogs and varieties of domestic cattle, and much on the geological formation of the Himalayas. When he tells his father of his discovery that genus replaced genus in the Himalayan flora as one travelled north while species replace species in easterly or westerly directions, he adds a postscript: "Don't forget to send this to Darwin". It was perhaps not unexpected that his *Himalayan Journals* should be dedicated to Darwin to whom he confessed

that the book fulfilled an early ambition: "you do not know how from my earliest childhood I nourished & cherished the desire to make a creditable journey in a new country, & with such a respectable account of its natural features, as should give me a niche amongst the scientific explorers of the globe I inhabit, & hand my name down as a useful contributor of original matter". (42)

Darwin admired the younger man's encyclopaedic commentaries. "I had no idea that you had attended to so many subjects. Even if you had not touched a plant, it would have been a very remarkable undertaking for its geology, meteorology, zoology and geography". (43) He marked those passages in his copy where Hooker noted plants from Europe, North America and the Far East as useful evidence to substantiate his theory that geographical distribution was an essential key to the "laws of creation". The *Flora Indica* yielded more phytogeographical data which Darwin cited in his *On the Origin of Species*.

His mentor in botanical matters, Hooker became one of the first to be told in 1844 of Darwin's conviction that "species . . . are not immutable". But Hooker's acceptance of Darwin's concept of the nature and origin of species was cautious and gradual. He had argued in favour of the permanence of specific characters in his Introductory Essay of 1853 to *Flora Novae Zelandiae*. The introduction by Hooker and Thomson to the *Flora Indica*, two years later, still recognized species as "being definite creations" but conceded "a certain degree of variability". "Plants in a state of nature, are always warring with one another, contending for the monopoly of the soil — the stronger ejecting the weaker — the more vigorous overgrowing and killing the more delicate. Every modification of climate, every disturbance of the soil, every interference with the existing vegetation of an area, favours some species at the expense of others". (44) Hooker, manifestly shifting his ground, capitulated in the Introductory Essay to the *Flora Tasmaniae* (1859). He had long been privy to Darwin's deliberations, but, as he assured W.H.Harvey in 1860, "I was aware of Darwin's views fourteen years before I adopted them and I have done so solely and entirely from an independent study of the plants themselves". In presenting the Darwin-Wallace Medal to Hooker in 1908, the President of the Linnean Society declared that the "incalculable benefit that your constant friendship, advice and alliance were to Mr Darwin himself, is summed up in his own words, used in 1864: 'You have represented for many years the whole great public to me'".

Sir William Hooker's statement in Kew Garden's *Annual Report* for 1850 that "It has been our especial object to cultivate what may be useful and valuable for our Colonies" affirmed a policy that was vigorously pursued by his son who devoted a wing of a new complex of glasshouses erected in 1868–69, and known as the T Range, to plants of economic importance. In 1860 Sir William participated in "one of the most important Horticultural operations in which, as Director of this Establishment, it has been my privilege to co-operate" (*Annual Report*).

At that time malaria was responsible for the deaths of some 4,000,000 people a year in India. The East India Company which had always encouraged its surgeons and botanists to seek quinine-yielding plants had incomprehensibly ignored advice to establish cinchona plantations. A year after the India Office had replaced the Company

in India, it accepted with commendable promptitude the offer of one of its junior clerks, Clements R. Markham, to collect cinchona plants in Peru for transmission to India. Kew was involved from the very inception of the project. The Treasury agreed to finance the building of a double forcing-house there for seeds and for restoring sickly plants to health *en route* to India. Sir William nominated the botanist, Richard Spruce, who had been in the Amazon basin for ten years and a Kew gardener, Robert Cross, as members of Markham's collecting expedition to South America. Markham returned to England in late July 1860 with half of his cargo of plants dead; more died before reaching their destination at Ootacamund in southern India. Not one struck root but survivors of Spruce's gathering of *Cinchona succirubra* were successfully planted by W.G.McIvor, a former Kew gardener, in charge of the new plantations. The Kew *Annual Report* for 1862 noted with satisfaction that over 70,000 cinchona plants were flourishing at Ootacamund with smaller plantations at Darjeeling and in Ceylon. Twelve years later Joseph Hooker announced that "the introduction of this febrifuge into India, Ceylon and Jamaica being now accomplished this subject no longer demands a notice in my report". But as he told J.F.Duthie a few years before his retirement, matters relating to cinchona and "the policy of making both quinine and the febrifuge in India are [still] coming to me to be reported on". (45) When he was an old man, his godson asked him what commercial transaction had given him the most satisfaction. "Quite certainly the getting of cinchona into India", came the reply.

Kew's services were again called upon by the India Office in the transfer of another South American medicinal plant, *Ipecacuanha*, used in the treatment of dysentry. From Brazilian plants propagated at Kew in 1864 a solitary specimen was taken in 1866 to the Calcutta Botanic Garden from which upwards of 300 were raised in Sikkim. Although *Ipecacuanha* became established in India, its growth was too slow to be a viable commercial enterprise.

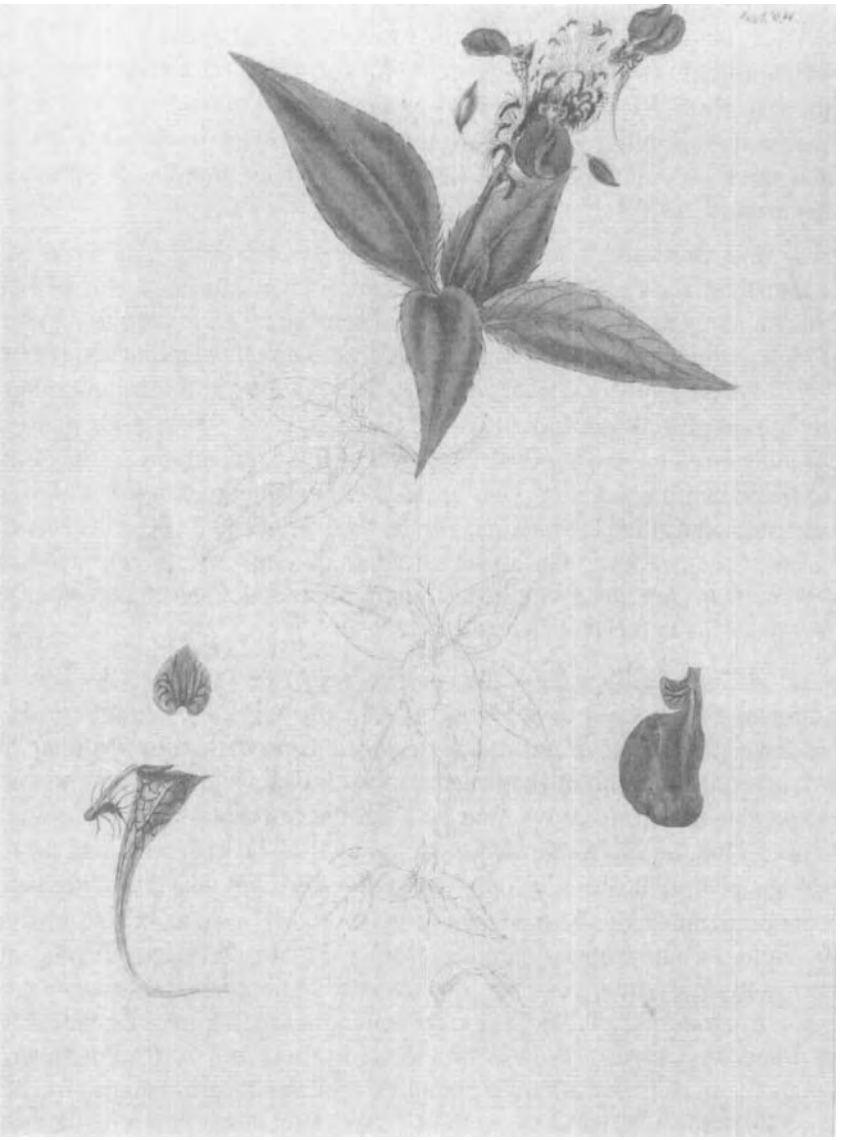
The introduction of rubber into India reunited some of the participants from the cinchona venture: Clements Markham, Robert Cross and Kew Gardens. Markham commissioned James Collins, Curator of the Museum of the Pharmaceutical Society to report on the state of the world's rubber industry. His *Report on the Caoutchouc of Commerce*, printed at the request of the India Office in 1872, was sent to Joseph Hooker in May 1873 for comment and advice on the feasibility of a rubber industry in India. He was also asked whether imported *Hevea brasiliensis* seeds should first be sown at Kew and their seedlings sent to India. Since an experimental consignment had died both in Calcutta and Sikkim, it was decided that future deliveries should go initially to Ceylon. Hooker was in no doubt about the commercial significance of the operation. "The cultivation of this tree [*Hevea brasiliensis*] is extremely important, not merely from the valuable quality of the rubber obtained from it, but also in view of the diminished supply of Indian *Ficus elastica*" (46). A large consignment of seeds of another rubber-yielding tree, *Castilla elastica*, collected by Robert Cross, failed to germinate at Kew, and few of his *Hevea* plants survived. Hooker recommended Henry Alexander Wickham, a coffee planter in Brazil, as an additional collector. Wickham, engaged by the India Office, loaded his collection of seeds on board ship at Para — whether with the knowledge of the Brazilian authorities or by subterfuge is open to question — and arrived at Kew on 14 June 1876. In view of the limited viability of

his precious cargo, some 2,700 were sown the following day in pots closely packed together in a specially prepared glasshouse. Within a few days four per cent had germinated and were growing vigorously. On 12 August 38 Wardian cases were loaded on a ship bound for Colombo, the nucleus of Ceylon's future rubber industry which briefly ranked as the world's third largest supplier of *Hevea* trees. William Thiselton-Dyer, Hooker's Deputy Director since 1875, had direct responsibility for a project which initially owed its inception to Hooker's support and promise of Kew's co-operation. In 1906 Wickham gratefully acknowledged his indebtedness to Hooker for his "foresight and initiative in securing the free hand enabling me to bring away the original stock on which it [*i.e.* the rubber industry] is founded, from the Forests of Alto-Amazonas". (47)

Hooker's most profitable contribution to imperial commerce was the rubber and cinchona transfers. Kew had become, as Thiselton-Dyer put it, "a sort of botanical clearing house or exchange for the empire". From 1878 Kew organized an annual supply of Mahogany seed, *Swietenia mahogoni*, from Jamaica to India. Seed of Liberian coffee *Coffea liberica* germinated at Kew, reached planters in the colonies and India. With Kew's expertise, West Indian Cacao and the West African oil palm, *Elaeis guineensis* added to the growing diversification of India's economic crops. It pleased Hooker to boast that he had been instrumental in introducing papyrus to India. Kew Gardens not only controlled the facilities for the transfer of such crops but also provided the staff to tend them. More than 30 Kew-trained gardeners were employed in 1870 in India's botanical gardens and agri-horticultural societies, and on cotton, tea and cinchona plantations and private estates.

