
THE LINNEAN

Newsletter and Proceedings of the Linnean Society of London

Edited by B. G. Gardiner

Editorial

Our Bicentennial Year ends with the Anniversary Meeting on 24 May. That it has been one of the most successful years in our history there can be little doubt. During the period January 1988—January 1989, 185 Fellows and 17 Associates were elected while several of our Bicentenary Joint Meetings proved so popular that we were forced to turn away many would-be participants. Social events included the Royal Reception, the Foundation Day Dinner, the Bicentenary Dinner and perhaps the most enjoyable of the year's celebratory occasions—the Summer Evening Party held in the Royal Botanic Gardens. This latter event which took the form of a grand picnic allowed some 421 Fellows and guests to enjoy the unique atmosphere of Kew in convivial company.

We wish to thank particularly the Bicentenary Committee under the chairmanship of Dr David Cutler and all the individual organizers of the

Bicentenary joint meetings for working so tirelessly to make the year both memorable and such a success scientifically.

Finally we extend our thanks to the authors of the special publications dealing with our history and to the editors of our Journals for processing and publishing the Proceedings of the joint meetings.

SOCIETY NEWS

Important Notices

The UGC's Next Research Selectivity Exercise

In June 1988, as one of 144 addressees, the Society was asked for its views on a long and comprehensive paper drawn up by the University Grants Committee in light of its previous (1986) experience. This was a precursor to the UGC's next exercise, due in 1989. Writing on behalf of Council, the President specifically commented on relevant paragraphs as follows:

Role of Professional Institutes and Learned Bodies

9. In the 1986 exercise attempts by the subject sub-committees and their panels to involve professional institutes, subject associations and learned bodies met with variable success. Subsequently, however, some subject associations went to considerable pains to collect information about research performance as a basis for challenging the UGC's ratings. The Committee hopes that professional bodies and subject associations will be more closely involved in the next exercise, since they have considerable knowledge and awareness of the strengths of their constituent institutions at a departmental level. One possibility might be for an individual nominated by the relevant association to participate, perhaps as a co-opted member of the appropriate sub-committee or panel; another might be for the association's own review of research performance to be submitted as evidence to the sub-committee. The Committee hopes that professional institutes and learned bodies will respond fully to this consultative paper.

Comment

"We welcome the suggestion that we and other such bodies might help in assessment, but clearly we have neither the knowledge nor organizational infrastructure to arrive at and present an objective comparative assessment of biology departments across all our universities. If invited, we should be pleased to nominate candidates for service as co-opted members within a review committee structure".

Criteria

10. Following the 1986 exercise the Committee received many enquiries about the criteria used for judging the quality of research. Critics have suggested that, in a future exercise, universities should be given more guidance on, for example, what the relevant sub-committee would be looking for, in terms both of quantity and of quality of research; how much relative importance would be attached to different forms of research activity; what weight would be given to signs of external recognition; how much credit would be given to external funding of research projects; how 'team' research projects would be regarded; and how much weight would be given to, for example, an original scholarly synthesis by comparison with a monograph. Another suggestion is that a synopsis might be given of what should be expected from a high calibre department in a particular subject area.

Comment

"(a) *Recognition of contribution to scientific communication.* We are concerned that the pressure to generate tangible research results (*i.e.* publication) will have an adverse effect on the less obvious contribution that university scientists make to running the infrastructure of scientific communication. Learned societies play a unique role in organizing meetings which bring together scientists from the universities with those from government research institutes and industry. While all parties concerned acknowledge the value of such meetings, the immediate tangible return is not such that the organization of a meeting can be presented to anybody as contract research. Sponsorship to pay for the running of meetings is normally sought by us, as by other similar bodies, but the very existence of all learned societies depends on the commitment and work of enterprising university scientists. We are conscious that in the present atmosphere young scientists are discouraged from accepting the responsibilities of office within societies, which do not contribute to the UGC's assessment of a department's standing, especially where travel and time may be involved. We believe that the participation of university scientists in the exchange of scientific ideas should be given some firm recognition in UGC assessments.

As biology becomes ever more complex and its interdisciplinary involvement extends, individual scientists in university departments need to have the chance of exchanging ideas with fellow specialists in their own field. Learned societies play a special rôle here in giving university scientists a chance to exchange ideas with colleagues in the same research field.

(b) *Need for breadth.* The complexity of modern biology makes a broad base of training essential for anyone entering the field. The pressures to form relatively narrow and highly productive research groups, engendered by the current criteria of assessment, especially external funding and publication production, act against a broad teaching base. We hope that assessment of relatively small but successful biology departments will take account of their need to present the subject on an adequately broad base.

We do not see the solution to the problem in isolating such small departments into a category of teaching units without any research base. We have the strongest conviction that involvement of university staff in research gives vitality to the teaching process that can be achieved in no other way. Examples of this of particular relevance to the Linnean Society are the many aspects of evolutionary biology, particularly those which involve the study of population samples over many generations, biogeographic surveys, biological survey and recording of all kinds, and taxonomic and systematic work on living and fossil plants and animals".

Publications and Other Publicly Identifiable Output

13. The Committee hopes that, when the time comes for it to request information about publications from universities, the CVCP/UGC Performance Indicators Steering Committee will have made sufficient progress on research performance indicators to enable publications output per member of staff to be measured in a consistent way. While they throw light on productivity rates, however, publication counts provide relatively little information about the quality of publications. Although a considerable amount of work is currently being undertaken on the evaluation of research output, it seems unlikely that by 1989 bibliometric techniques will have reached the stage where they can be used as a measure of quality across all disciplines. There is

unlikely, therefore, to be any reliable substitute for sub-committee members forming their own view of the quality of publications in the light of their own knowledge and advice from outside experts.

Comment

"*The time scale and scoring of publications.* Even if weighted by a science citation index factor, assessment of research productivity by publication is also in danger of favouring research on problems of short-term perceived 'relevance' or 'topicality' at the expense of long-term work which may not reach fruition within less than a decade".

Timescale

21. The Committee envisages that the 1989 exercise will assess research performance over the period 1985/86 to 1987/88, although it is for consideration whether published output needs to be looked at over a longer period. There was criticism of the 1986 exercise, particularly on the part of departments which were unfavourably rated, on the grounds that it did not take into account work in progress and, in particular, the effect of recent staff changes. The problem is that there is no practicable method of measuring the value of prospective work. Nonetheless, the Committee agrees that it would be reasonable for sub-committees, in exercising professional judgement, to take into account recent knowledge of, as well as advice from the Research Councils on, the strength and promise of teams of researchers working on current studies.

Comment

"Some research lends itself to fairly quick results: an hypothesis leads to obvious testing and the test either supports or contradicts it, and so leads to further testing and publication. Much taxonomic research (giving the data base on which other areas of biology—ecology, biochemistry, genetics *etc.* depend) is long term often leading to a monograph based on perhaps half a lifetime's research. It is most important that the pressure for quick publication should not mean that good monographic work is underrated because of the time scale in which it is accomplished".

NOTES

Iter Lapponicum: Phase II

The Lapland Journey arranged by the Society as part of the Bicentenary Year (*The Linnean*, *2*(3): 2–3) went ahead as planned. On the evening of 25 July 1988 the six Swedish and twenty-two British participants were given a splendid welcome and a magnificent dinner by Svenska Linné-Sallskapet at the Hotell Linné, adjacent to the Linnaean Botanic Garden in Uppsala. After a speech of welcome from Professor Bengt Jonsell, President of the Swedish Society, I presented him with a copy of the Bicentenary History as a symbol of the Society's gratitude in response to the magnificent gifts received from Sweden on 24 May 1988. An address from our President was duly read and the thanks of all the participants rendered in an appropriate manner.

It would take far too much space to record all our experiences in the following fortnight, which we had the good fortune to share with two direct descendants of Linnaeus, Agneta Myhr and Lona Forslid. Things went very

much as planned. The boat trip to Ulvon was made in brilliant sunshine and the weather was fair apart from rain on the days when we visited the lagoon at Kvikkjokk, Mt Sjnjerak, Mt Vallevare and reached the coast at Narvik.

We compiled extensive plant lists for the main localities and made a general bird list. This material has been worked up into an A4 booklet of some 50 pages which has numerous black and white diagrams, the lists referred to, a diary of the trip and information useful to anyone making a similar visit in the future. Copies of '*In the Footsteps of Linnaeus: Lapland 1988*' by John Packham, Roland Moberg and Rosemary Wise (published by the Linnean Society of London) have been deposited with both societies, and further copies should be on sale by the time this account is printed (at £5 a copy).

One of the most enduring aspects of the trip is the production of two magnificent A3 colour plates of Lapland plants, one created at Kvikkjokk and the other in Abisko, painted by Rosemary Wise, F.L.S. These plates have now been printed in limited editions of 250, while the Linnean Society of London and Svenska Linné-Sallskapet have each been given one of the originals. The first print in each series was presented to the King of Sweden at the joint Linnean and Anglo-Swedish Society dinner in October.

The plates will form part of an exhibit concerning the Lapland trip at the Conversazione on 14 June 1989 and artist's proofs can be seen in the Library at other times. Numbered prints can be purchased directly, at £25 each, from Mrs Rosemary Wise, 82 Hill Crescent, Finstock, Oxford OX7 3BS.

Though the trip itself took only a fortnight, the whole process, from commencement of planning to completion of the final account, occupied three and a half years. It has, however, been very much worthwhile and its finest memorial is formed by the links forged between ourselves and the Swedish party, which was so ably led by Dr Roland Moberg, F.L.S. who made the arrangements with Folkes Buss and Flygresor.