When Sir William Hooker died, his son succeeded him not only as Director but also as editor of *Curtis's Botanical Magazine*. While serving as editor for 39 years, Hooker reviewed 250 plants from India, Ceylon and Burma, thereby bringing the flora of South Asia to the attention of British gardeners. Balsams featured among the plants he tried to persuade them to grow. When he figured *Impatiens latifolia*, collected by Thwaites in Ceylon, in the *Botanical Magazine* in 1867 he observed that "of the vast horde of Indian perennial Balsams, only two or three are actually in cultivation, whilst nearly a hundred, most of them highly ornamental, are yet to be introduced, and especially from the subtropical jungles of Ceylon, the Western Ghauts, and the Himalayas". (48) Balsam species are not easy to distinguish, especially herbarium specimens — a taxonomic challenge Hooker could not resist. Since he had reservations about the diagnoses of the 120 or so *Impatiens* in the *Flora of British India*, based often on inadequate or damaged dried plants, he requested fresh material from friends in India — J.F.Duthie at Saharanpur in the Western Himalayas was a regular supplier. "To tell you the truth", he admits to Duthie, "I quail before the task". When two years later he had completed his examination of Duthie's specimens, he turned his attention to collections in the British Museum, and the herbaria in Paris, Berlin, Vienna and St Petersburg. "Happily my eyes are as good as ever, and my hands as steady; patience ought to be inexhaustible", he tells Duthie. His account of the species in the Wallich Herbarium, then housed in the Linnean Society, was published in the Society's *Journal* for 1904 and an epitome of *Impatiens* in British India appeared in the *Records of Botanical Survey of India*, 1904-06. He could claim three years later: "I have now

detailed descriptions of nearly 300 British Indian species on a rough estimate". (49) With his glasses characteristically high on his forehead, he persevered in dissecting delicate specimens, extending his examination to Malayan and Chinese species. The

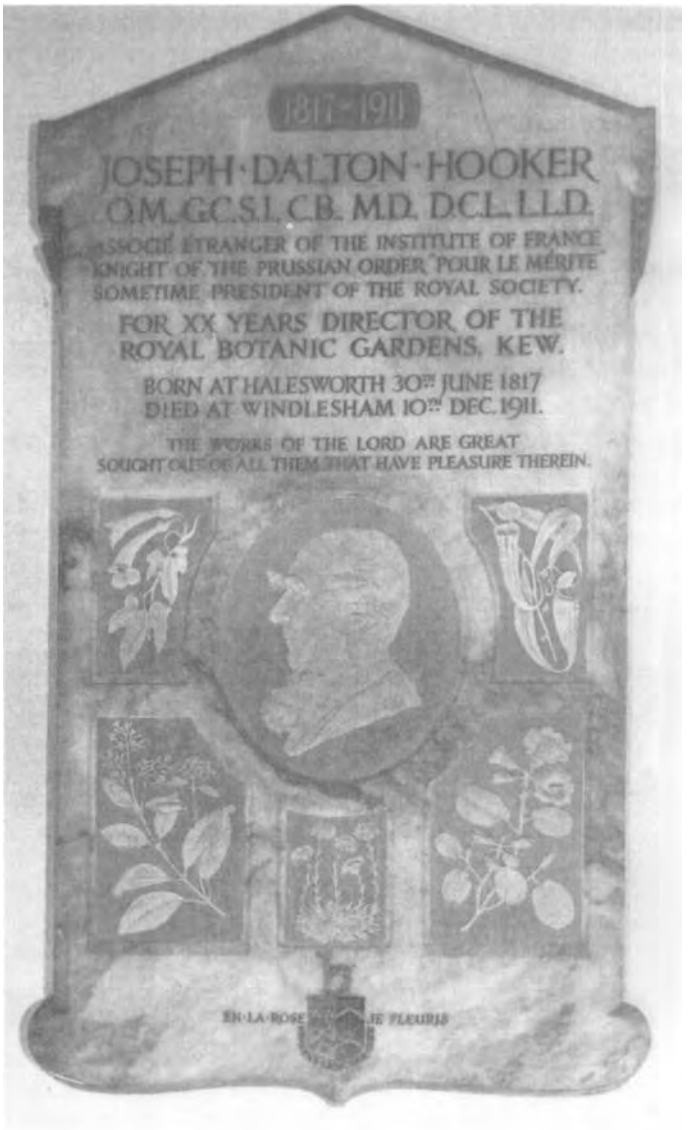


Impatiens bracteata.
Drawing by J.D. Hooker during his exploration of the Khasia Hills, Bengal, August 1850

year in which he died — 1911 — the *Kew Bulletin* published three articles by him on *Impatiens* — one on Malayan species and two on Indian. Hooker's career as a botanist had begun with descriptions of Indian mosses; it was fitting that it should also conclude with Indian plants.

For more than half a century he monitored the state — or stagnation as he saw it

— of botany in India. He complained to the Under Secretary of State for India. "It is really a pity that steps are not taken to centralize and utilize the scientific efforts of the Indian Govt. Indian Botany is the bête noire of Botanists". (50) When George



Wedgewood plaque commemorating Sir J. D. Hooker in St Anne's Church, Kew

King, Superintendent of the Calcutta Botanic Garden, and Duthie were both on leave in England at the same time in 1884. Hooker seized the opportunity for all three to meet at the India Office to urge improvements in the organization of botany in India. The eventual formation of the Botanical Survey of India, achieved through Thiselton-Dyer's initiative, failed to realize its objectives, largely because of the lack of support from the provincial governments. Hooker constantly lamented to his

correspondents in India the pervasive inertia and absence of dynamic policies. "The fact is, that except at Calcutta the botanists of India have been asleep since the days of Wight, Beddome, Law, Stocks, Dalzell and a few others". (51) He longed for positive action. "The want of a Botanical Laboratory such as all English and Scotch Universities have, and as Ceylon, the West Indies and other Government institutions have, is notorious. The work of the Botanical Survey seems to me to be very small beer". (52) India also lagged behind other countries in the botanical exploration of its territories. "Excuse my growl", he told A.T.Gage, assuring him that he did "love Indian botany". (53)

Hooker excelled as an explorer, cartographer, plant collector, taxonomist and as a constructive thinker. Sir William Thiselton-Dyer admired his "keen powers of observation, a lively interest in what he observed and an aptitude for reflecting up it". (54) But without remarkable stamina, a capacity for sustained hard work — qualities he inherited from his father — resolution and, of course, good health, he could never have achieved so much. Even as an octogenarian he seldom relaxed. According to a close friend his regular daily routine at Sunningdale was an hour's work before breakfast, resumed again until lunch, followed by a return to his desk with only a light supper as an interlude before retiring to bed at eleven o'clock. One of our most distinguished botanists, it is appropriate that two of the five plants that decorate Hooker's Wedgwood memorial plaque in St Anne's Church on Kew Greeen commemorate his Indian interests — *Rhododendron thomsonii* and *Cinchona calisaya*.

REFERENCES

1. HUXLEY. *Life and Letters of Sir J. Hooker* vol.1, 1918, 167.
2. *Ibid.* 216.
3. J.D. HOOKER. *Himalayan Journals* vol.1, 1854, 3.
4. *Ibid*, preface.
5. *Ibid*, 247.
6. Darjeeling, 2 April 1849. 'Letters from J.D. Hooker', vol. 9, folio 43. Kew.
7. J.D. HOOKER. *Himalyan Journals*, vol.2, 1854, 238.
8. 18 March 1850. 'Hooker letters to his father'. Kew.
9. To his father, 6 July 1850. 'Hooker letters ASC-BEN' Kew.
10. To his father, 23 June 1849. 'Letters from J.D. Hooker', vol.9, folio 75. Kew.
11. L. HUXLEY *Life and Letters of Sir J. Hooker*, vol.1, 1918, 343.
12. To his father, 18 July 1850. 'Letters from J.D. Hooker', vol.7, folio 212. Kew.
13. Hooker's *Journal of Botany*, vol.3, 1851, 21.
14. 18 August 1850. 'Letters from J.D. Hooker', vol.9, folio 225. Kew.
15. *Correspondence of Charles Darwin, vol.5, 1851-1855*, 1989, 177
16. Lady Thiselton-Dyer to Sir Arthur Hill, 2 September 1935. 4/T/1. Kew.
17. Darjeeling, 1 February 1849. 'Letters from J.D. Hooker', vol.9, folio 19. Kew.
18. To his father, Lachen 23 June 1849. 'Letters from J.D. Hooker', vol.9, folio 76. Kew.
19. To his father, June 1850. L. HUXLEY. *Life and Letters of Sir J.D. Hooker*, vol.1, 1918, 340-1.
20. To his father, Khasia 18 June 1850. 'Letters from J.D. Hooker'. vol.7, folio 212v. Kew.
21. 12 June 1850. 'Indian, Moroccan and Syrian Journals, etc.', folio 493. Kew.
22. 12 April 1851. 4/F/2/143. India Office Library and Records.
23. To Munro, July 1852. 'J.D. Hooker to Munro'. Kew.
24. To Bentham, December 1853? 'Hooker letters ASC-BEN'. Kew.
25. To J.S. Gamble, 14 May 1908. 'Hooker letters DUT-HAR'. Kew.

26. Hooker's *Journal of Botany* vol.7, 1855, 256.
27. To Court of Directors, E.I.C., 5 February 1858. 'Herbarium presentations to 1900', vol.1, folios 249-51. Kew.
28. 20 January 1880. L. HUXLEY. *Life and Letters of Sir J.D. Hooker*, vol.2, 1918, 240.
29. 18 August 1861. 'Letters from J.D. Hooker', vol.1, folio 26. Kew.
30. To T. Anderson, 19 February 1868. 'Letters from J.D. Hooker', vol.1, folio 104. Kew.
31. 'Flora of British India', folio 42. Kew.
32. 30 July 1870. 'Flora of British India', folio 43. Kew.
33. 2 August 1870. 'Flora of British India', folio 45. Kew.
34. 2 August 1870. 'Flora of British India', folio 47. Kew.
35. 31 July 1871. 'Flora of British India', folio 21c. Kew.
36. 'India Miscellaneous 1878-1928', folio 21v. Kew.
37. To W. La Touche, 9 April 1894. 'Letters from J.D. Hooker', folio 56. Kew.
38. To J.F. Duthie, 24 January 1901. L. HUXLEY. *Life and Letters of Sir J.D. Hooker*, vol.2, 1918, 387.
39. *Flora of British India*, vol.7, 1897, preface.
40. 13 February 1897. 'India Miscellaneous 1878-1928', folio 69. Kew.
41. *Sir Joseph Dalton Hooker: an Ovation*, 1912, 20.
42. 26 February 1854. *Correspondence of Charles Darwin, vol.5, 1851-1855*, 1989, 176.
43. 10 March 1854. *Correspondence of Charles Darwin, vol.5, 1851-1855*, 1989, 182.
44. *Flora indica*, 1855, 41.
45. To J.F. Duthie, 4 April 1882. 'Hooker letters DUT-HAR'. Kew.
46. *Kew Annual Report* 1874.
47. L. HUXLEY. *Life and Letters of Sir J.D. Hooker*, vol.2, 1918, 6.
48. *Curtis's Botanical Magazine* plate 5625.
49. To A.T. Gage, 6 March 1909. 'Letters from J.D. Hooker', vol.4, folio 183. Kew.
50. To Sir Mountstuart E. Grant Duff, 3 November 1869. 'Letters from J.D. Hooker', vol.4, folio 296. Kew
51. To J.S. Gamble, 11 November 1903. 'Hooker letters DUT-HAR'. Kew.
52. To J.S. Gamble, 17 January 1904. 'Hooker letters DUT-HAR'. Kew.
53. To A.T. Gage, 12 July 1906. 'Letters from J.D. Hooker', vol.4, folio 173-65. Kew.
54. *Proceedings of Royal Society*, vol.85, 1912, iv.

Record of the Proceedings of the Linnean Society of London for the 204th Session (1991-92)

The Anniversary Meeting

of the Society held at Burlington House, Piccadilly, London W1V 0LQ on Friday, 28th May 1992

The President took the Chair and welcomed some 50 members and their guests to the meeting.