JOHN R. PACKHAM

The Roll and Charter Book

This colloquial title refers correctly, as described by Professor W. T. Stearn in his *Bicentenary History*, to the Admission Roll since it contains the names of those Fellows who have attended for formal admission and does not show those who have not. Indeed it has been said, we understand, that a certain Fellow was not only elected to but sat on Council without having been admitted! Fortunately, not many of the great names of British Biology, especially of the nineteenth century are missing.

While the *History* was being published, plans were set in train to replace the old book as it was estimated this would be filled, or very nearly so by the time Fellows had been admitted at the Bicentenary Meeting. Exceptionally, as reported in the Proceedings, *The Linnean*, *5*(1): 46, the back of this second book was also used to record the attendance at the Royal Reception. The Admission Roll was formally signed off by Professor William Chaloner, the outgoing President, on 24 May 1988, *The Linnean*, *5*(1): 65, after 176 years' regular use. Although still in remarkably good condition, the book will be properly curated prior to its being boxed for the archives. An annotated Index would be very useful but this will have to wait for a volunteer with sufficient time and expertise

both to unearth the basic biographical data often lacking from our early records and to decipher the often illegible signatures.

For the new Admission Roll, special consideration has been given to conservation requirements, bearing in mind the need for it to last equally long. A durable blue leather binding and acid-free heavyweight paper (the same paper as that being used for the facsimile editions of the Domesday book) have been used and provision has been made for the insertion of illuminated vellum pages. A matching lined leather box houses the Roll when not in use to protect it from accidental damage. A facsimile of the handwritten original Charter and the text of the Additional Charter have been included at the beginning but the Bye-Laws have been omitted as being subject to regular change. This new book was brought into commission on 20 October 1988, at the first meeting of the 201st Session.

Some corrigenda to 'A Bicentenary History of the Linnean Society' *by A. T. Gage and W. T. Stearn*

The decision having been made that a sumptuously bound copy of *A Bicentenary History of the Linnean Society of London* by A. T. Gage and W. T. Stearn should be presented to Her Majesty Queen Elizabeth II, the Society's Patron, during her visit to the Society's rooms on 17 March 1988, its production for the Academic Press had to be accomplished at a speed, to say the least, academically unusual. For example, the proofs of the Index (pp. 224–242) received by courier at 11.45 had to be returned by 3.30 pm the same day! The whole book in accordance with modern custom was set up in pages from the start, thereby preventing the insertion of further material and modifications desirable after completion of the manuscript. Thus, to quote from John Gerard's preface of 1597 to his *Herball* written in less hurried days, "therefore accept this at my hands (loving countriemen) as a token of my good will, trusting that the best and well minded will not rashly condemne me, although something have passed woorthie reprehension". The book of 242 pages closely printed was published on 28 April 1988.

Faults escaped in the printing

Like Thomas Johnson writing in 1633 of errata in his edition of Gerard's *Herball*, "I would wish the courteous reader to take notice and amend these faults escaped in the printing, and to pardon other such literal faults as he may perhaps here and there observe".

Page 1: *for* Glanville *read* Glanvill
Pages 3, 12: *for* D. A. Allen *read* D. E. Allen
Page 12: *under* STEARN, W. T. 1988 *for* 96 (ined.) *read* 96: 199–216
Page 29: *for* Prodomus *read* Prodromus
Page 109: *for* Burkhill *read* Burkill
Page 110: *for* remained for the duration of the war *read* until July 1941
Page 134: *for* Ölandski *read* Öländska
Page 136: Greenwood *for* from 1967 to 1976 *read* from 1967 to 1970
Page 139: *add* At the Anniversary Meeting on 21 May 1981 the President presented the Linnean Medal for Botany to Brian Laurence

Burtt, the Linnean Medal for Zoology to Sir Cyril Astley Clarke, the H. H. Bloomer Award to David Elliston Allen, and the Bicentenary Medal to Richard Stephen Kent Barnes: cf. *Biological Journal*, 16: 364–366 (1982)

Page 139: *for* palymology *read* palynology
Page 148: *for* Cichoriene *read* Cichorieae
Page 179: *for* Brander (1720–1845) *read* Brander (1720–1814)
Page 185: *from* Plate XX. Staff *delete* Staff
Page 196: *to* 176–86 *add* 918
Page 223: *against* Mrs Jacqueline Elliot *insert* 1986–
for 1987 Miss Marie Joanna Polius *read* 1987– Miss Maria Joanna Polius
Page 224: *for* Boner Robson *read* Bonar Robson
add to list of Curators 1980 Alwynne Wheeler (General Zoological)
Page 225: *add* Allen, D. E., quoted, 3
Amman, J., quoted, 139
for Akihito . . . 21 *read* Akihito . . . 21, 140, 200
Page 227: *add* Braun-Blanquet, J., awarded Linnean Medal, 135
Page 228: *add* Clapham, A. R., awarded Linnean Medal, 134
Page 230: *under* Dryander *for* 23 *read* 25
add Duncan, U. K., awarded H. H. Bloomer Award, 134
Page 232: *add* Hennig, E. H. Willi, awarded Linnean Medal, 135
Page 235: *under* Linnean Society of London *add* policy and aims, 2, 13, 23, 127, 148, 209.
add Lockett, G. H., awarded H. H. Bloomer Award, 135
Page 236: *for* Moody W. T., 58, *read* Moody, J. W. T., 58, 131
add Millidge, A. F., awarded H. H. Bloomer Award, 135
Page 238: *add* Romer A. S., awarded Linnean Medal, 134
add Rothschild, Miriam, awarded H. H. Bloomer Award, 130
Page 240: *add* Stamps, commemorative postage, 141, 148 (Frontispiece)
Page 240: *add* Stebbins, G. L., awarded Linnean Medal, 134
Page 241: *add Urtica* (stinging nettle), retention of virulence in Linnaean specimen, 111
Page 242: *under* Women *add* employment in British Museum (Natural History), 97
first woman Linnean Medallist (Agnes Arber), 80
first woman President (Irene Manton), 134
Page 242: *add* Young, J. Z., awarded Linnean Medal, 134

W. T. STEARN

Corrigendum to article on Robert Brown—*Linnean 4* (3): 42. It was Alexander MacLeay *not* William who was the first speaker of the Australian Parliament

A. T. SWAINSTON

Corrigenda: *Linnean 5* (1): 6, *for* £22.00 *read* £35.00
for £35.00 *read* £22.00

Conservation

If you have been a regular reader of these lines for over two years you may remember our quotation (*Linnean 2* (1): 5) that in 1762 Transportation (for life) was actually mooted in England as a proper penalty for the theft of curious plants. Whilst we have to steer a careful course not to be seen to 'tub thump', and certainly we would not campaign for quite such an awful sentence, we think the Fellowship should be made aware of efforts being made to protect the global environment. To that end we intend to publish without prejudice notices such as that below.

The Madagascar Environmental Research Group

Background

Madagascar, as a result of its long separation from mainland Africa and its large size—the fourth largest island in the world—has evolved a huge variety of plants. Whilst we have to steer a careful course not to be seen to 'tub thump', once almost completely covered in forest but since the arrival of man about 1000 years ago, the forest has been progressively cleared or burnt. Based on current estimates of forest clearance and the growing alarm of scientists working in Madagascar, the island has been declared the world's top conservation priority by leading international conservation organizations. The next 30 years will provide mankind's last chance to conserve the unique diversity of plants and animals which are the product of 100 million years of isolated evolution.

Between 1985 and 1988 three University of London expedition teams have worked in collaboration with Malagasy scientists to carry out research in remote and poorly known rainforests on the island. These projects were given the full backing of the Malagasy Government and supported by a wide variety of conservation, exploration and commercial organizations. MERG was formed in early 1988 as a response to the growing commitment felt by the expedition members to continue long-term conservation research projects in Madagascar. A 'Protocol of Collaboration' was drawn up between the third expedition team and the Malagasy Government in 1987 which is intended to promote further collaborative research over the next five years.

Objectives

The Madagascar Environmental Research Group (MERG) aims to promote the conservation of Madagascar's unique environment and wildlife. This is to be achieved through:

(i) surveys of the flora and fauna in key areas whether they be protected or unprotected;

(ii) basic research on the ecology of endemic or threatened species;

(iii) studies of the traditional medicinal uses of Malagasy plants (ethnobotany);

(iv) providing practical field experience and scientific training for Malagasy research students;

(v) drawing up management plans for key sites with multiple use objectives to ensure the maintenance of biotic diversity and to consider the needs of the local people;

(vi) stimulating interest outside Madagascar to fund conservation projects in the country.

Current and future projects

An educational book on the birds of Madagascar to be distributed free to schools in Madagascar.

A study of the medicinal plants of northern Madagascar.

Ecological research upon the rainforest floor reptiles and behavioural studies of the endemic Leaf Tailed Gecko.

Fauna and flora surveys of other rainforest areas, including the Tsaratanana Rainforest Reserve, the Ambatonaly Special Reserve and the unprotected Masoala peninsula.

Details may be obtained from The Conservation Foundation, Fairholt House, 2 Pont Street, London, 8W1X 9EZ. Tel. 01-235 1743

New portrait for the Society

The Society has bought a small oil painting on panel of a fresh-faced young Linnaeus in Lapland dress, holding the inevitable sprig of *Linnaea borealis* in one hand and supporting a Laplander's drum, suspended from a girdle around his waist, in the other. It is three-quarter length and is probably one of the versions painted by Hendrik Hollander, after the Hoffman portrait of Linnaeus, aged 30. A larger version was given to *Naturâ Astis Magistra* in Amsterdam in 1852. The portrait is hanging in the Reading Room.

From the Archives

Dover
11 June 1811

My Dear Sir

I am favour'd with your letter of yesterday, and agreeably to your wish, I loose no time in giving you a brief account of the *wonderful* Pig.

The relation of several tremendous falls of the Cliff in this neighbourhood, during the last winter, is no doubt fresh in your recollections; and this particular fall, from which arose the remarkable circumstance that I am now to relate, though not the most considerable in magnitude, yet was the most dreadful in its consequences, by crushing to death in one moment a Mother and Six Children; no alarm of danger, no notice of their unhappy destiny, could have been felt;—not yet risen from their beds, and probably whilst sleeping, they were all instantaneously deprived of life; this it evidently appeared must have been the case, from the state, and the situation in which the bodies were found, as soon as it was possible to remove the pressure and weight of Rock under which they were buried.

This lamentable affair occurred on the 14th of December last, between Six and Seven O'Clock in the morning; Mr John Poole, Master Carpenter in the Ordnance Yard, the Husband, Father, and Uncle of the unfortunate victims, was just risen, going out of the yard, and in the act of shutting the gate, when he was instantly invelop'd by the fall of earth up to his Shoulders, but from which situation he was soon extracted, without receiving much corporeal injury; the house was a Light boarded building of one floor; situated against the Cliff in the Ordnance work yard close by Guildford Battery, and near it were some adjoining work shops and a stable, which were also nearly buried, in the latter were two Horses, but soon got out without material injury; all other animals in

or about the premises were supposed to be destroyed, and of course when the bodies of the unfortunate family were found and removed, no further search was made, but the large quantity of Chalk was daily casting away, yet it was not 'till the 23d May near five months or 160 days after the accident, that the workmen imagin'd they heard the sound of complaint from the Pig; I was accidently walking near the spot, when I was told of the circumstance, and though I had great doubt of the reality of the Workmens auricular information, yet I encouraged them to proceed carefully in their work, under the direction of Mr Poole, who was present, and remembered the situation of his Pig's residence; on return from my walk an hour after, I was surprised on seeing the Pig alive, just extracted from its confinement, its figure was extremely emaciated, its bones appearing only covered with its skin, no muscles scarcely discernable, and its bristles erect and pointing outwards, though not stiff, but soft, clean, and white; the animal was lively walked well, and took food eagerly, but which I advised being given in very small quantitities.

Mr Poole assured me, there was not any food or water, or indeed scarcely any straw, with the Pig at the time of the fall; its sty is a cave dug in the Rock, at the back part of the destroyed dwelling house, is about six feet square, was boarded in front, to which there was a door two feet wide, and the whole was cover'd about thirty feet deep in the chalk that had fallen; Mr Poole also tells me, his Pig weighed as he imagined about 8 Score or 160 Pounds, was very fat, and was intended to be killed for the ensuing Christmas fare; from this weight it was reduced to 2 Score or about 40 Pounds when it was found alive; the door and other wood in front of its sty had been much nibled, and from the appearance of the poor animals excrement, it may be conjectured it had passed more than once through the intestines; the sides of the cave were very smooth, having apparently been constantly licked for obtaining the moisture exuding through the Rock, and of the loose chalk in the front, there is no doubt some had been eaten.

On the whole this is one of the most remarkable instances of life being preserved without food that we read of, without air also, except the quantity contain'd in the Vacuum of the Cave containing the Animal.

As a fact in Natural History, if you deem it worthy noticing to our Society, this account of it is entirely at your service.

I am my Dear Sir,
with true regard and esteem
faithfully yours

T. Mantell

Alex^{r} M'Leay Esq.

I have this morning again seen the poor animal, he is very well, and has sufficiently regain'd his flesh.

TM.

The above letter was read to the Society by the Secretary—Alexander MacLeay—on June 18th 1812. T. Mantell, a surgeon by profession was for many years the Mayor of Dover; he was knighted in 1820.

The Conversazione

Owing to the success of last year's summer party we have received requests for us to hold the Conversazione in Kew Gardens in the future. We would not

dispute that the setting was ideal but, to be fair, we were blessed on that special evening with the best weather of the whole summer, as far as we can remember, and we were indebted to the Director and his staff for their very great help. It would be unreasonable to take both for granted.

We have certainly not dismissed the idea but for 1989 the Conversazione will be held in the Rooms with the customary arrangements. Fellows wishing to mount displays or arrange exhibits are requested to contact the Executive Secretary as soon as possible.

Please complete and return the white booking form in good time.

Picture Quiz

Our last picture (*5* (1)) was a lithograph of Alphonse de Candolle, son of Augustin Pyrame de Candolle. An extended solution, including the winners will be published in the August *Linnean.*

Who and approximately when? (clue a coffee addict!). Solution by July to the editor. Prizes include old prints or hand decorated China.

Room Closures

The Rooms will be closed as follows: 24 to 28 March, 29 April to 2 May, 27 to 30 May and 25 to 29 August.

Deadlines

The closing date for material for *The Linnean* are 5 May for the August issue and 4 August for the 1990 issue.

Membership

We welcome the following who were elected on 21 January 1989:

Fellows

Prof. Mary T. Kalin de Arroyo, B.Sc., Ph.D.
Michael A. Bell, Ph.D., M.A.
Daniel Crawford, B.S., M.A., Ph.D.
David Charles Emerson
Ernest Edward Emmett, C.Chem, M.R.S.C.
Malcolm Charles Gillham, B.Sc.
Prof. G. I. C. Ingram, M.A., M.D., F.R.C.P., F.R.C.
T. E. Langford, B.Sc., M.I.Biol.
David Roger Lees, M.A., D.Phil., M.I.Biol.
Robert Frazer Leggate, B.Sc., Ph.D.
John Lynn
Peter Marcus Martin, M.Sc., Ph.D.
Michael Maunder, Dip. Hort. (from Associate)
Heather Anne Outred, M.Sc., Ph.D.
Prof. Malcolm Peaker, B.Sc., Ph.D., F.I.Biol., F.R.S.E.
Md. Matiur Rahman, M.Sc.
Dr Gerardo Riechel-Dolamatoff
Timothy George Shreeve, B.Sc., M.Sc., Ph.D.
Campbell Robert Smith, B.Sc., F.R.E.S.
Terence Malcolm Stephenson
Raymond Correll Stoddart
Colin James Livingstone Taylor, B.Sc., M.Sc.
Sir Peter Frank Dalrymple Tennant, Kt., C.M.G., O.B.E.
George William Henry Thomson, F.Inst.SMM, M.I.S.T.C.
Geoffrey William Gwynne Vevers
Judith Gay West, B.Sc., Ph.D.
Gordon Lawrence Woodroffe, M.Phil., B.Sc., C.Chem., F.R.S.C.

Associates

Roger D. Hyam, B.Sc., M.Sc.
Jane Murray

Student Associates

Christopher John Cumming, H.N.D.
Anthony King

Errata *The Linnean 5(1):* 11, *for* Kucker *read* Küçücker
for Knap *read* Knapp

Meetings

12–16 April 1989. ***Evolution and Change in the Bristol Channel and Severn Estuary.*** This meeting is being held at Taunton, Somerset, jointly with the British Ecological Society and Estuarine and Brackishwater Sciences Association. It is the last of the Bicentenary meetings. For further details write to The Director, The Leonard Wills Field Centre, Nettlecombe Court, Williton, Taunton, Somerset TA4 4HT, enclosing a s.a.e.

19 April 1989 at 17.30. Tea will be served at 16.30. ***Kimberley Research Project, Western Australia, 1988.*** The Project was launched at the Royal Geographical Society on 15 December 1987 in the presence of the Patron, HRH The Duke of Kent and the sponsors. This meeting, the second to be held after the completion of the field work will present preliminary findings of the project as a precursor to the symposia being planned for later in the year.

It will be attended by the Patron, sponsors, members of the organizing committee and British based members of the team.

Programme

16.30 Tea.
17.15 Assemble in the Meeting Room.
17.29 Welcome by the President.
17.30 Lecture and discussion. Prime speaker: Mr M. J. S. Sands, Deputy Leader.

24 May 1989 at 16.00. **Anniversary Meeting.** Tea will be served at 15.30.

Agenda

1. Admission of Fellows.
2. Minutes of the business meeting held on 16 March 1989 and the scientific meeting held on 19 April 1989.
3. Reading of the Bye-Laws governing the election of new Members of Council and of Officers, and appointment by the President of the Scrutineers of the Ballots for new Members of Council and for the Officers.
4. Ballot for new Members of Council and for the election of Foreign Members, Fellows and Associates. Council nominations for members of Council are:
   Professor J. A. Beardmore
   Dr P. E. Brandham
   Dr D. Edwards
   Dr D. J. Galloway
   Dr V. R. Southgate
5. Presentation of Medals and Awards
   Linnean Medals to: Professors W. D. Hamilton, F.R.S. and Sir David Smith, F.R.S.
   The H. H. Bloomer Award to: Mr J. C. Gardiner
   The Jill Smythies Award to: Miss Christabel King
   The Bicentenary Medal to: Professor P. M. Brakefield
6. Treasurer's Financial Report and Accounts for 1988.
7. Executive Secretary's Report and review of the Session 1988–89.
8. Results of Ballots for New Members of Council, Foreign Members, Fellows and Associates.
9. Ballot for Officers.
10. Presidential Address: *How similar can species be?*
11. Results of Ballot for Officers.
12. Appointment of Vice-Presidents for 1989–90.

6–8 July 1989. ***Interactions between Ants and Plants.*** This international symposium is being held jointly with the Plant Sciences and Zoology Departments of Oxford University, and will take place in the rooms of the latter department. Further information is available from the organizer: Dr C. R. Huxley, Dept. of Plant Sciences, Oxford University, South Parks Road, Oxford OX1 3RA. See also the yellow flier.