Apologies were received from Mr Brightman, Dr. Kermack and other Fellows.

The following signed the Obligation in the Roll and Charter Book and were admitted Fellows: Graham A.C. Bell, Julia Simone Bruce, Vana Haggerty, David John Louis Harding, Bruno Holzmann, Javier Francisco-Ortega, Alison Margaret Osment, Neil Parker Schultes, Dennis Roy Seaward and Aaron John Sharp.

The Minutes of the Meeting held on 14th May 1992 were taken as read and signed.

The Executive Secretary read for the third time the Certificates of Recommendation for the election of one Foreign Member and six Fellows *Honoris causa*. The President appointed as scrutineers Professor Berry, Mr. Pain and Professor Pye.

The following was elected a Foreign Member of the Linnean Society:
Dr Olivier Rieppel.

The following were elected Fellows *Honoris causa*: Professor A. J. E. Cave, Professor P. C. C. Garnham, Dr. Norman Moore, Professor W. T. Stearn, Dr. S. M. Walters and Dr. E. B. Worthington.

The following were elected to Council: Dr. P. E. Ahlberg, Prof. J. Cohen, Dr. M. E. Collinson, Dr. D. Ingram and Dr. J. P. Thorpe. 41 Fellows and an Associate were elected. The Officers elected were: President, Prof. J. G. Hawkes; Treasurer, Prof. R. W. J. Keay; Zoological Secretary, Prof. J. Green; Botanical Secretary, Dr. C. J. Humphries and Editorial Secretary, Dr. D. F. Cutler.

The President read the citations for medals and awards as follows:

The Linnean Medal for Botany to Professor R. E. Schultes

The Linnean Medal for Zoology to Professor S. J. Gould

The H. H. Bloomer Award to Dr. K. A. Spencer

The Jill Smythies Award to Mr. J. M. Fothergill

The Bicentenary Medal to Dr. S. Blackmore

The Irene Manton Prize to Dr. S. A. Robinson and Dr. R. W. Scotland

Subsequent to reading their respective citations (below), he presented the medals and awards to Professor Schultes, to Dr. Blackmore and Dr. Spencer. Professor Gould, Mr. Fothergill, Dr. Robinson and Dr. Scotland were not present to accept their awards. Drs. Robinson and Scotland had received part of the Irene Manton Prize at the meeting on 23rd January, Mr. David Hawke received the work of art on behalf of Dr. Scotland.

The Treasurer presented the Accounts for 1991 (below, with Treasurer's Report). He explained the Grants Received item in the income and expenditure account as representing grants fron the EC, The Danish and UK Governments, the *Annals of*

Botany Company and ICI plc and drew attention to the computing item under Office Equipment. He also gave an up-to-date valuation of the Society's investments. The meeting accepted the recommendation of the Audit Review Committee proposed by Mr. Graham-Kerr, that the Accounts for 1991 be approved.

The Treasurer then recommended that the Society reappoint as auditors Messrs. Fraser and Russell, which was carried unanimously.

The President then reviewed the past programme of the Society, pointing out that the programme had been successful in terms of the numbers attending, and the quality of the presentations. He particularly welcomed the high level of interest shown in the VIth Form meetings.

The Executive Secretary presented his report for 1991 (below), pointing out the wide variety of Council activities during the year, including the Society's publishing work, which had seen the appointment of two new Editors, Dr. Edwards to the *Botanical Journal* and Dr. Crothers to the *Synopses of British Fauna*. Their predecessors, Dr. Jury and Dr. Kermack, deserved the Society's warmest thanks for their efforts for the Society.

The President then gave his address: *The History of the Potato in Spain in the 16th Century*. A motion of thanks was moved by Professor Jorgensen, seconded by Dr. Richards, requesting that the address be published. The President thanked all those members of the Society, the Council and his fellow Officers for their invaluable assistance during the past year. Professor Hawkes drew members' attention to forthcoming meetings of the Society before appointing as Vice-Presidents Professor Jorgensen, Dr. Joysey, Dr. Lees and Professor Lucas. The President warmly thanked the Officers, members of Council and the permanent staff for their work on behalf of the Society during the past year. He then declared the meeting closed.

JOHN MARSDEN
Executive Secretary.

Foreign Member of the Linnean Society

Dr. Olivier Rieppel
Dept. of Geology, The Field Museum, Chicago

Dr. Rieppel is distinguished for his research on the comparative and functional anatomy, systematics and evolution of extinct reptiles, for his work on the comparative anatomy and phylogeny of fossil fishes and reptiles, for the theory and practice of cladistic classification and for research into the history and philosophy of biology.

Fellows *Honoris causa*

Professor A. J. E. Cave
President of the Society 1970-73

Professor Cave is distinguished for his anatomical work on *Homo sapiens* and its progenitors and subsequently on a wide variety of vertebrates including other primates, elephants, rhinoceroses, cetaceans and the giant panda.

Professor P. C. C. Garnham FRS

Professor Garnham is distinguished for his work in parasitology, especially malaria where he discovered the fate of the descendants of sporozoites, amongst other observations on the life cycle of this protozoan. He was elected a Fellow of the Royal Society in 1964.

Dr N. Moore

Dr. Moore is the author of The Bird of Time, based on his experiences with the UK Nature Conservancy Council, where he studied the effects of pesticides and herbicides on the environment. He was involved in the setting up of SSSI's and Nature Reserves and the Farming and Wildlife Advisory Group, continuing his deep commitment to conservation of wildlife.

Professor W. T. Stearn
President of the Society 1979-82

Professor Stearn is the author of several classic works, including the introduction to the Ray Society's facsimile of Linnaeus' *Species Plantarum* and his *Botanical Latin.* He has also written monographs on several plant groups, on the nomenclature of wild and cultivated plants, on the history of natural history and on taxonomic theory and terminology.

Dr S. M. Walters
Vice-President of the Society 1980-83

Dr. Walters is distinguished for his outstanding contributions to European flora work and to nature conservation in Britain and Europe.

Dr E. B. Worthington

Dr. Worthington is distinguished for his early work on tropical ecology, particularly of rivers, and his commitment to sustainable development in Africa. At the UK Nature Conservancy Council he was involved in the creation of SSSI's, National Parks and Reserves and in the improvement of air and water quality. Within the IBP, he coordinated successfully the ecological and other biological work of 97 countries.

The Linnean Medal for Botany

Professor Richard Evans Schultes

It is a great pleasure to be able to award the Linnean Medal for Botany this year to my old friend and colleague Dr. Richard Schultes, a man who has received many honours during his long and productive life. Let me present a short outline of his scientific career.

Dr. Schultes began his association with Harvard University in 1933, graduating in 1937 and obtaining his doctoral degree in the same University in 1941. He was then awarded a grant from the National Academy of Sciences to study the production and use of curare in the Amazon basin. I first met him in Bogota, Colombiá, in 1948 when he had come up from the Amazon, only to descend again for so many months that we all gave up hope of ever seeing him again, fearing that he had been converted into a

tasty meal for some Indian tribe. Evidently he was considered uncookable and he went back to the Colombian Amazon region again to set up a rubber plantation after Pearl Harbour and the conquest of south-east Asia by the Japanese had rendered the plantations there inaccessible to the Allies. Here in Colombia Dr. Schultes broadened even further his knowledge of ethnobotany and particularly of medicinal plants.

Returning to Harvard in 1953 he became curator of the Orchid Herbarium of Oakes Ames, and six years later the Curator of Economic Botany; in 1967 he was named Executive Director of the Botanical Museum and in 1970 as a professor he was appointed Director, teaching economic botany to generations of students until his retirement in 1985.

Retirement, of course, did not stop his career — indeed it could be said to have moved it into overdrive; and Dick Schultes made many more expeditions to study the pharmacological properties of Amazonian plants. This brought me back into his orbit again, with his excellent treatise on Solanaceous hallucinogens published in 1979 in the Linnean Society Symposium on the Biology and Taxonomy of the Solanaceae. Dr. Schultes was quite willing to be grabbed again for a further instalment in the Third Solanaceae Conference, recently published by the Royal Botanic Gardens for the Linnean Society (*Solanaceae III – Taxonomy, Chemistry, Evolution,* 1991) written in collaboration with his colleague Robert Raffauf. Their recently published book *"The Healing Forest"* is now widely known and has received great critical acclaim.

Dr. Schultes has also been instrumental in expediting the publication of many of the Mutis plates which resulted from The Royal Botanic Expedition sent out to Colombia (then New Granada) in the early years of the 19th century. Very few volumes have appeared so far but two of them on the Solanaceae are on their way.

Richard Schultes has received many awards during his career, most recently the Harvard Medal. He tells me that of the five other Americans awarded the Linnean Society Medal four were Harvard professors, including such well-known names as Ernst Mayr and the late G.G.Simpson. Now we are adding two more to that illustrious company.

Richard Evans Schultes, it gives me the greatest pleasure to award you the very well deserved Linnean Society Medal for Botany for 1992.

The Linnean Society Medal for Zoology

Professor Stephen Jay Gould

There can be few biologists who need so little introduction as Stephen Jay Gould. He is one of those all too rare scientists who not only has made major and fundamental contributions to his own chosen fields of evolution and palaeontology, but also has had the skill and ability to write for a larger and wider audience.Stephen was born and grew up in New York City. He himself records that at the age of only five he visited the American Museum of Natural History with his father and first saw the fossil dinosaurs there. After an awestruck encounter with *Tyrannosaurus* he announced "that I would be a paleontologist when I grew up". This view was confirmed six years later when he records reading G.G.Simpson's *Meaning of Evolution* at the age of only eleven. He studied Geology at Antioch College and later took his Ph.D. at Columbia

University.His career has centred around his work as Curator of Invertebrate Palaeontology and later as Professor of Geology at the Museum of Comparative Zoology, Harvard University. Since 1982 he has also been Alexander Agassiz Professor of Zoology. His detailed studies of fossil organisms have led him to challenge some of the tenets of modern neodarwinism. Perhaps his most important general contribution to evolutionary thinking was the development and publication in 1972, together with Niles Eldredge, of the concept of punctuated equilibrium. The suggestion was that evolution occurs rapidly at times of speciation and is typically then followed by long periods of evolutionary stasis, in contrast to the more traditional view that evolutionary change is generally more gradual and not necessarily accompanied by speciation events, or cladogenesis. In the twenty years since it was published, this idea has stimulated a wide variety of studies and has brought palaeontology back to the forefront of evolutionary biology. What greater value can a hypothesis have?

We were indeed fortunate that Stephen was able to take part in our Annual Regional Meeting last September in Cardiff, where he himself contributed to a broad review of the development of the concept of punctuated equilibrium over the past twenty years. We all, as biologists and scientists, owe a deep debt of gratitude to Stephen Gould for his attacks on much of the non-science that pervades so much of modern society on both sides of the Atlantic. This is best exemplified in his critiques of so-called creation-science and his willingness to stand up and argue the case on behalf of us all in public. He surely played a major, if not the decisive, part in convincing the Federal District Judge in Arkansas in January, 1982, to declare the act requiring a balance of time to be devoted to the teaching of evolution and creation-science in schools to be unconstitutional.

Stephen's writings are very widely read. His collections of essays, mostly first published as monthly contributions to *Natural History Magazine*, brought together in a series of volumes under such intriguing titles as — *Ever Since Darwin*, *The Panda's Thumb*, *Hens' Teeth and Horse's Toes*, *The Flamingo's Smile*, and most recently *Bully for Brontosaurus*, are classics and models for students of all ages. His recent *Wonderful Life* is a best seller and prize winning volume which again puts palaeontology at the centre of evolutionary biology by an analysis of the astonishing diversity of life at the Cambrian explosion, specifically as exemplified in the remarkable fauna of the Burgess Shales.