Provisional Programme

July 6

Welcome by the President

Crystal gazing in ant-plant research. Professor A. J. Beattie, Macquarie University, Australia.

SESSION I. Effects of Ants on Herbivores of Plants without Specializations

Review of the effects of ants on temperate woodland trees. Professor J. B. Whittaker, University of Lancaster.

Predatory strategies of ants inhabiting trees in Africa and Mexico. Dr A. Dejean & Dr J. Olmsted, Université de Yaoundé, Cameroon.

SESSION II. Effects of Ants on Plants with Homopterans

Relationships between red wood ants (Formica rufa *group*), *Cinera aphids and pines in southern Finland.* Dr R. Rosengren, University of Helsinki.

Why are so few species of aphids ant-tended? Professor C. M. Bristow, Michigan State University.

Formica *and Homopterans in Montana.* Dr R. Ryti, Montana State University.

Effects of ant/homopteran systems on fig/figwasp interactions. Dr S. F. Compton, Rhodes University, Grahamstown.

Conditional interactions in Ant/Plant/Homopteran mutualisms. Dr J. F. Addicott, University of Alberta & Mr H. Cushman, Northern Arizona University.

Nocturnal predation by spiders of ant-tended Homoptera. Dr R. Buckley, C.R.E.S. Australian National University.

SESSION III. Ants, Plants and Other Insects

Host plant effects on Lycaenid/ant interactions. N. Pierce, Princeton University.

Ants, plants and beetles—a triangular association. Dr P. Jolivet, Paris.

Evolution and ecology of myrmecophilous Riodinid butterflies. Dr P. DeVries.

A novel parasite of the Piper-Pheidole *symbiosis in Costa Rica.* Professor D. K. Letourneau, University of California at Santa Cruz.

Poster Session

July 7

SESSION IV. Plants with Extra-floral Nectaries

Extrafloral nectary mediated interactions between plants and insects (ants, parasitoids and herbivores): a comparison of herbs and trees. Dr S. Koptur, International University, Miami.

The pattern of plants with ant-food in different habitats and ant communities in Panama. Dr E. W. Schupp, Estacion Biologica de Doñana, Seville.

The ant community associated with extrafloral nectaries in the Brazilian Cerrados. Dr P. Oliveira & C. R. F. Brando, Universidade Estadud de Campinos, Brasil.

Acacias and ants in Australia. Dr. D. O'Dowd, Monash University, Australia.

Ants and herbivory of Bracken in the U.K. and South Africa. V. K. Rashbrook, S. G. Compton & Professor J. H. Lawton, University of York.

SESSION V. Ants which Inhabit Plant-Domatia

Guild structure of myrmecophytic associations—Cecropia *and other ant-plants.* Professor D. W. Davidson, University of Utah.

Phylogenetic analysis of ant-plant associations involving pseudomyrmecine ants. Dr P. S. Ward, University of California at Davis.

The Association between Macaranga *and* Chematogaster *in S.E. Asia.* B. Siala & Johann Wolfgang, Goethe Inst., Frankfurt.

Ant promoted plant nutrition. Dr D. H. Benzing, Oberlin College, Ohio.

SESSION VI. Dispersal and Seed Predation by Ants

Review of seed dispersal by ants. Dr M. Westoby, L. A. Hughes & B. L. Rice, Macquàrie University, Australia.

Elaiosomes and ant dispersal in the Fabaceae: Evolutionary potential and parallel evolution. Professor R. Y. Berg, University of Oslo.

Myrmecochory in Cape Fynbos. Dr W. J. Bond, University of Cape Town.

Food preference and factors of choice among Old World seed harvesting ants (Messor). Dr C. Baroni Urbani, Universität, Basel.

Effects of ground beetles on the seed dispersal of the myrmecochorous plant Trillium tschonoskii. Professor S. Higashi, Hokkaido University.

Selection for ant-dispersal compared to bird dispersal: the rôle of treefall-gap dynamics and comparative demography in a genus of neotropical herbs. Professor C. C. Horvitz, University of Miami.

July 8

SESSION VII. Leaf-cutter ants

Detoxification of plant toxins by leaf-cutter fungi. Drs D. Stradling & R. Powell, University of Exeter.

Selectivity and effects of leaf-cutter ants on vegetation. Dr. A. C. Mintzer, Arizona.

SESSION VIII. Ants and Vegetation

The influence of ants on British lowland vegetation. Dr T. J. King & Dr S. R. J. Woodell, University of Oxford.

The ant-mosaic in tropical Australian tree crops. Dr J. D. Majer, Curtin University of Technology, Australia.

Spatial dynamics of desert ant communities on two continents. Professor T. J. Case, University of California.

Parallels between ant and plant communities. Dr A. N. Andersen, C.S.I.R.O. Australia.

Conclusion

Thoughts on ant/plant systems. Professor R. May, University of Oxford.

Other Meetings

1989

March

21–22 *Evolution of Primate Adaptations.* Liverpool. Primate Society of Great Britain. Details from: Dr A. T. Chamberlain, HACB, University of Liverpool, Liverpool L69 3BX.

April

3–7 *Applications of Remote Sensing in Agriculture.* Sutton Bonnington. Details from: Dr M. D. Steven, Department of Geography, The University, Nottingham NG7 2RD.

4–6 *The Scientific Management of Biotic Communities for Conversation.* Southampton University. British Ecological Society.

5 *Are Hedylids moth-like Butterflies?* Dr M. J. Scoble, Royal Entomological Society, 41 Queen's Gate, London SW7 5HU

5–6 *The Deep Sea Bed: its Physics, Chemistry and Biology.* Discussion meeting. Royal Society, 6 Carlton House Terrace, SW1Y 5AG.

14 *10th Annual Seed Ecology Meeting.* Southampton University. Details from: Dr M. Fenner, Biology Dept., The University, Southampton SO9 5NH.

14–16 *Applied ornithology.* Surrey University, Guildford. Details from: BOU Office, c/o BM(NH), Sub dept of Ornithology, Tring, Herts HP23 6AP.

26–27 *Animal Cell Growth and Differentiation Factors.* Discussion meeting. Royal Society, 6 Carlton House Terrace, SW1Y 5AG.

26–29 *Limnology and Oceanography Congress.* Marseilles, France. Details from: Congrès AFL-UOF. Centre d'Oceanologie de Marseilles, Faculty des Sciences de Luminy, case 901, F13288 Marseilles Cedex 9, France

May

3 *The last two million years of beetle history.* Dr G. R. Coope. R. Ent. Soc.

June

1–2 *Life at Low Temperatures.* Royal Society Lecture. Details from: The Scientific Meetings Secretary, Royal Society, 6 Carlton House Terrace, SW1Y 5AG.

27–30 *2nd Conference of the International Federation of Classification Societies.* Charlottesville, Virginia. Details from IFSC-89 Dept of Mathematics University of Virginia Charlottesville VA 22903 U.S.A.

28–29 *Human Factors in High Risk Situations.* Discussion Meeting, Royal Society.

July

5 *Lepidoptera genetics ?holding our own against Drosophila.* Sir Cyril Clarke, R. Ent. Soc.

15–23 *Selborne Celebrates.* Bicentenary of *The Natural History and Antiquities of Selborne.* Details from: The Curator, The Wakes, Selborne, Alton, Hants GU34 3JH.

August

6 12 *International Workshop on Seeds.* Williamsburg Va. Details from: Dr R. Taylorson, USDA/ARS, Room 38, Building 001, BARC-West, Beltsville, MD 20705, U.S.A.

22–29 *5th Int. Theriological Congress.* Rome, Italy. Details from: 5th Int. Theriological Congress, c/o Dipart. di Biologia Animale e dell'Uomo, Universita di Roma 'La Sapienza', Viale dell'Universita 32, I-00185, Roma, Italy.

25 *Palaeolimnology and Lake Acidification.* Discussion meeting. Royal Society.
31 *Vth Int. Symposium on Palaeolimnology.* Ambleside, Cumbria. Details from: Prof. F. Oldfield, Dept. of Geography, Liverpool University, P.O. Box 147, Liverpool L69 3BX.

September
3–7 *2nd Congress of European Society for Evolutionary Biology.* Rome, Italy. Details from: Prof. V. Sbordoni, Dipartmento di Biologia, II Universita di Roma "Tor Vergata", via Orazio Raimondo—La Romanina I-00173 Roma, Italy
4–7 *Population Dynamics of Forest Insects.* Heriot-Watt University. Details from: Dr A. Watt, ITE, Bush Estate, Penicuik, Midlothian EH26 0QB.
4–8 *Tropical Lichenology.* British Museum (Natural History). Details from: Dr D. J. Galloway, F.L.S., BM(NH).
5–9 *Int. Symposium on Conservation Phytoecology.* Beijing, China. Details from: Assoc. Prof. Chen Weille, Inst. of Botany, Academia Sinica, 141 Xizhimenwai Ave., Beijing 100044, China.
6–8 *Major Evolutionary Radiations.* Durham. Details from: Dr G. Larwood, University of Durham.
11–15 *Peatland Ecosystems and Man—An Impact Assessment.* Dundee. BES.
11–15 *151st Meeting B.A.A.S.* Sheffield. Details from: Dr C. Martin Amregs, B.A., Fortress House, 23 Savile Row, London W1X 1AB
11–19 *1st World Congress of Herpetology.* Canterbury, Kent. Details from: The Secretariat, First World Congress of Herpetology, Ecology Research Group, Rutherford College, University of Kent, Canterbury CT2 7NY
14–15 *The Conservation of Insects and their Habitats.* Symposium. R. Ent. Soc.
19 *Ordination in Classification.* Rothamsted, Herts. Details from: Dr J. N. Perry, Rothamsted Experimental Station, Harpenden, Herts AL5 2JQ
24–29 *Photomorphogenesis in Plants.* Freiburg. Society for Experimental Biology.
23–30 *Global Natural Resource Monitoring and Assessment; Preparing for the 21st century.* Venice. Details from Mr C. T. Leali, Compendium S. P. A., Corso Vitorio Emanuele II, 209-00186 Roma, Italy.

October
4 *The Effects of Temperature on the Final Stages of Butterflies.* Mr K. E. J. Bailey, R. Ent. Soc.

November
1 *Some New Developments with Pheromones and other Semiochemicals: a Chemist's View of Entomology.* Dr J. A. Pickett. R. Ent. Soc.
8–9 *Allochthonous Terranes.* Discussion meeting. Royal Society.

December
6 *The Craving Locust.* Dr S. J. Simpson. R. Ent. Soc.

1990

March
7–8 *Quantitative theory in Soil Productivity and Environmental Pollution.* Discussion meeting. Royal Society.

May
23–24 *Regulation and Relative Abundance of Plant and Animal Populations.* Discussion meeting. Royal Society.

December
2–9 *XX Int. Ornithological Congress.* Christchurch, New Zealand. First circular form: Dr B. D. Bell, Sect. General, XX Int. Ornithological Congress, Dept. of Zoology, Victoria University of Wellington, Private Bag, Wellington, New Zealand.

John Sibthorp

JOHN SIBTHORP (1758–1796) a founder member of the Linnean Society, featured in *The Linnean 3* (2): 32 when the Prospectus for his posthumous *Flora Greca* was illustrated (Nelson 1987). I wonder how many members of the Society

know the delightful monument to Sibthorp in Bath Abbey, of which I enclose a picture. The memorial was designed by John Flaxman and there is a plaster model for it in the Flaxman Collection belonging to University College; it is at present on loan to the Victoria & Albert Museum. There were originally two models (Ely 1900; 30, 32) but one is presumed destroyed when the College was bombed in 1941 as only one was listed by Whinney & Gunnis (1967: 35).

A separate tablet below the monument bears the inscription:

JUXTA TUMULATUS EST
JOHANNES SIBTHORP M.D. R.S.S.
BOTANICES
IN ACADEMIA OXONIENSI
PROFESSOR.

RERUM NATURALIUM INVESTIGATIONI
PER VITAM BREVEM DEDITUS
PHYTOLOGIÆ IN PRIMIS AMANTISSIMUS
REGIONES LONGINQUITATE AC METU
PEREGRINANTIBUS TANTUM NON IMPERVIAS
ADVERSA DISSUADENTE VALETUDINE.
OBSTANTIBUS INSUPER EX OMNI PARTE PERICULIS
EXPLORAVIT.
ITINERIS MOLESTIARUM PLENI
QUOD PER GRÆCIAM NUPER CONFECERAT
LABORE OPPRESSUS
OBIIT BATHONIÆ
DIE OCTAVO FEBRUARII
ANNO ÆTATIS SUÆ TRICESIMO OCTAVO
CHRISTI MDCCXCVI.

which has been translated by my colleague Robert Ireland as follows:

> Nearby is buried JOHN SIBTHORP, Doctor of Medicine, Fellow of the Royal Society, Professor of Botany in the University of Oxford; devoted throughout his short life to research into natural history; above all, an enthusiastic student of the science of plants. He explored lands which, because of their remoteness and terror, were all but closed to travellers, notwithstanding his poor health and although danger surrounded him on all sides. Crushed by the labours of a journey full of difficulties which he had recently undertaken to Greece, he died at Bath on the eighth day of February, in the thirty-eighth year of his age, A.D. 1796.

The "poor health" refers to Sibthorp's malaria and tuberculosis, and the "dangers" presumably to brigands (Stearn 1976).

The monument was ordered by Thomas Platt, one of Sibthorp's executors, who paid a deposit of £20 to Flaxman on 25th July 1799. The total cost was 50 guineas, and it was three years before the finished work was paid for and sent to Bath in July 1802 (Croft-Murray 1940; 64). It has been described and illustrated by Whinney (1964; 192, plate 154B) who notes a "moving reverence for Antiquity" and that "the tribute to Sibthorp's scholarship is unmistakable". However, the most informative discussion of the monument is by Penny (1977;

26–28). Part of his comment is as follows:

> Flaxman casts the deceased in the role of a Greek traveller wearing sandals, a short cloak (or *chlamys*), and a hat (*petasus*) slung on his back, inspired perhaps by an attic relief such as the grave lekythos of Hegemon now in the Fitzwilliam Museum, but then in the possession of Sibthorp's friend, J. Spencer Smith. The monument is a very early case of a consciously severe Greek revival relief: the carving is crisp (the acroteria almost appear to have

Monument to John Sibthorp.

> been snipped out of stiff card) and the frame is unmoulded. In the pediment there is a garland of *Sibthorpia europea*, the Cornish Moneywort, a little creeper named by Linnaeus after Sibthorp's father. But the important flowers are those which Sibthorp carries. Are these simply the botanical specimens with which the traveller returned to his homeland, or are we also to see him as a pilgrim carried now by Charon, to "the other side" still dwelling on earth's beauties?

Penny thought that the proposal to engage Flaxman, and perhaps the idea for the design, may have originated with John Hawkins, another of Sibthorp's

executors, who was closely associated with Flaxman and an amateur of classical antiquities.

Robert Ireland notes that the Latin of the inscription is "very accomplished, highly elaborate in vocabulary and with far-flung constructions". One wonders whether the inscription was composed by James Edward Smith, for Stearn (1967; 172) noted that Smith's preface to the *Florae Grecae Prodromus* is in "rather pretentious Latin".*

The monument is to be found on the south wall of the South Choir Aisle of Bath Abbey.

References

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D. T. DONOVAN

*William Stearn thinks it was more likely to have been Goodenough — Editor.

George Bentham's account of the horticultural fête at Chiswick in 1828

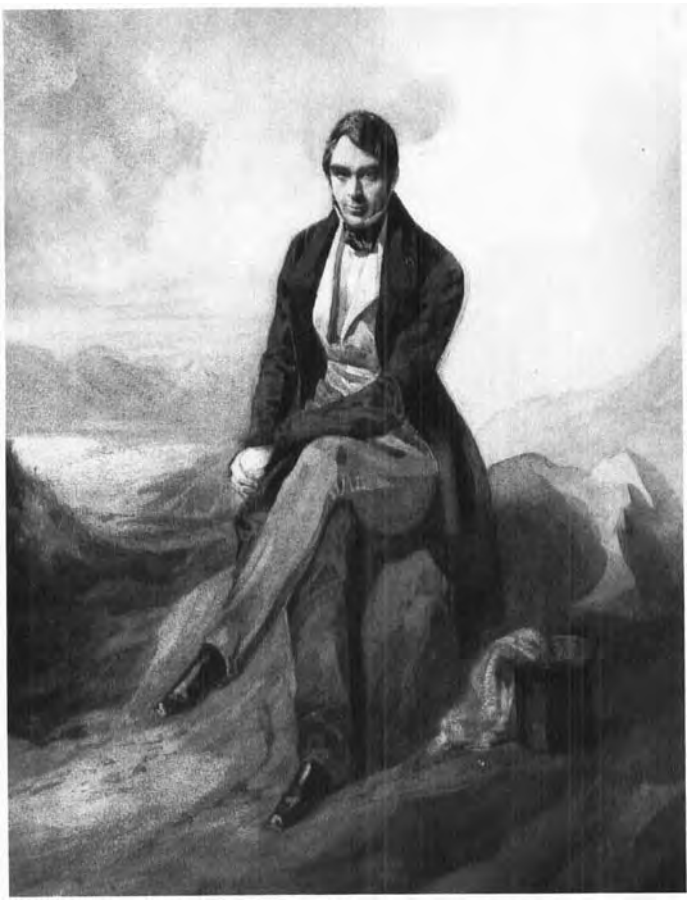
George Bentham wrote a very detailed journal of his life in London, which he sent regularly to his married sister, Mary, who was living in France. He himself, had lived with his family in France, for nine years and consequently observed fashionable London life with the eyes of a Frenchman, and his comments are frequently not those of a typical young Englishman. Although already a good botanist and the author of a book on the plants of the Pyrenees, he seldom wrote about flowers; when he attended the Horticultural Society fête at Chiswick, in June 1828, he wrote no description of the gardens but gave minute details of the food served and the display of fruit, for which the Society was famous.

He went to the fête with Alphonse De Candolle*, whom he had first met with John Lindley, who was at that time the Assistant Secretary of the Society. The young men took a hackney carriage as the morning had been too wet for them to go by boat. On their arrival at half-past one, they were amazed to see the long line of carriages, which by half-past two stretched for two miles, reaching as far back as Kensington. Not until half-past four were all the people set down.

Bentham took a great interest in the behaviour and dress of the upper classes, which he appeared much to admire and wished to emulate; he was always the first to comment on any lack of manners amongst "vulgar people". He wrote,

*Who featured in our last picture quiz, see p. 10—Editor.

"The gardens presented a splendid display of rank, beauty, fashion and toilettes". He joined his friends, the Carrs, and doubtless continued his eager but fruitless courtship of Laura, who, alas, looked far above him for a husband, and later married Lord Cranworth, who twice held the office of Lord Chancellor.



George Bentham, aged 34 from the watercolour by C. Leblanc.

They listened to the bands of the Grenadier Guards and the Artillery Regiment, playing alternately; they enjoyed the Tyrolean singers and sat and watched the dancers on the green. There were also bands of twenty-five musicians playing quadrilles. Not many danced as "English etiquette is a great bar to dancing in so public a place". However, those less conscious of social restrictions carried on with great spirit, until nearly nine o'clock.