Stephen Gould has received many awards, distinctions and honorary degrees for his contributions to science. He has served as President of the Paleontological Society (1985-86) and the Society for the Study of Evolution (1990). His contributions to our subject have been recognised previously by this Society when he was elected as a Foreign Member in 1985.

Stephen you rank with the greatest of popularisers of biological science, in the formidable tradition of T.H.Huxley, J.B.S.Haldane and Peter Medawar. You are indeed a worthy recipient of the Linnean Gold Medal for Zoology.

H.H.Bloomer Award (Zoology)

Dr. Kenneth Angus Spencer

Ken Spencer was born and lived much of his working life in Surrey, though he and his wife Ann have for some years now lived in Cornwall. As a schoolboy Ken was interested in natural history and collected all kinds of animals and plants, but even at that stage showed a predilection for insects.

After taking his degree in German and other languages at University College, London, he went into business as a sales director. In this capacity he travelled widely and it was during a visit to Berlin that he first met Professor E.M.Hering, a noted lepidopterist and expert on leafminers at the Berlin Museum. Hering was a major influence on him and encouraged his enthusiasm for leafmining Diptera of the, at that time, little known family Agromyzidae. Ken visited Berlin very frequently during the 1950's and 60's and on these occasions he always found time to visit Herin. His enthusiasm then, as at all times since, was enormous. For many years he did two full time jobs, for only one of which was he paid!

He rapidly became a leading authority, first on British and European Agromyzidae, but later on the World fauna. He himself has collected in more than 50 countries and described 1200 new species in 130 major publications. None of this descriptive work would have been possible without the devoted help of his wife Ann, who illustrates his works with meticulous and accurate drawings of details of genitalia, mouthparts and other diagnostic features.

Ken's interests in Agromyzidae as living insects and their behaviour and host plant preferences has enabled him to produce taxonomic work of the highest quality. This body of work was recognised in 1970 by the University of London when he was awarded a richly deserved D.Sc.

Ken has a new book in press, and due to be published shortly, entitled - *"Flycatcher–memoirs of an amateur entomologist"*. In this he will reveal his own view of his life and of his interactions with, and observations on, other entomologists both amateur and professional. Some of us will await this publication with eager anticipation.

Kenneth Spencer is one of that special band of amateur scientists who have more than matched the achievements of their professional colleagues. He is a very worthy recipient of the Linnean Society H. H. Bloomer award.

The Jill Smythies Prize for Botanical Illustration

John Mark Fothergill

Mark Fothergill was born in Westmorland and graduated in medieval history and archaeology from St. Andrew's University in 1983. Until 1985 he worked as an archaeologist in Scotland, Cumbria and the Peruvian Andes. It was there that he painted several local plants and subsequently brought the drawings to Kew to be identified. His talent was evident and with the help of Tony Hall in the Alpine Department and Dr Chris Grey-Wilson at Kew he built up a professional portfolio of botanical paintings and was taken on to illustrate the *Kew Magazine* and *Kew Bulletin.*

He has been working in a freelance capacity at Kew for the past six years, also

obtaining an M.Sc in Forestry at Oxford University in 1988; he has participated in expeditions to Brazil, where he has painted plants for Brazilian collectors, such as Roberto Burle Marx, the landscape architect, and to Venezuela. Currently he is in Brazil participating in the UNCED meeting as a Margaret Mee Scholar, teaching and carrying out fieldwork.

His work has been or is about to be published additionally in *Flower Artists of Kew*, *Weed Flora of Kuwait*, *European Garden Flora*, *Flora of India*, *Flora of Australia*, *Orchids of Borneo*, *Flowering Plants of Africa*, *Flora Neotropica*, *Flora of Arabia* and *Orchid Digest*. He has exhibited at Kew in 1989 and at the Broughton Gallery in Scotland in 1992. He holds silver and silver gilt medals from the Royal Horticultural Society, and is a worthy winner of the Jill Smythies Prize.

The Bicentenary Medal (Botany)

Dr. Stephen Blackmore

Dr. Blackmore's research career began with his Ph.D. on the *"Palynology and Systematics of the Cichorieae"* at the University of Reading. In the early 1970's this study pioneered the extensive use of SEM sections to elucidate pollen wall architecture, and this approach proved particularly useful for interpreting the complex and systematically informative pollen wall in the Compositae. Several publications resulted from this work and on the basis of these, and many subsequent studies, he is now acknowledged as a leader in the field of systematic palynology.

After graduating from Reading in 1976, Dr. Blackmore worked briefly for the Royal Society as a botanist and administrator at their Aldabra Research Station, and subsequently he was employed by the ODA and University of Malawi as head of the Malawi National Herbarium in Zomba. During his three-year stay in Malawi he led an active programme of collecting, participated actively in the design of the National Botanic Garden, and advised on the management of the Malawi National Parks.

In 1980 Dr. Blackmore returned to the U.K. as Head of the Palynology Section of the British Museum (Natural History), and began to develop an active program of research in the broad field of palynology. He substantially expanded the range of research projects under way in the section, and while continuing traditional strengths in systematic and descriptive palynology he was also able to attack broader questions of pollen grain function and development. In many ways, under Blackmore's guidance the palynological research undertaken at the BM began to focus more on attempting to explain, rather than simply document, the extraordinary diversity of form among pollen grains.

Blackmore's broad interests have led him to investigate the functional morphology of pollen grains (both pollination and harmomegathy) and also to undertake studies of comparative ontogeny. Most recently, he has focused on comparing the ontogeny of morphologically different pollen grains in closely related taxa, with a view to understanding how modifications of ontogeny have resulted in evolutionary divergence. For his ontogenetic studies Blackmore has made extensive use of the scanning electron microscope and has developed several new techniques of cytoplasmic etching in collaboration with Susan Barnes of the British Museum SEM unit. These

etching techniques allow three-dimensional visualization of internal cellular details (membranes, nucleus, vesicles etc.) and provide detail of cytoplasmic constituents that are simply unattainable using conventional TEM techniques. The success of this new approach was recognized by the Linnean Society in 1987 with the presentation of the Trail Crisp Award. Blackmore's research on the comparative ontogeny of pollen and spores continues, and there is every reason to anticipate further outstanding results from his work in this area.

In parallel with an exceptional laboratory-based research career Dr. Blackmore also has gained extensive field experience through his work in the Aldabra Atoll, Malawi, Belize, Honduras and Australia as well as several parts of Europe. He has supervised several excellent students and he also contributed a great deal to the vitality of botanical science in the U.K. He is an active participant in the Society for Electron Microscope Technology, the Systematics Association and especially the Linnean Society. He has been a Fellow since 1976, and in 1985, together with Keith Ferguson, organized a very well attended and successful Linnean Society symposium on "Pollen and Spores: Form and Function", which was seen through to publication in 1986. Blackmore has also worked actively for the Linnean Society Palynology Specialist Group and has been involved in organizing many of its regular meetings. In 1989, together with Frank Bisby, Blackmoore organized the joint Bicentennial Symposium on "Development Pathways and Evolution" which was subsequently published in the *Biological Journal* (**39**,2); and in 1990, together with Susan Barnes he organized a further Bicentenary Symposium on "Pollen and Spores: Patterns of Diversification" which is shortly to appear in print.

In 1990 Dr. Blackmore succeeded John Cannon as Keeper of the Department of Botany at the Natural History Museum. He became the youngest scientist to be appointed Keeper of Botany since Robert Brown,but he also assumed these responsibilities in the face of major changes at the museum. In my view, Blackmore has shown excellent judgement in guiding his Department through some difficult times, ensuring the Department's long-term vitality and safeguarding its important role as a center for basic systematic research. There are very encouraging recent signs (such as the decision to hire Sandy Knapp) that under Blackmore's leadership the Department of Botany will not only survive, but flourish, in the reorganized Natural History Museum.

Irene Manton Prize

The award of the Irene Manton Prize was made to Drs Sharon Robinson and Robert Scotland, with the following citations:

Professor George Stewart, of University College London, writes:

"Sharon's thesis was a model of its kind; the results of her thorough investigations were clearly and ably presented. Sharon undertook a difficult problem, which was to establish the role of the enzyme glutamate dehydrogenase in plant metabolism. Up to the early 1970's it was widely assumed that this enzyme was responsible for ammonia assimilation in higher plants. However, the discovery of an alternative pathway in 1974 led to the realisation that GDH did not function in the role previously put forward

for it. Sharon employed a variety of highly sophisticated techniques to investigate directly the function of the enzyme. Using a combination of *in vivo* and *in vitro* approaches she was able through studies with ^{15}N labelled compounds to demonstrate that GDH catalyses the reductive deamination of glutamate. Her studies comprise the first direct evidence for the role of glutamate dehydrogenase. The impact of these results is amply demonstrated by the fact that the paper published from her thesis has been in constant demand from researchers in the field all over the world. This paper is likely to become a citation classic."

Dr Stephen Blackmore writes:

"Dr Scotland's thesis is a highly original study in plant systematics that contains an impressive body of new data (superbly documented and illustrated) coupled with innovative approaches to systematic analysis. The progress made towards an entirely new understanding of relationships between tribes and genera of a large and complex tropical family is quite exceptional for a doctoral thesis. The resolution of the systematic problems of the family was dependent on a thorough knowledge of their pollen grains, the most diverse of any family. Obtaining palynological data is painstaking work, but Robert prepared and examined a substantial amount of material. In addition, he reappraised several other important characters, such as corolla aestivation.

Robert has already published papers on systematic theory and on the hydro- dynamics of some Acanthaceae pollen grains. He is now preparing a major palynological monograph on the family and has several other papers in press. His paper at the symposium to mark Professor Stearn's 80th year was well received and characteristic of Robert's flair and originality."

Report of the Executive Secretary

In examining the work of Council and its Committees in 1991, undoubtedly the major concern has been the role of systematic biology in biological sciences as a whole and in the conservation of biodiversity in particular. Details of the various meetings held, or attended by Officers, in the course of the year have been publicised in *The Linnean* and the results of the UK taxonomy meeting in July in the blue booklet entitled *Taxonomy in the 1990's*. The House of Lords Select Committee on Science and Technology, aided by two former presidents of the Society, Professors Chaloner and Claridge, has deliberated and reported on the matter. NERC is due to report next week, after which the Society is seeking a meeting with Rt. Hon. William Waldegrave MP. Interesting times for the Society, indeed.

Two editors are in the throes of moving on, Dr. Doris Kermack from the *Synopses of British Fauna*, and Dr. Stephen Jury from the *Botanical Journal*. They are replaced by Dr. John Crothers and Prof. Dianne Edwards. To the former go our thanks and good wishes, and to the latter our best wishes for their success. Publishing is a mainstay of the Society and all who give freely of their time to the Society's publications deserve our special thanks. It was great in October to be able to celebrate 25 years with Academic Press, the patience and understanding of whose staff surpasses all expectations.

Meetings have been well attended this year. This contrasts with 1990, when the Programmes Committee felt it necessary to make some changes to the Society's schedule, by reducing the number of evening meetings, and starting them at 4.30pm. The Sixth Form programme has been particularly well attended, and clearly demonstrates the value of Mrs. Virginia Purchon's work in getting it together. The enhanced support for all the Society's meetings is gratifying for speakers, organisers and Society staff, who work hard and, by and large, successfully in making them tick.