The main attraction of the afternoon was the display of fruit, laid out on a table seventy yards long, in the tent which was beautifully lined with pink and white cloth. The table was completely covered with plates of grapes, melons, peaches, nectarines, apricots, cherries, raspberries, strawberries and other fruits including sixty pineapples, some of which weighed six or seven pounds. The fruit had come from all over England and a steamboat had arrived from Holland, but sadly the fruit had been so badly packed, that most of it had been

spoilt. After the people had admired the fruit, the tent was closed and servants cut it all up. Later, the tent was opened, the crowd poured in, and "rushed upon the pineapples with an eagerness not over decorous". Although John Evelyn mentions in his diary, tasting a pineapple from Barbados, at the table of Charles II, they were still uncommon in England in 1828 and only grown in large private gardens with hot-houses.

When the fruit had been demolished, Gunters' (the firm was still in existence after the 1939–45 war) waitresses served cakes, tea and lemonade. There were four other tents with more substantial provisions, which though crowded until seven o'clock, never ran out of food. Bentham complained that the previous year, the caterers, Jarin by name, had failed to supply the company with enough to eat. Gunters had provided an inexhaustible amount of strawberries, meat pies, cakes and jellies. All this was washed down with Champagne, Sauterne, Moselle, and Hock. One might be forgiven for thinking that the object of going to the show was to enjoy the food.

The Royal tent was fitted out sumptuously and Bentham observed that members of the Royal Family and "some of the principal of the Nobility were seated at their repast". On this occasion, the Dukes of Sussex and Cumberland, Prince Leopold, Princess Esterhazy, the Duke and Duchess of Leinster and of St. Albans were all present.

Bentham and De Candolle remained until the end and then went across the green to Lindley's house, where they stayed the night. He told his sister that the fête had been more brilliant than the year before despite the rain which had made the walks muddy for the ladies in their satin shoes. About 4000 people had attended, of which 2000 were ladies, "amongst whom were but few vulgarities and no disrespectable person". He explained that recommendation was necessary to buy a ticket, which cost, for those days, the not inconsiderable sum of one guinea. The expense of buying a new outfit of clothes and the hiring of horses and carriages prevented "anybody who was not of bonne société" from being there.

The following morning Bentham and De Candolle went back to the gardens to survey the devastation. There remained unconsumed, like the feeding of the four thousand, as much food over, as Jarin had provided for the previous year's fête. It is interesting to note that not until six years later, in 1834, were any flowers exhibited at the Horticultural Society's fête.

MARGOT WALKER

Man Directed Evolution of Crop Plants

This joint meeting with the Association of Applied Biologists held on 20 November 1986 was not only the first in our Bicentenary celebration programme but also one of our most successful meetings in terms of numbers and interest generated. It was organized by Dr William J. Angus of Nickerson RPD Ltd. Following the welcome by the President, Professor W. G Chaloner, the Scientific Meeting was introduced by Mr G. A. Wheatley, President of the Association of Applied Biologists. The abstracts of the seven papers presented are published below.

Dr J. Barrett (U. of Cambridge), *Pests and diseases in crop evolution*

Evolutionary change in crop plants has occurred in three distinct phases: during domestication of wild species; by natural selection as a response to local conditions and by unconscious selection by farmers under traditional agriculture; and as a result of the activities of plant breeders. In all of these phases pests and diseases have had an influence on the type and rates of change possible. From the evidence provided by the introduction of alien crop species to new areas during more recent times, it seems highly likely that pests and diseases partly determined which wild species were capable of domestication. Documentary evidence suggests that endemic disease with periodic episodes of severe infections has been a feature of crop cultivation from earliest times. It seems to be a reasonable inference that if evolutionary change had not been taking place in crops in the form of a dynamic interaction between the crop population and populations of pests and pathogens, cultivation could not have been maintained. With the advent of scientific plant breeding during the 19th century, and the realization that resistance to pests and diseases could be selected just like any other character, the situation changed to one in which evolutionary change in crops became dictated by the plant breeder. For many intensively cultivated crops today, pests and diseases are among the major constraints on production. However, the genetic modification of crop plants by breeders has, in many cases, exacerbated the very problems with pests and diseases that they are trying to solve. Consequently, in many crops we are probably witnessing the most rapid evolutionary response to pests and diseases that has ever occurred.

Dr J. M. Thresh (O.D.A., East Malling), *Viruses and the evolution of crop plants*

Plant virology is such a young science and there is so little information on the viruses of natural or semi-natural vegetation that few definitive inferences can be made on the long-term effects of viruses on the evolution of crop plants. Despite the paucity of the available evidence, the overall properties of viruses as plant pathogens and their current prevalence in crops suggest that viruses have played and continue to play an important role. This will be illustrated by experiences in various countries where viruses determine which crops and varieties can be grown successfully and exert a dominating influence on the overall breeding strategies adopted. Examples include sugarbeet and beet curly top virus in the south-west of the United States and sugarcane and sugarcane mosaic virus in many different countries. Viruses can also influence breeding programmes in unexpected ways, as illustrated by experience with cocoa. The merits of Upper Amazon types from Peru and the opportunity for exploiting hybrid vigour were not appreciated until they were introduced to West Africa in attempts to identify virus-resistant genotypes. Hybrid progenies involving at least one Upper Amazon parent have since been used in many countries including some where swollen shoot is not a problem.

In recent years there has been considerable discussion of the concept of genetic vulnerability and several viruses have become prevalent following the introduction of a new variety or group of closely related varieties. Sugarcane Fiji virus in Queensland is one striking example but greater attention has been given to rice tungro and other virus diseases of rice in the Far East. These have caused serious epidemics following the introduction of a few modern high-yielding varieties which have largely displaced the many traditional local land-races grown previously. However, it has been difficult to distinguish the effects of changes in variety from the introduction of new cropping practices including increased use of fertilizers, pesticides and irrigation. This has led to considerable debate on breeding and production strategies, on the relative merits of major and minor genes for resistance and on the opportunity for making more effective use of the improved varieties and techniques now available. Much of the discussion has concerned the rôle of man as the direct or indirect cause of pest and disease outbreaks and the proposition that epidemics are largely man-made. In relation to viruses this is a plausible assumption rather than a verifiable fact. Nevertheless, there are many examples of the ways in which cropping practices facilitate virus spread and lead to greater 'infection pressure' on plantings than is encountered by natural or semi-natural vegetation.

Sir Ralph Riley (Plant Breeding Institute, Cambridge), *Genotype enhancement by chromosome adjustment*

Plant breeders started to make improvements in the chromosome complements of crops from times soon after the discovery of polyploidy and the recognition of polyploid series in 1916 and 1917. For example, in the early 1920's, Bremer used spontaneous non-reduction into female

gametophytes in interspecific crosses in the "nobilization" of sugar cane (*Saccharum officinarum*). Cultivars with chromosome numbers somewhat in excess of triploid resulted. While in 1928 Karpechenko published the classic work on *Rhaphanobrassica*, the spontaneous allotetraploid combining the chromosome complements of radish and cabbage, which still attracts commercial interest. However, it was not until the discovery of the effects of colchicine by Blakeslee and Nebel independently in 1937 that modification of chromosome numbers became readily possible to the experimentalist. Induced polyploid has had a profound effect on some crops. For example the majority of sugar beet (*Beta vulgaris*) varieties are now triploid hybrids. The seed used by farmers has two genomes derived from an induced autotetraploid multigerm pollinator and one genome from a diploid male sterile monogerm which is the seed parent. The deleterious effects of the genotype of the male sterile and monogerm parent are swamped out by the double dose of the tetraploid parent.

Synthetic autotetraploid water melon (*Citrullus lanatus*) is hand pollinated by diploids to produce autotriploids which are sterile. Their seedlessness makes such fruits more attractive and convenient to consumers. Here the breeder's art is imitating nature since bananas are more attractive because the fruit is seedless in part because of triploidy. Bananas and triploid water melon both have 33 chromosomes.

The use of balanced and fertile synthetic polyploids is well shown by synthetic tetraploid rye grass which contains the entire chromosome complements of *Lolium perenne* and *L. italicum*. Tetraploidy, compared with diploidy, delays segregation in later generations away from the combination of advantageous characters derived from both parents.

Triticale is an entirely new cereal derived as synthetic allohexaploid from hybrids of diploid rye (*Secale cereale*) and tetraploid durum wheat (*Triticum turgidum*). It has yet to establish itself as a significant crop in world terms but offers agricultural advantages in certain environments.

Opportunities to reduce the level of ploidy have been developed infrequently. In maize (*Zea mais*) and potato (*Solanum tuberosum*) haploids have been produced with high frequency by selecting seeds or seedlings showing a recessive marker following pollination with males carrying the dominant. Haploids have also been produced by making interspecific hybrids in which the chromosome set of one parent is eliminated during embryo development. This is particularly useful in barley (*Hordeum vulgare*) where the use of colchicine on haploids permits a rapid return to diploidy and complete homozygosity. Similar use is made of haploids that arise from the development into sporophytes by pollen grains in culture in such species as oil-seed rape (*Brassica napus*) and rice (*Oryza sativa*) in which doubled haploids have been developed into varieties.

The use of aneuploids has been especially valuable in naturally occurring polyploid crops such as bread wheat (*Triticum aestivum*). Full sets of nullisomics, monosomics and tetrasomics have been isolated in wheat by Sears. As a result single pairs of chromosomes can be substituted into a recipient from a donor variety. Analytical and breeding precision are enhanced from work with the derivatives of parents in which a single chromosome pair is heterozygous while the remainder of the complement is homozygous.