In 1991, the successful Annual Regional Meeting at Cardiff encompassed a Council Meeting, the first, we believe, outside the Society's rooms for many years. Members' attention is drawn to the next Annual Regional Meeting in Edinburgh on 1/2nd October.

The BES has moved to its own premises in Putney after 9.5 years. It has been a useful collaboration, which we hope to continue under the watchful eye of John Crothers, as our representative on the BES Council and Meetings Committee. We wish the BES well in its new-found independence.

The Society is contributing through its members to the provision of free books for Eastern European academic institutions. At present this is confined to Charles University in Prague, but might be extended to other places if this initial experiment is successful.

Finally, our membership is just short of 2500, of whom nearly one half are overseas.

JOHN MARSDEN

Treasurer's Report

Audited Accounts for year ended 31 December 1991

These accounts were examined by the Finance Committee in March, by the Audit Review Committee in April and by Council this afternoon.

On the Income side of the Income and Expenditure Account there is a new item entitled 'Grants Received' – £17,705. This is made up of grants received from the European Commission, the Danish Government, the UK Government, Annals of Botany and Imperial Chemicals Industries in respect of the meetings we held last summer on Taxonomy (at the Royal Society) and on Biodiversity (at the Savile Row lecture theatre). These grants helped to meet staff and other costs associated with the meetings. Under Expenditure, the item for Scientific Meetings (net) takes into account the monies paid by participants for meals and fees but not the grants referred to above. To these and other donors the Society returns its very sincere thanks. Fellows will note that expenditure on the Library increased from 1990 to 1991 by nearly £5,000; this was approved in advance by Council who, like the Fellowship generally, greatly appreciate this most valuable asset which includes not only the books and manuscripts but also our excellent Librarian and her assistants. Under Office Equipment, the substantial increase on 1990 was due to additions to our computer system.

The £32,781 shown as Excess of Income over Expenditure for the year is carried forward to the General Fund (see Note 4) where an additional £8,800 from the Irene Manton Estate is also shown. Transfers of £10,000 each were made from this General

Fund to the Provisions for Repairs and Improvements and for Special Library Expenses.

The Joint Publishing Account shows the economies achieved by the policy of charging Fellows over and above Annual Contributions if they wish to receive two or more journals. We continue to be much indebted to Academic Press for the way they publish our journals. Our share of the Gross Profit for the year 1991, in respect of journals, was £106,116; from this we pay for the journals supplied to Fellows and we meet Editorial Expenses; the remaining surplus, £55,521, was transferred to the Income and Expenditure Account. The Society remains much indebted to authors for our scientific papers, our Editors and the publishers for this healthy state of affairs.

The market value of our investments (General Account and Trust and Special Funds) totalled £1,062,626 on 31 December 1991. I am pleased to report that on 26 May 1992 the total market value had increased to £1,161,294, in line with the rise in the stock market.

29 May 1992 R. W. J. KEAY

Report of the Auditors to the Fellows of the Linnean Society of London

We have audited the Financial Statements on pages 61 to 68 in accordance with auditing standards.

In our opinion the Financial Statements give a true and fair view of the state of the Society's affairs at 31st December 1991 and of its results and source and application of funds for the year ended on that date.

4, London Wall Buildings
LONDON EC2M 5NT

FRASER & RUSSELL
Chartered Accountants

The Linnean Society of London

Balance Sheet
31st December 1991

31st December 1990 £	ASSETS	£	£
606,672	**Investments** (as per schedule) (Market Value: 31st December 1991; £894,766) (31st December 1990; £789,163)		615,824
109,013	**Sundry Debtors**		74,258
21,031	**Deposit and Current Account balances**		65,691
736,716			755,773
	Less: Current Liabilities		
25,063	Contributions received for future years	26,789	
72,151	Provision for Repairs and Improvements (Note 1)	72,708	
14,481	Provision for Special Library Expenses (Note 2)	14,069	
29,300	Sundry creditors and provisions	26,859	
140,995			140,425
595,721			615,348
	Trust and Special Funds		
	Investments (as per schedule)		
172,870	(Market value; 31st December 1991; £198,156) (31st December 1990; £155,158)	202,351	
22,459	Deposit and Current Account balances	15,002	
195,329			217,353
£791,050			£832,701
	Represented by:—		
	General Funds		
578,017	General Fund (Note 3)	599,680	
17,704	Publications Fund (Note 4)	15,668	
595,721			615,348
	Trust and Special Funds		
195,329	Balance of Funds		217,353
£791,050			£832,701

R.W.J.Keay — Treasurer

Patricia D Fry,
W A Graham-Kerr,
Peter Henderson,
R W J Keay
Richard Wilding — Audit Review Committee

Income and Expenditure Account for the year ended 31st December 1991

1990 £		£
	INCOME	
61,580	Annual contributions received	62,859
555	Income tax recoverable on covenanted contributions (year to 5th April 1991)	673
45,709	Dividends and interest	50,135
2,211	Transfer from Minchin & Jane Jackson Funds	2,168
2,429	Publications - sales of back issues	2,735
921	Donations received	1,711
11,103	Use of rooms	15,990
13,860	Facilities of Premises	14,414
1,149	Miscellaneous receipts	2,236
3,140	VAT recoverable	1,709
239	Royalties	1,218
53,455	Publications (Note 7)	55,521
5,448	Contributions for Library Facilities	5,257
—	Grants Received	17,705
£201,799		**£234,331**
	EXPENDITURE	
7,185	Scientific Meetings (net)	14,427
464	Medals	1,171
4,238	Library— books and periodicals	6,129
691	binding repairs and cleaning of books	1,573
3,623	cataloguing	5,765
6,451	Newsletter (*'The Linnean'*)	6,131
	Bye Laws	1,416
67,558	Salaries and National Insurance	79,566
40	Staff Recruitment Costs	—
9,140	Financial Services (including audit fees)	12,004
9,750	Printing, stationery, postage and telephone	10,977
1,658	Photocopying	2,178
3,042	Office Equipment (including computer system)	13,176
5,289	General Rates	5,290
6,773	Electricity and Gas	10,645
6,400	Repairs, Renewals and Insurance	9,583
1,868	Expenses of Officers and Council	1,982
4,025	Catering	7,071
7,026	Miscellaneous	6,136
4,059	Cleaning and refuse disposal	6,330
£149,280		**£201,550**
£ 52,519	**Excess of Income over Expenditure for the year**	**£ 32,781**

Notes to Accounts - 31st December 1991

1990 £			£
74,338	**Note 1**	**Provision for Repairs and Improvements**	
		Balance at 1st January 1991	72,151
20,000		Increase in provision	10,000
(22,187)		Expenditure during year	(9,443)
£72,151		**Balance at 31st December 1991**	**£72,708**
	Note 2	Provision for Special Library Expenses	
11,001		Balance at 1st January 1991	14,481
6,000		Increase in provision	10,000
(2,520)		Expenditure during year	(10,412)
£14,481		Balance at 31st December 1991	**£14,069**
	Note 3	General Fund	
52,519		Excess of Income over Expenditure for the year	32,781
35,458		Realised net gains/(losses) on changes in investments during the year	(38)
—		Composition fees received during the year	120
—		Irene Manton Estate – Investment received	8,800
(20,000)		Transfer to Provision for Repairs and Improvements	(10,000)
(6,000)		Transfer to Provision for Special Library Expenses	(10,000)
516,040		Balance at 1st January 1991	578,017
£578,017		Balance at 31st December 1991	**£599,680**
	Note 4	Publications Fund	
17,527		Balance at 1st January 1991	17,704
4,603		Transfer from Joint Publishing Account (Less due to other Societies £20)	1,881
22,130			19,585
4,426		**Less:** Transfer to Publications Account	3,917
£ 17,704		**Balance at 31st December 1991**	**£15,668**

Note 5 No value is attributed to the Library, furniture, office equipment and stock of unsold journals in this Balance Sheet. Costs of acquisitions are written off as incurred.

Note 6 Annual contributions in arrears at 31st December 1991 amounted to £7,837 (31st December 1990; £7,996) 16% of this was paid in 1991).

	Note 7	**Publications Account**	
116,354		Half share of surplus on 1991 Joint Publishing Account – Journals	106,116
4,426		Transfer from Publications Fund	3,917
(14,859)		Synopses including purchase from E. J. Brill	1,671
105,921			111,704
	Less:		
46,143		Contributions to Joint Publishing Account and distribution cost for Journals – Fellows	47,057
6,323		Editorial expenses	9,126
52,466			56,183
£ 53,455		**Surplus transferred to Income and Expenditure Account**	**£ 55,521**

Joint Publishing Account with Harcourt Brace Jovanovich Ltd.

Income and Expenditure Account for the Publishing Year ended 31st December 1991

1990 £			£
	Sales –		
391,813	Journals (including Linnean Society contributions)		378,125
9,887	Books		6,925
£401,700			£385,050
	Stock at 1st January 1991		
	Production Costs –		
159,105	Journals		165,894
636	Books		3,870
159,741			169,764
—	**Less:** Stock at 31st December 1991		(748)
£159,741			£169,016
	Gross Profit for year –		
120,979	Harcourt Brace Jovanovich Ltd.		108,017
	Linnean Society –		
116,354	Journals	106,116	
4,626	Books: Publications Fund	1,901	
120,980			108,017
£241,959			£216,034

Trust and Special Funds
for the year ended 31 December 1991

	Deposit and current account balances at 1 January 1991	Income		Expenditure			Deposit and current account balances at 31 December 1991	Investments at	
		Dividends interest and income tax recovered	Investment sales Royalties or other receipts	Grants, awards transfers and sundry expenses	Purchase of investments	Administration contribution		Book value	Market value
	£	£	£	£	£	£	£	£	£
Flora Europaea Trust Fund	6,633	556	*7,000	12,675	415	122	977	3,425	3,425
Westwood Fund	557	233	-	-	515	19	256	3,468	3,395
Trail-Crisp Fund	466	143	-	-	-	12	597	2,001	1,957
Hooker Fund	2,117	393	-	-	-	38	2,472	4,548	4,448
Goodenough Fund	1,001	416	500	159	800	33	925	5,855	5,726
Minchin Fund (Note)	-	47	-	**41	-	4	2	680	665
Jane Jackson Fund (Note)	-	2,464	-	**2,127	-	217	120	35,045	34,274
The H.H. Bloomer Fund	1,201	512	-	-	25	51	1,637	6,612	6,472
P. Appleyard Fund	3,622	2,594	-	3,605	1,018	244	1,349	36,206	35,435
Dennis Stanfield Memorial Fund	853	470	-	121	31	65	1,106	6,289	6,157
Omer-Cooper Fund	4,166	2,279	-	4,238	537	223	1,447	29,268	28,743
Bonhote Fund	954	1,037	-	970	98	101	822	14,332	14,038
Jill Smythies Award Fund	(44)	459	-	495	-	35	(115)	6,525	6,381
Irene Manton Prize Fund	933	1,648	-	-	-	207	2,374	23,219	22,709
A. G. Side Fund		1,033	24,554	-	24,554	-	1,033	24,878	24,331
	£22,459	£14,284	£32,054	£24,431	£27,993	£1,371	£15,002	£202,351	£198,156

** Amount transferred to General Account

Royalties	6,000
Transfer from Post Office	1,000
	*£ 7,000

Schedule of Investments 31st December 1991

Nominal		General Account	Book Value £	Market Value £
£10,000		Treasury 8 1/2% Stock 1994	8,800	9,716
£25,000		Treasury 9% Stock 1994	21,637	24,659
£27,500		Conversion 10% Stock 1996	26,868	27,862
£27,500		Exchequer 10 1/2% Stock 1997	28,092	29,076
£27,250		Treasury 10 1/2% Stock 1999	27,148	28,413
58,000	Units	Allied Dunbar UT European GrowthTrust	15,196	11,983
14,874	Shares	Attwoods 5p Ordinary Shares	30,791	17,254
8,282	Shares	Barclays Bank Plc £1 Ordinary Shares	10,217	31,389
7,000	Shares	Bass 25p Ordinary Shares	35,933	34,545
4,250	Shares	B.A.T. Industries Plc 25p Ordinary Shares	3,397	26,690
8,000	Shares	Boots Co. Plc 25p Ordinary Shares	10,475	34,320
7,300	Shares	BTR Plc 25p Ordinary Shares	21,917	29,127
5,500	Shares	Cable & Wireless 50p Ordinary Shares	20,428	32,505
6,000	Shares	Cadbury Schweppes Plc 25p Ordinary Shares	4,620	25,860
3,990	Shares	Commercial Union Assurance Co.	12,934	19,232
4,700	Shares	Fisons 25p Ordinary Shares	18,227	15,322
10,350	Shares	General Electric 5p Ordinary Shares	24,992	20,648
7,600	Shares	Glaxo Holdings Plc 50p Ordinary Shares	1,287	64,828
8,000	Shares	Glynwed International 25p Ordinary Shares	24,999	16,720
1,250	Units	GUS "A" Ordinary Stock	7,700	17,688
15,100	Shares	Hanson Trust Plc 25p Ordinary Shares	18,920	30,125
28,000	Units	Henderson UT Management European Income Trust	14,476	15,848
12,000	Shares	Inchcape 25p Ordinary Shares	28,906	46,560
4,000	Shares	Inchcape Convertible Unsecured Loan Stock	—	2,380
4,490	Shares	Marks & Spencer Plc 25p Ordinary Shares	9,324	12,505
£20,000		J.Sainsbury Plc 8 1/2% Conversion Bonds	20,203	25,096
£11,000		Scottish Mortgage & Trust Plc. 8-14% Stepped Deb.	11,083	14,277
11,000	Shares	Sedgwick Group 10p Ordinary Shares	27,017	23,210
6,870	Shares	Shell Transport & Trading Co. Plc 25p Ordinary	8,330	34,213
2,854	Shares	Smithkline Beecham 25p 'A' Ordinary Shares	10,869	25,572
9,000	Shares	Tarmac 50p Ordinary Shares	29,008	10,440
10,730	Units	The Equities Investment Fund for Charities	16,711	50,699
9,600	Shares	Trust House Forte 25p Ordinary Shares	27,940	22,368
4,745	Shares	Unilever Plc 5p Ordinary Shares	16,543	42,800
		Uninvested cash held by James Capel	10,602	10,602
			605,590	884,532
		National Savings Bank - Investment Account	10,234	10,234
			£615,824	**£894,766**

Nominal		**Trust And Special Funds**	Book Value £	Market Value £
£25,000		Treasury 10 1/2% Stock 1999	24,923	26,066
7,150	Shares	Abtrust New European Investment Trust 25p Ordinary Shares	7,428	4,147
3,150	Shares	British Petroleum 25p Ordinary Shares	10,937	9,230
1,930	Shares	BTR 25p Ordinary Shares	8,347	7,701
1,550	Shares	Cable and Wireless 50p Ordinary Shares	8,493	9,161
7,800	Shares	F & C Eurotrust 25p Ordinary Shares	15,255	11,388
2,520	Shares	Fisons 25p Ordinary Shares	8,496	8,215
5,230	Shares	Fleming American Investment Trust 25p Ordinary Shares	9,269	9,649
4,687	Shares	Fleming Japanese Ivestment Trust 25p Ordinary Shares	7,386	7,499
937	Warrants	Fleming Japanese Investment Trust	348	300
2,490	Shares	Guinness 25p Ordinary Shares	8,483	12,637
3,690	Shares	Hanson 25p Ordinary Shares	8,494	7,362
10,020	Units	James Capel Gold and General Unit Trust	7,728	5,804
9,070	Units	James Capel Tiger Index Fund Unit Trust	9,279	7,912
2,905	Shares	Lloyds Bank £1 Ordinary Shares	8,492	11,388
900	Units	M & G Group Charifund	1,956	4,253
3,270	Shares	Sedgwick Group 10p Ordinary Shares	8,493	6,900
		Uninvested cash held by James Capel	36,929	36,929
			190,736	186,541
		National Savings Bank - Investment Account	11,615	11,615
			£202,351	£198,156

Source and Application of Funds Statement for the year ended 31st December 1991

	General Funds		Trust Funds	
	1991	*1990*	*1991*	*1990*
	£	£	£	£
Source Of Funds				
Excess of Income over Expenditure for the year	32,781	52,519	—	—
Other Sources of Income				
Composition fees received	120		—	—
Investments sale proceeds	491	186,405	132,054	168,010
Net Transfer to Publications Fund	—	177	—	—
Investment from Irene Manton Estate	8,800	—	—	—
Decrease in Debtors	34,755	—	—	—
Increase in Sundry Creditors	—	977	—	—
Increase in Contributions received for future years	1,726	—	—	—
	78,673	240,078	32,054	168,010
Application Of Funds				
Additions to Investments	9,681	176,481	27,993	160,974
Repairs and Improvements Expenditure	9,443	22,187	—	—
Special Library Expenditure	10,412	2,520	—	—
Decrease in Sundry Creditors	2,441	—	—	—
Increase in Debtors	—	40,693	—	—
Net Transfer from Publications Fund	2,036	—	—	—
Trust Funds Excess of Expenditure over Income	—	—	11,518	10,649
Decrease in Contributions received for future years	—	1,490	—	—
	34,013	243,371	39,511	171,623
Movement in Cash Deposit and Current Account balances	44,660	(3,293)	(7,457)	(3,613)
Balances at 1st January	21,031	24,324	22,459	26,072
Balances at 31st December	£65,691	£21,031	£15,002	£22,459

Library

The summer reorganisation of journals now gives us a historical/geographical sequence for France and Belgium and we are half way through the Netherlands, hoping to finish this over the Christmas period. This leaves a large body of German journals still to be dealt with. As these are now in temporary locations they may take a little longer to find. We have also had some extra help with cataloguing and have caught up with most of the accumulated backlog of older donations or book-sale additions. The next book sale will be on 21 January 1993.

Donations

We would to thank all those listed below for their gifts to the Library over recent months, including P. Tuley whose constant gifts of tropical agriculture books are too numerous to list individually and the Joint Nature Conservation Committee for copies of 16 recent publications. This issue includes all items received by the end of August but the other accessions exclude some of the older items acquired through "Booknet". As usual we are also grateful to those who present us with back issues of journals, miscellaneous publications and reprints. An addition to our collection of illustrative material is a nature print of a bat by M. Auer, presented by Dr. G. Reichel-Dolmatoff FLS, a descendant of Auer.

Prof.S.I. Ali	Ali, S.I. & Nasir, Y.J.,*Flora of Pakistan, No. 193: Ranunculaceae*, by Harold Riedl and Yasin J. Nasir. 164 pp.,illustr., map, Islamabad, P.A.R.C. 1991.
An Gum	O'Curraoin, P.L. *Feara agus Banta Eireann.* 101 pp., illustr., [Dublin], An Gum, 1991.
E. & D.S.Berkeley	Berkeley, Edward & Berkeley, Dorothy Smith,eds., *The correspondence of John Bartram 1734 - 1777.* 808 pp., frontisp., Gainesville, Univ. Presses of Florida, 1992.
D. O'D. Bourke	Bourke, D.O'D, *French - English agricultural dictionary with English-French index.* 293 pp., Wallingford CAB, 1992.
C. Bowlt	Ochse, J.J., *Vegetables of the Dutch East Indies* (reprint of the English edition). 1005 pp. + appendices, illustr., Amsterdam, Asher, 1980.
Dr. H.M. Burdet	Jeanmonod, D. & Burdet, H-M, *Complements au Prodrome de la flore Corse: Scrophulariaceae.* 234pp., illustr., maps, Geneva, Conservatoire et Jardin Botanique, 1992.
Chapman & Hall	World Conservation Monitoring Centre, *Global biodiversity, status of the Earth's living resources,* edited by B. Groombridge. 585 pp. maps, London, Chapman & Hall, 1992.
Prof.J.L. Cloudsley -Thompson	Cloudsley-Thompson, J.L., *Invertebrate animals (from Protozoa to Annelida*), 76 pp., illustr., Jodhpur, Scientific Pubs., 1992.
Prof. E.J. Corner	Corner, E.J., *Botanical monkeys.* 55pp.,illustr., Edinburgh, Pentland Press, 1992.

Dr.D.F. Cutler	Cutler, D.F. & Richardson, I.B.K., *Tree roots and buildings* (2nd edition), 71 pp.,map, Harlow, Longmans Scientific, 1989.
	Gasson, P.E. & Cutler, D.F., *Tree root plate morphology and the windblown tree survey, analysis of records*, 286 pp., illustr., [London,] A.B. Academic Publishers, 1990.
R.A. DeFillips	DeFilipps, Robert A., *Ornamental garden plants of the Guianas: an historical perspective of selected garden plants from Guyana, Surinam and French Guiana*, 364 pp., illustr.,maps, Washington, Smithsonian Institution, 1992.
Dr.L.K. Derrick	Nilsson, Annika, *Greenhouse earth*, 215pp.,maps, Chichester, J.Wiley, 1992.
Mrs B. Edwards	Broberg, Gunnar, *Carl Linnaeus*, 29 pp., illustr., Stockholm, Swedish Institute, 1992.
R.G. Fitter	Bannikov, A.G. & Rustanov, A.K. [*Protection of Nature, textbook and manual*], 206 pp. illustr., Moscow, Kolos, 1977.
P. Forey	Forey, Pamela, *The pocket guide to wildflowers of the British Isles and Northern Europe*, 224 pp., col. illustr., Limpsfield, Dragon's World, 1992.
Geological Society	Doumenge, Francois & Toulemont, Anne, *Nacres et Perles* (Bull.Inst. Oceanog. Monaco, special No. 8). 162 pp., illustr., some col. Monaco, Musee Oceanographique 1992.
	[FRANCE, Voyages etc.], *Exploration scientifique de Tunisie: illustrations de la partie botanique*. pl. 1 -20, Paris, Imp. national, 1892 - 1895.
	Griffiths, C.L., *Guide to the benthic marine amphipods of Southern Africa*. 106 pp., illustr., Cape Town, South African Museum, 1976.
	Harvey, M.J. & McLachlan, J., *Chondrus crispus*, 155 pp., illustr., Halifax, Nova Scotia Inst. of Science, 1973.
	Kensley, Brian, *Guide to the marine isopods of Southern Africa*, 173 pp., illustr., Cape Town, South African Museum, 1978.
	TOKYO, Dept. of Education, *Preservation of National Monuments in Japan: II*. 49 pp., illustr., maps, Tokyo, 1933.
	Walker, C.W. & Smith, A.J., *Herefordshire birds*, 74 pp., Hereford, Woolhope Naturalists' Field Club, 1975.
B. Guild Gillespie,	Gillespie B. Guild, *On stormy seas, the triumphs and torments of Captain George Vancouver*, 298 pp. illustr.,maps, Victoria, B.C. Horsdal & Schubert, 1992.
P. Holliday	Holliday, Paul, *A dictionary of plant pathology* (reprinted with corrections). 369 pp., Cambridge, CUP, 1992.