Finally, and again in wheat, intact alien chromosomes or segments of alien chromosomes from related species can be introduced into the crop by geneticists. The manipulation on which this depends may involve the use of aneuploids for entire chromosomes, the use of induced translocation, the exploitation of centric fusion or interference in the genetic determination of the specificity of meiotic chromosome pairing.

Professor A. H. Bunting (University of Reading), *Breeding and selection for post-harvest characters*

The total weight of economic plant biomass (excluding timber, fuel, fodder and feed) harvested in the world in 1984 was about 2400 million tons. Of this 1800 million tons was cereals. What happens after harvest is physically a very substantial matter, and most of it relates to cereals. After harvest, economic plant products generally pass through four phases transport, storage, processing, and final use. Breeding for post-harvest characters exploits the many heritable characteristics which facilitate, or offset damage or loss in these phases.

Transport. Most harvested crop produce is put into a container and transported to the farmstead, and a good deal of it may travel long distances to main markets and beyond. It must therefore withstand the mechanical stresses which tend to crush or fracture it, the consequent decay processes, and the consequences of endogenous biological processes after harvest.

Storage. Most crop products have to be stored after harvest. The average quantity of cereal grain in store in the world, in domestic or larger-scale stores, must be about half the total

production, 900 million tons. Produce in store may suffer further mechanical damage; it may be damaged by insects, fungi and bacteria; and it may deteriorate for endogenous reasons. Resistance to storage insects is effective and important in many traditional land-races and cultivars of cereals and in some pulses, but it is easily lost if breeding is concerned mainly with increasing yield per unit area.

Processing. Virtually all foodstuffs, and all industrial plant products, are processed before they reach the end-user or consumer. Most foods are cooked or baked, and many are milled, pounded, fermented, freed from undesirable constituents, graded or at least washed and packed before they reach the kitchen.

Final use. Produce which is intended to be eaten or drunk as food or for amenity must be aesthetically attractive or at least acceptable. Considerable effort has also been devoted to altering the nutritional composition of foods.

The industries which process oilseeds, rubber, sugar and plant fibres (particularly cotton), have traditionally required precisely-defined physical and chemical properties in the harvested product. However developments in processing methods may well alter the specifications and so alter the objectives of breeding. Breeders can more easily meet these many needs if they know the botanical bases of the properties required; and they also need rapid and convenient means of screening. The inheritances of many of the characters are complex, so that substantial resources are needed to handle large segregating populations. Since breeders also have to meet many preharvest requirements, they have to breed simultaneously for many objectives.

Plant products were harvested and utilized by man and other animals long before the advent of agriculture. Hence selection and breeding have sometimes been able to build on pre-existing foundations. Dormancy in seeds and organs of vegetative reproduction can evidently aid storage. In other cases the attributes of wild forms have had to be modified and even removed for example cyanide in cassava, and alkaloids in some pulses. In yet other cases selection has captured and magnified attributes which are unnecessary or even undesirable in wild forms, such as the lint of cotton.

Dr W. Day (Rothamsted), *Theoretical and practical limits to productivity*

The limits to the productivity of agricultural crops are set by the available solar energy, the ability of the crop to intercept that radiant energy and convert it to chemical energy in crop biomass, and the proportion of that biomass that is the economic yield. At each step from solar energy to economic yield there are theoretical principles that can help define the maximum potential efficiency. Practical considerations, relating, for example, to the availability of nitrogen or water, pose further constraints. The opportunities to influence the practical achievement of high productivity lie, therefore, in increasing radiation absorption, photosynthetic efficiency or partitioning, or increasing the efficiency with which limiting resources such as nitrogen and water are used.

Selection for increased length of growing season is the most direct way to increase biomass production. The incorporation of characters that increase cold tolerance, to allow winter planting, or delay flowering in biennials grown for their first year storage root, to allow earlier spring planting, are practical examples of how increased radiation interception and growth can be achieved. Conventional breeding has not sought directly to increase the efficiency of photosynthesis, and the lack of increase in total biomass production in U.K. wheat breeding would suggest that none has accrued as a consequence of other selections in breeding for yield in this crop. Observations of CO_2 fixation by individual leaves suggest that there is significant variation in photosynthetic rates at high photon fluxes, and thus scope for increased photosynthetic efficiency in crops. However the association between high maximum rates of photosynthesis and high nitrogen content of leaf tissue will mean that practical constraints will also be important in deciding whether increased photosynthetic efficiency in leaves leads to greater crop production.

The importance of nitrogen for photosynthesis means that nitrogen availability is a key constraint to crop photosynthesis. In practice, shortage of nitrogen leads first to less photosynthetic area and thus less interception of radiation. Improvements in maximum photosynthetic rates that require additional nitrogen per unit intercepting area will increase nitrogen requirements, and potentially exacerbate concern about environmental damage associated with excessive fertilizer use. Increased photosynthetic capacity may be particularly attractive in association with the ability to fix N_2 from the air. The energy cost of this nitrogen fixation will influence productivity of leguminous crops, and genetic variation in this cost has been established.

The association between CO_2 fixation and water loss has been well known for over a hundred years, and in agricultural practice is commonly considered in terms of water use efficiency. Recent work has clarified the detailed basis of water use efficiency of crops, showing how it can vary between climates and how it relates to the control of gas exchange by leaves. This improved understanding may lead to better ways of selecting for higher efficiencies of water use. Though irrigation can in some areas make efficient water use less important, lack of water or salinity problems in much of the world's agriculture make high efficiency an important goal.

The relationship between biomass productivity and economic yield is the most difficult area in which to seek to quantify the potential efficiency of agricultural production. Developmental rates and partitioning patterns are key influences here, and considerations of crop quality are also important. Thus biomass productivity may increase monotonically with sowing density, but high density leads, for grain crops, to smaller partitioning to grain, and, for vegetable and root crops, to smaller plants that are not so easily processed or marketed. Changes in developmental characteristics can move the flowering and seed filling period relative to the most favourable weather conditions; for wheat in the U.K. it can be argued that earlier flowering would lead to even greater yields than at present, especially in the cooler areas.

These various contributions to the achievement of maximum productivity will be illustrated by examples from a range of crops and environments. The descriptions are in terms of physiological traits or processes, but future modifications to them are likely to require close identification of their genetic base. It is unlikely that the more significant processes involve single enzyme/single gene systems; most will be integrated processes having complex genetic control. The future challenge will be as much in identifying the complex controlling relationships and their interactions with environmental factors as in the mechanics of manipulating them.

Dr R. B. Flavell (Plant Breeding Institute, Cambridge), *Genetic engineering and crop evolution*

Through wide-crossing programmes plant breeders have introduced new genes or alleles into crop plants from other species and in some instances these events have played a significant part in crop evolution. Similar events have occurred frequently during 'natural' evolution, especially in the formation of polyploids. However, in the last few years special attention has focussed on the widening of the genetic base of crops by so-called 'genetic engineering'. In this approach, new genes are incorporated into plants as discrete, defined pieces of DNA. It is now possible to introduce genes from any organism into certain plant species such as tobacco, potato and tomato. The genes can be modified at will before insertion or synthesized to order in the laboratory. The means has already been developed to design new genes which are expressed only at specific times during development or only in specific organs or tissues. Although much more research needs to be accomplished, especially in broadening the number of crop species into which genes can be inserted, it is clear that a new means of influencing crop evolution has been established.

One of the most successful ways of introducing genes into plants is to use the 'natural' gene transfer system evolved in *Agrobacterium tumefaciens*. This bacterium is capable of transferring specific genes from one of its plasmids into cells of many different dicotyledonous plants. Recently, DNA sequences closely related to these genes have been detected in uninfected *Nicotiana glauca* chromosomes. It has been hypothesized that these sequences are a consequence of some 'natural' transfer of information from the bacterium to the plant species during evolution. Also, studies on the structure of some plant chromosomes have revealed the presence of many elements reminiscent of the stable chromosomal forms of retroviruses, well-known pathogens of mammals. This finding prompts the conclusion that many chromosomal DNA sequences and genes may have arisen from infecting viruses. So, the principle of adding genes to plants from unrelated organisms and from other kingdoms may not be new but now man is involved it can be a directed, controlled process.

It is still too early to pronounce how quickly crops modified by genetic engineering, will become commercially successful cultivars. This will depend upon their value to the farmer or product user, on legislation and ease of patenting. Some genes already inserted into plants that improve agricultural value will be described. However, progress in the modification of crop plants is such that we can be confident that new genes introduced by genetic engineering techniques will enter agriculture and be sustained in the working germplasm of future plant breeders. The number of genes maintained in the germplasm is likely to be closely related to the investment in research to isolate and characterize useful genes. The genes inserted by the genetic engineer will be characterized in detail before insertion and so will be able to be distinguished easily using

molecular biological techniques from the genes currently in the germplasm. This will provide the means of monitoring some of the consequences of genetic engineering on crop evolution.

Professor W. Williams (University of Reading), *Impacts and interactions of genetic improvement in crop plants*

Plant breeding has for some time enjoyed a favoured status among the agricultural technologies. It is perceived as a counter to the vulnerability of food crops to disease, and as a factor in reducing fertilizer usage while being completely neutral to the environment. Most importantly it is recognized as decisive in securing an adequate and reliable food supply in both industrialized and Third World countries. This burnished image has been further brightened by prestigious honours, such as the Nobel Peace Prize, to highly successful plant breeders who have been recognized in a manner similar to the decorations with which outstanding generals and empire builders have been honoured through the ages. But the most recent and indeed the most telling recognition has been the realization by large agribusiness industries that plant breeding is a healthy area for capital investment, and that without close and adequate control of the nature and marketing of genotypes, full commercial advantage can be derived from related, interacting technologies such as crop protection chemicals, fertilizers and modern biotechnology. Hence we witness the biggest names among the international oil and chemical companies in open competition to become plant breeders as well as producers and purveyors of farm seeds.