Dr A. Hollman	Udvardy, Miklos D.F., *Audubon Society field guide to North American birds: western region*, 852 pp., col. illustr., maps, New York, Knopf, 1992.
House of Lords	Great Britain & Ireland, House of Lords, *Report of the House of Lords select Committee on Systematic Biology Research*, Vol.2. 319 pp., London, HMSO, 1992.
R. Howard	Howard, Richard & Moore, Alick, *A complete checklist of birds of the world*, 2nd ed. 622pp., London, Academic Press, 1991.
Hunt Institute	PITTSBURGH, Hunt Institute, *7th International Exhibition of botanical art and illustration*. 141 pp., illustr., Pittsburgh, Hunt Institute, 1992.
Prof.R.W.J. Keay	Gartland, Steve, *La conservation des ecosystemes forestieres du Cameroun*, (IUCN Conservation Programme series) 186 pp., illustr.,map, Gland, IUCN, 1989.
	Howard, Peter C. *Nature conservation in Uganda's tropical forest reserves*, (IUCN Forest Conservation Programme series) 313 pp., maps, Gland, IUCN, 1991.
	Jarry. I, *Theodor Monod*, 239 pp., illustr., Paris, Plon, 1990.
	Myers, Norman, *Tackling mass extinction of species, a great collective challenge*. (Horace Albright lecture, No.26), 40 pp., Berkeley, Univ. California, 1986.
	Poore, Duncan & Sayer, Jeffrey, *The management of tropical moist forest lands*, (IUCN Forest Conservation Programme series) 69pp. illustr., Gland, IUCN, 1991.
Dr.M. Kirkpatrick	Bovet, P. (and others), *Plantes medicinales populaires des Seychelles*, 93 pp., illustr., Victoria, (privately) 1991.
Dr. M. Köhler	Köhler, Marcus, *Fruhe norddeutsche Landscafts garten zwichen 1750 und 1770*, (doctoral thesis, Freien Universitat Berlin, Inst. fur Kunstgeschichte) 190 pp., illustr., Berlin, 1992.
Dr.K. Magdefrau	Magdefrau, Karl, *Geschichte de Botanik, leben und leistung grosser Forscher*, 359 pp., illustr., maps, Stuttgart, Fischer, 1992.
Dr.J. Marsden	Ereshefsky, Marc, ed. *The units of evolution. Essays on the nature of species*. 405 pp., Cambridge, Mass., MIT Press, 1992.
Dr. K.P. Matthew	Matthew, K.M., An excursion flora of Central Tamilnadu, India, 647 pp., map, New Delhi, Oxford U.P. & IBH, 1991.
	Matthew, K.M. A manual for RHT and SHC Herbaria, India, 92 pp., illustr., 4 col.pl., Tiruchirapalli, Rapinat Herbarium, 1992.
Prof. A.D.J. Meeuse	Meeuse, A.D.J. *Angiosperm evolution, no abominable mystery*, 63 pp., illustr., Delft, Eburon, 1992.

National Trust	National Trust, *An English arcadia, design for gardens and garden buildings in the care of the National Trust 1600 - 1990*, by Gervase Jackson-Stops. 160 pp., illustr., London, National Trust, 1991.
Oxford University Press	Stearns, Stephen C. *The evolution of life histories*, 249 pp., illustr., Oxford, OUP, 1992.
Tom Panzera	Aiken, George D., *Pioneering with wildflowers*, 129 pp., illustr., Putney,Vt., privately, 1935.
	Aiken, George D., *Pioneering with wildflowers*, 208 pp., illustr. some col., Englewood Cliffs, NJ., Prentice Hall, 1968.
R. Pethiyagoda	Pethiyagoda, Rohan, Freshwater fishes of Sri Lanka, 362 pp., col.illustr.,maps, Colombo, Wildlife Heritage Trust, Sri Lanka, 1991.
F. Pieters	Clarke, T.H., *The rhinoceros, Durer to Stubbs, 1515-1799,* 219 pp., illustr., some col., maps, London, Sotheby's, 1986.
Prof. P.H. Raven	Chen, Chia-jui, Hoch, Peter C. & Raven, Peter H., *Systematics of Epilobium (Onagraceae) in China*, Systematic Botany Monographs Vol. 34. 208 pp., illustr., maps, Ann Arbor, 1992.
L. Schaaf	Schaaf, L., *Tracings of light, Sir John Herschel and the Camera Lucida*, 119 pp., illustr., San Francisco, Friends of Photography, 1989.
Prof. R.E. Schultes	Schultes, R.E. & Raffauf, R.F. *Vine of the soul, medicine men, their plants and rituals in the Colombian Amazon*, 282 pp., illustr., map, Oracle, Synergetics Press, 1992.
Dr O. Seberg	Seberg, O. & Lundquist,A., *Proceedings of the 1st international Triticeae symposium, Helsingborg, 1991*, (Hereditas Vol.116). 328 pp., illustr., 1992.
Dr.K.A. Spencer	Spencer, K.A., *Flycatcher, memoirs of an amateur entomologist*, 414 pp., illustr., The Hague, SPB, 1991.
Akad.L.Tatarinov	Chudinov, P.K., [*Faunie Terapsidi.*] 226 pp., illustr., Moscow, 1983.
	Sytchevskaya, E.K., *Neogene freshwater fish fauna of Mongolia*, 140 pp., illustr., Moscow, Nauka, 1989.
Dr. L.Wallin	Uppsala University, Zoological Museum, *Catalogue of type specimens: 4: Linnaean specimens*, complied by Lars Wallin, 233 pp., Uppsala, Zoological Museum, 1992.
Martin Walters	Walters, Martin, Wildlife travelling companion: Great Britain & Ireland, 240 pp., col. illustr.,maps, Marlborough, Crowood Press.
P.J. Warren	Gorsline, Jenny, ed., *Rainshadow, Archibald Menzies and the botanical exploration of the Olympic Peninsula*, 63 pp., illustr., map, Port Townsend, Jefferson Co. Historical Society, 1992.

R. Wilding	Collected bound reprints: *Lectures in physical geography* (including papers by A.R. Wallace and others) various, London, 1877-1878
	Richards, Robert J. *The meaning of evolution, the morphological construction and ideological reconstruction of Darwin's theory*, 205 pp., illustr., Chicago, Univ. of Chicago Press, 1992. London, E.Arnold, 1971.
R. Wise	Coe, Malcolm & Beentje, Henk, *A field guide to the Acacias of Kenya*, 148 pp., illustr., Oxford, OUP, 1991.
Prof.B. Wood	Wood, Bernard, *Koobi Fora research project Vol.4: Hominid cranial remains*, 466 pp., illustr., Oxford, Clarendon Press, 1991.

Other recent accessions received by 1st September 1992 include:

Berhaut, J. ed. *Flore illustree du Senegal*, Vols. 1,3,4,5,6 & 9, Dakar, Govmt. of Senegal, 1971 - 1988.

Bibby, Cyril, *Scientist extraordinary, the life of Thomas Henry Huxley 1825 - 1895*, 208 pp., illustr., Oxford, Pergamon. 1972.

Bishop, George, *Travels in Imperial China, the explorations and discoveries of Père David*, 192 pp., illustr., 20 col.pl., maps, London, Cassells, 1990.

Calder, William A. *Size, function and life history*, 431 pp., illustr., Cambridge, Mass., Harvard University Press, 1984.

Chhapgar, B.F. *Nature guides: seashore life of India*, 78 pp.,8 col. illustr., Bombay, OUP for WWF India, 1991.

Cottrell, C.B. *Aspects of the biogeography of Southern African butterflies*, 100 pp., Salisbury, 1978.

Courtenay, Walter R. & Stauffer, J.R. *Distribution, biology and management of exotic fishes*, 430 pp., Baltimore, John Hopkins Univ. Press, 1984.

Darlington, P.J. *Evolution for naturalists: the simple principles and complex reality*, 262 pp., illustr., New York, Wiley, 1980.

Duffus, C.M. & Slaughter, J.C. *Seeds and their uses*, 154 pp.,illustr., Chichester, Wiley, 1980.

Erikkila, A. & Siiskonen, H., *Forestry in Namibia, 1850-1990*, 244 pp., illustr. some col., maps, Joensuu, Joensuu University, 1992.

Falk, Donald A. & Holsinger, Kent E. *Genetics and conservation of rare plants*, 283 pp. New York, Oxford University Press, 1991.

Forst, Clifford M., *Rhubarb, the wondrous drug*, 371 pp., illustr., Princeton, Princeton University Press, 1992.

Gupta, V.K. & Sharma, N.K. *Tree protection*,439 pp., Solan, Indian Soc. of Tree Scientists, 1988.

Heiser, Charles B. *From seeds to civilization, the story of food*, 254 pp., illustr., San Francisco, W.H. Freeman; 1981.

Holmgren, Patricia K. & Holmgren, Noel H. *Plant specialist index* (Regnum Vegetabile 124). 394 pp. Konigstein, Koeltz for IAPT, 1992.

I.U.C.N. World Conservation Union, *Protected areas of the world, a review of natural systems:* Vol.2. Palearctic. 556 pp., maps, Gland, I.U.C.N., 1992.

Lines, William J. *Taming the great south land: a history of the conquest of nature in Australia*, 337 pp. illustr., London, Allen & Unwin, 1991.

Linnean Society of London, *Desertified grasslands, their biology and management*, edited by G.P. Chapman (Linnean Society Symposium Series, No.13) 360 pp., col.illustr., London, Academic Press, 1992.

Martin, Claude, *The rainforests of West Africa, ecology, threats, conservation*, 234 pp., illustr.,some col., maps, Basel, Birkhauser, 1991.

Miller, Jaqueline Y. ed., *The common names of North American butterflies*, 177 pp., Washington, Smithsonian Institution Press, 1992.

Nayar M.P. & Giri, G.S., *Key works of floristics of India*, 350 pp., col. illustr., Delhi, Botanical Survey of India, 1988.

Prance, G.T. *Leaves*, 244 pp., col.illustr., London, Thames & Hudson, 1985.

Shetty, B.V. & Singh, V. eds., *Flora of India, ser.2, Flora of Rajastan*, 451 pp., illustr., Delhi, Botanical Survey of India, 1987.

South, A. *Terrestrial slugs, biology, ecology and control*, 428 pp., illustr., London, Chapman & Hall, 1992.

Spencer, Kenneth A. *Host specialization in the world Agromyzidae (Diptera)*, 444 pp., illustr., Dordrecht, Kluwer Academic, 1990.

Store, Charles P. & Scott, J. Michael, *Hawa' ii 's terrestrial ecosystems: preservation and management* (Proceedings of a symposium. . .) 584 pp., Honolulu, Univ. of Hawaii, 1984.

Storr, G.M., Smith, L.A. & Johnstone, R.E. *Lizards of Western Australia, I. Skinks*, 200 pp., illustr., some col., maps, Perth, Univ. Western Australia Press, 1981.

Winston, Mark L. *Killer bees: the Africanized honeybee in the Americas*, 162 pp.,illustr., Cambridge, Mass., Harvard University Press, 1992.

Book Reviews

The Plant Finder (6th Edition - April 1992)

This is quite the most valuable source of information about the plants stocked by the nurseries and garden centres of the British Isles.

It offers an alphabetical list of genera of flowering plants, ferns and fern-allies, and, within each genus, there is a list of species (and infrataxa and cultivars), each entry recording the nurseries currently offering plants. This information derives from the catalogues of the various suppliers whose geographical locations are shown in a series of maps.

In the most recent editions, additions to this list concern seedsmen and orchid, cactus and succulent suppliers whose offerings are not yet fully incorporated in the general list — a decision maybe deferred because of the increase in bulk that this incorporation might well engender.

Gardeners going abroad may like to know that similar volumes are now available for France, Germany and Switzerland.

Speaking personally the *Plant Finder* has served me well with an impressive freedom from errors and omissions and I can thoroughly recommend it.

[Apart from my interest as a "botanical gardener" the listings have also been invaluable in helping me to locate materials used by a prestigious group of tissue-culture researchers led by Barry Charlwood of King's College and Brazil].

Phylogeny, Ecology and Behaviour. A Research Program in Comparative Biology, D.R.Brooks and D.A.McLennan. 1991. The University of Chicago Press, Chicago. xii+434pp.

This book justly deserves attention. Its publication could not come at a more appropriate time. It highlights in a most exemplary manner the importance of systematics and phylogeny reconstruction for issues in ecology and behavior, issues with intimate links to conservation. "Historical ecology" is the discipline the authors advocate as a research program in comparative biology. Presenting critical arguments bearing on parts of Brooks and McLennan's book should in no way detract from the attractive perspective of integration of phylogenetic systematics with ecology and behavior with which the authors provide us — a perspective which promises to move systematics and phylogeny reconstruction into the focus of students primarily interested in ecology and behavior who until now may have seen little merit in mastering the tortuous path of "character optimization" on a tree.

The book is dedicated by its authors to leading biologists such as Charles Darwin, Willi Hennig, Konrad Lorenz, Herbert Ross and Niko Tinbergen. I personally was particularly intrigued by the reference to Konrad Lorenz (1941a), whose seminal paper on the mating behavior of ducks is cited in the list of references, but hardly discussed in the text — in spite of the fact that Lorenz, in this paper, presents an abstract of the principle of "Hennig argumentation". Hennig's "auxiliary principle", as well as the "principle of generality" (providing the theoretical justification for the application of the principle of parsimony and hence of the test of congruence in today's phylogeny reconstruction) were fully developed in this paper by Lorenz.

And this is where, as I believe, some rather theoretical problems start, that is with a Kantian view of nature — decidedly a bias of Lorenz (1941b) — or rather with its neglect! Kant introduced the intellectual postulate of a "thing in itself" or "reality in itself" only to show that there is no empirical access to such an ideal world. Indeed, taking the intellectual postulate of "reality in itself" as an empirical dimension creates a logical contradiction: this is what Brooks and McLennan create with their postulate

of knowledge of "the *true* phylogeny" (p.158; emphasis added). Knowledge of "the true phylogeny" is impossible. All we can strive for is maximum congruence of what we believe is similarity with potential for phylogenetic information, i.e. congruence of conjectures of homology. However, as we all know, homology always represents only a conjecture of common ancestry, which in the context of parsimony analysis and upon the introduction of new characters, or re-definition of old ones, may turn out to be homoplasy: every homologue is a potentially homoplastic character and vice versa. One wonders, therefore, what Brooks and McLennan could have had in mind if they state that "classes are defined by convergences [i.e.homoplasies], whereas individuals are defined by homology [i.e. synapomorphies]" (p.74). The argument is misguided in two ways: first it implies that every "class" may potentially turn out to be an "individual" and vice versa, and secondly it implies that individuals can be defined (by homologies), which is precisely what has been denied by those authors who defend the thesis that species are individuals.

If every conjecture of homology may potentially turn out to be homoplasy upon re-analysis, and vice versa, every Aristotelian class may — on the argument presented by Brooks and McLennan — potentially turn out to be an individual and vice versa, and the distinction becomes trivial, which is probably true, at least from an epistemological point of view. What is less trivial, however, is that species as individuals should be *defined by homologies* (p.74, emphasis added)! The problem originates with the attempt to use the term "cladogram" as a synonym of "phylogenetic tree" (p.206) and hence to treat the species as a monophyletic group (taxon) while at the same time preserving its role as the unit of Darwinian evolution, i.e. as actual ancestor.

A long-standing conundrum of cladistic approaches to phylogeny reconstruction has been how to deal with species and ancestors if the "discovery procedure" (Nelson, 1989) allows for the recognition of taxa (monophyletic groups) and levels of common ancestry only. One strategy to deal with this problem is to waive the requirement of monophyly (as demonstrated by synapomorphy = homology) for species, and to view species as something different from taxa = monophyletic groups. What about cladistic structure below the "species" level? The claim that species level homologies are autapomorphies (p.371–372) does not resolve the issue since species autapomorphies are synapomorphies at the level of demes or populations. If species are defined by homology (p.74), species autapomorphies must be homologies (p.371–372) — but since homology is a relational concept, it must be a *shared* character, i.e. shared by below-species-level entities. There is no basis for denying the existence of cladistic structure below the species level.

In their strategy, Brooks and McLennan follow Wiley *et al.* (1990), considering species as individuals (p.74), while at the same time exempting species from the monophyly criterion (p.27) but retaining their status as taxa: "There are two kinds of natural taxa: species and monophyletic groups". By implication, the species is *not* a monophyletic group. But the species can be an ancestor of monophyletic groups (p.28), and a monophyletic group comprises "an ancestral species and all of its descendants" (p.27), i.e. it is a group of organisms that is bound together "by common ancestry relationships" (p.27). Does this mean that members (or parts if you wish) of species

are not bound together by common ancestry? Or if they are, does it mean that they, too, are monophyletic groups? But how, then, can they be ancestral, or why distinguish species and monophyletic groups as "*two kinds* of natural taxa" (emphasis added)? After all, species "*are* bound together by unique common ancestry" (p.76; emphasis added), and individuals (species) *are* "defined by homology" (p.74) — just as monophyletic groups! Ultimate confusion is created with the notion of the "artificial taxon" (p.28), a unit that neither takes part in an evolutionary process nor is a result thereof, and hence is a paraphyletic or polyphyletic assemblage. Such artificial taxa must by all standards constitute an Aristotelian class — characterized by characters nonetheless which may come to diagnose monophyletic groups, as homoplasy becomes homology upon re-analysis of the data. The artificiality of any taxon, indeed, is not revealed by knowledge of the "true" phylogeny, but by congruence, or rather the lack thereof, of conjectures of homology.

While all of the above may be dismissed, by a *coup de grâce*, as semantic quibble, matters become more serious when it comes to the analysis of modes of speciation and their consequences for co-evolutionary studies and conservation on the basis of cladistic principles. Brooks and McLennan follow Lynch (1989) in his conclusion that vicariant speciation is the most frequent mode of speciation, a model of speciation generating the prediction that "The phylogenetic tree for the group will be predominantly dichotomous. . ." (p.93). Could it be that vicariant speciation emerges as the most frequent mode of speciation simply because speciation is analyzed in terms of sistergroup relationships among species, equating dichotomies in a cladogram with speciation events on the basis of the assumption that "character evolution . . . is tightly coupled with speciation" (p.78)? What kind of character? Decoupling of molecular and morphological? evolution has been documented to a degree (Larson, 1988) which makes it impossible to correlate speciation with morphological evolution. Definition of species on the basis of molecular traits may not solve the problem for practical purposes (Geist 1992), and "most species are composed of geographic populations whose members occupy different branches of an intraspecific phylogenetic tree" (Avise, 1987: 516). By all standards, species end up with "fuzzy boundaries" — a theoretical requirement of Darwinism, as emphasized by David Hull (quoted on p.77), but certainly no promising perspective for a "definition" of species — as an entity of Darwinian evolution and as a potential ancestor of monophyletic groups — by homology!

If the pattern resulting from cladistic analysis is indistinguishable from vicariant speciation, vicariant speciation requires a test independent of cladistic methodology. Wiley (1981), Lynch (1989) and Brooks and McLennan have outlined a number of predictions by which the vicariant speciation model differs from other speciation models, but in no case are these predictions allowed to falsify the cladogram against which distributional patterns are matched. It has also been noted that speciation (by vicariance) seems to be enhanced in "hot spots" of the earth's surface (J.Cracraft), yet "at the moment, actual geological data for specific studies may exist only in a historical ecologist's utopia" (p.198). On the other hand, Brooks and McLennan admit the possibility of speciation processes resulting in polytomies (pp.95, 103; Figs. 4.6 4.8, 4.9), an observation I entirely agree with, but one which also creates problems for cladistic analysis in that it forfeits the theoretical justification for parsimony analysis and therewith for the test of congruence.

In parsimony analysis, polytomies are usually evidence for lack of resolution, i.e. lack of knowledge of phylogenetic relationships. However, if the term "cladogram" (or "branching diagram") is used synonymously with "phylogenetic tree" (p.206), if nodes in the tree represent speciation events (Fig.2.7), and if speciation may produce polytomies (that is: if there is no evolutionary law predicting dichotomous speciation) — why should we search for further resolution if polytomies occur in any analysis? Why search for additional and/or other characters, rather than accept polytomies as evidence for particular speciation events? This is a question clearly answered in Lorenz's (1941a) paper: dichotomies in a tree ("cladogram" or "branching diagram"), based on the logical subordination of the less general under the more general and on "Hennig's auxiliary principle"(which favors homology rather than homoplasy as the explanation for congruence), specify patterns and therewith levels of common ancestry, not causal relations such as speciation events.

Brooks and McLennan think that the time has come to develop the empirical data base "without the distraction of constant philosophical and methodological debate" (p.347). I for one certainly admire their summary of current knowledge, and there can be no doubt that mapping and/or optimizing functional or behavioral traits, geographic distributions, life-history traits, etc. on a cladogram provides interesting and important insights in the study of evolution — even if this procedure amounts to post-hoc explanations of patterns previously reconstructed, rather than to tests of these patterns. I am planning to use their engaging book in my class on phylogenetic systematics, as it breathes life into the otherwise tedious study of As, Bs and Cs. Yet the discussion above will hopefully indicate that philosophical and methodological debates are by no means useless distractions, but continue to be necessary to strengthen the research programme advocated by Brooks and McLennan.

OLIVIER RIEPPEL

REFERENCES

AVISE, J.C., 1987. Intraspecific phylogeography: the mitochondrial DNA bridge between population genetics and systematics. *Annual Review of Ecology and Systematics, 18*:489-522.

GEIST, V., 1992. Endangered species and the law. *Nature, 357*:274-276.

LARSON, A., 1989. The relationship between speciation and morphological evolution. *In* Otte, D. and J.A.Endler (eds), *Speciation and its Consequences*, pp.579-598. Sunderland, Mas.: Sinauer Assoc.

LORENZ, K., 1941a. Vergleichende Bewegungsstudien an Anatiden. *Journal fur Ornithologie, 83, suppl. 3 (O.Heinroth Festschrift):* 194-293.

LORENZ, K., 1941b. Kants Lehre vom Apriorischen im Lichte gegenwartiger Biologie. *Blätter für deutsche Philosophie, 15*:94-125.

LYNCH, J.D., 1989. The gauge of speciation: on the frequencies of modes of speciation. *In* Otte, D. and J.A. Endler (eds), *Speciation and its Consequences*, pp.527-535. Sunderland, Mas.: Sinauer Assoc.

NELSON, G., 1989. Cladistics and evolutionary models. *Cladistics, 5*:275-289.

WILEY, E.O., 1981. *Phylogenetics: the theory and practice of phylogenetic systematics.* New York: Wiley Interscience.

WILEY, E.O., J. SIEGEL-CAUSEY, D.R. BROOKS, and V.A. FUNK, 1990. *The Compleat Cladist: A Primer of Phylogenetic Procedures.* Lawrence: Museum of Natural History, Univ. of Kansas.