Evolution and Extinction

This joint meeting with the Royal Society organized by Professors W. G. Chaloner and A. Hallam was held at Carlton House Terrace on 10 November 1988. It took the form of a discussion meeting with some seventeen speakers. Although the abstracts are listed below more extensive proceedings will eventually be published by the Royal Society.

J. Maynard Smith, F.R.S., *The biology of extinction*

A species may go extinct because its genetic system is such that it cannot adapt to changing circumstances, or, more probably, because environmental change eliminates the niche to which it is adapted. Environmental change may be biotic or abiotic. The roles of predation, competition and disease are reviewed in the light of recent extinctions, and of the fossil record. The possibility of developing a theory of the coevolution of many interacting species, which might be testable by ecological and palaeontological data, will be briefly discussed.

A. Hoffman, *What, if anything, are mass extinctions?*

(Abstract not available)

C. H. Holland, *Establishing synchronism of events*

It is often easier to play with secondary data than to collect primary data. Rates of evolution can be assessed in an absolute sense only if the relevant data can be related to some kind of clock. Use of palaeobiological data in discussion of relative tempo and mode of evolution certainly requires not only a rational taxonomy but also a precise stratigraphical scale. Debates about mass extinctions are meaningful only if their durations as well as their taxonomic extent are clear. In essence, discussion of all these matters demands the recognition of synchronism of events. The difficulties of establishing this will be commented upon. Some previous case histories and models will be assessed in the light of these difficulties.

A. H. Knoll, *Microfossils and megathink: the constraints planktonic protists place on thinking about mass extinctions*

Planktonic protists have a 1500 Ma fossil record; they are almost undoubtedly the most abundant fossils in all systems in which they occur. In general, patterns of radiation and extinction in microplankton mirror those documented for Phanerozoic marine invertebrates. Micropalaeontological studies of Proterozoic successions suggest that episodes of major extinction in fact predate the initial radiation of animals. Most Palaeozoic microplankton extinctions are documented in insufficient detail to place more than general constraints on extinction hypotheses, but more recent extinction events are known well enough to constrain thinking significantly. Broad patterns of diversity change in planktonic protists show similarities across the Cretaceous–Tertiary and Eocene–Oligocene boundaries, but comparisons of origination and extinction rates indicate major differences. Common causation of the two events appears unlikely, a conclusion having obvious implications for monolithic theories of mass extinction, whether periodic or not.

R. A. Spicer, *Plants at the Cretaceous–Tertiary boundary*

Environmental selection determines to a large extent the morphology and anatomy of individual plants, and composition and structure of vegetation. The intimate relation between vascular land plants, climate and substrate produces an abundant fossil record with a strong inherent signal reflecting, in particular, air temperatures, precipitation and evaporation, light régime and seasonality. Studies of palynomorphs, cuticles and plant megafossils in detailed sedimentological and stratigraphic context across the Cretaceous–Tertiary boundary in North America, suggest sudden and traumatic vegetational disturbance, profound and long-lasting climatic change, and survivorship patterns that are palaeogeographically heterogeneous and possibly related to the ability of taxa to enter dormancy. Some of these changes are reflected in palaeosols. Major vegetational changes are also apparent in Europe and Asia, although the data are in a stratigraphic framework of lower resolution. The record, as presently interpreted, is one of ecological catastrophe, some selective extinction of broad-leaved evergreen taxa, and long-term vegetational restructuring, expressed most strongly at middle and lower latitudes in the Northern Hemisphere.

M. R. House, *Ammonoid extinction events*

The ammonoid cephalopods range from the early Devonian to the late Cretaceous, a period of some 350 Ma. Because of their importance for biostratigraphic discrimination and their use in practical age-dating for this period, they have been intensively studied. Major extinction events at the close of the Devonian, end-Permian, end-Trias and end-Cretaceous have long been recognized and linked with regressional palaeogeographical events. The recognition of smaller-scale international extinction events is relatively new and is especially well shown in the Palaeozoic when there was a simpler distribution of land and sea pathways than in later periods when the influence of latitudinal distributions and local provinces was more severe. Some eight such extinction events are known in the Devonian and evidence will be presented for some of these to illustrate the nature of the process. Usually a decline in diversity is followed by extinction; then there is a period of low diversity but often international abundance; then novelty appears and is seen usually in new characters of the early stages; elaboration and diversification follows. These fluctuations can frequently be correlated with changes in other groups and also with sedimentological and palaeogeographical changes. Often a regression-transgression couplet is involved with evidence of ocean turnover indicated by anoxic events. Therefore on both the large and small scales there is an association of evolutionary change with palaeogeographical change. Whether periodicity is involved or not, such factors seem readily explicable in endogenic earth causations and for the present these provide the most parsimonious explanations.

R. A. Fortey, *Possible causes of Lower Palaeozoic extinction events*

The history of the trilobites and graptolites in the Lower Palaeozoic will be reviewed from the perspective of extinctions. It is important to distinguish between the effects of taxonomic pseudoextinction and true extinction. Taxonomic pseudoextinction is an artefact produced by taxonomic procedure, especially the habitual use of paraphyletic groups in the classification of

fossil organisms. The 'disappearance' of the olenellid trilobites at the end of the early Cambrian is probably not to be regarded as the extinction of a major group, simply because olenellids are likely to be a papaphyletic taxon. Similarly the 'extinction' of the anisograptid graptolites at the end of the Tremadoc does not record the passing of a major taxon so much as the polyphyletic loss of bithecae. In these cases particularly, families cannot be regarded as surrogates for genera or species in measuring extinction events. Extinction at the Cambro-Ordovician boundary is high at the generic level, but those at family level may be largely taxonomic pseudoextinctions. The major extinction event at the end of the Ordovician is indisputable. As far as the trilobites were concerned this event coincides not with the onset of the Ashgill glaciation, but with its end. Asaphine trilobites having planktotrophic larvae were particularly affected and several other groups with a long previous 'oceanic' history were likewise extinguished. This is most economically explained by a widespread anoxic event affecting the oceanic realm. The late Ordovician event may be contrasted with Cambrian 'biomere' events, or the Cambro-Ordovician boundary, for which it has been claimed that the shelf trilobites were those vulnerable to extinction whereas the outer shelf to oceanic forms provided phyletic continuity. None the less, the shelf extinctions may be explained also by the shoreward extention of cool or anoxic water masses or both. In no case is there evidence of, or a necessity for, extraterrestrial influence at horizons of faunal change.

D. Jablonski, *The biology of extinction*

Extinctions are not biologically random: certain taxa and functional or ecological groups are more extinction-prone than others. Because this selectivity is based on biotic traits that vary within as well as among higher taxa (suggestions include geographical range, trophic level and population densities), differential survivorship patterns will tend to be manifest at relatively low taxonomic levels. Survivorship patterns may differ between background and mass extinctions, with some traits that tend to confer extinction-resistance during background times being ineffectual or even detrimental during mass extinctions. Thus taxa and morphologies can be lost not because they were poorly adapted by the standards of background processes, but because they failed to possess–or be linked to the organismic, species-level or clade-level traits favoured during the mass extinction régime. Post-extinction diversifications can be channelled in directions not predictable from evolutionary patterns during background times.

M. J. Benton, F.L.S., *Mass extinction among vertebrates and the quality of the fossil record*

The fossil record of vertebrates is patchy because of the problems of preservation in terrestrial sediments in particular, and because vertebrates are rarely very abundant. However, the fossil record of vertebrates has the advantages that it is easier to establish a phylogenetic taxonomy than for many invertebrate groups, and there is the potential for detailed ecological analyses. Both 'fishes' and tetrapods show similar logistic patterns of familial diversification, with low levels during the Palaeozoic and most of the Mesozoic. Rapid and sustained increase in fish diversity took place during the Cretaceous and Tertiary with the radiation of teleosts. The diversification burst for tetrapods began in the late Cretaceous, and both are still continuing. Several extinctions may be identified in the vertebrate fossil record. Most of these correspond to major events that also affected invertebrates (end-Permian, late Triassic, end-Cretacaeous), but others do not (early Permian, early Triassic, mid-Oligocene, late Miocene). In studies of the kind, it is important to attempt to distinguish quantitatively between 'true' mass extinctions and periods of relatively poor fossil preservation.

A. J. Charig, F.L.S., *The Cretaceous–Tertiary boundary and the last of the dinosaurs*

Disaster theories of the Cretaceous–Tertiary (K–T) extinctions, more specifically dinosaur extinctions, are currently engendering much controversy. They require (*inter alia*) that those extinctions were sudden and simultaneous worldwide; and, further, that they coincided with the allegedly causal disaster at the K–T boundary. I shall review the evidence for and against those requirements.

Unfortunately, there are surprisingly few places where a continuous succession of continental, potentially dinosaur-bearing deposits passes without disconformity across the K-T boundary, enabling the stratigraphic position of the last dinosaur to be determined precisely. (In any case,

specialists in different fields define the position of the boundary on different criteria.) Although some alleged discoveries of Palaeocene dinosaurs have long been discredited (the beds were not Palaeocene, or the bones were not dinosaurian), there is reliable evidence that dinosaurs died out at different times in different places, sometimes surviving whatever it was that produced the iridium anomaly and sometimes co-existing with Tertiary-type mammals.

J.-J. Jaeger, *Patterns and rates of extinction among Neogene and Pleistocene perimediterranean mammals*

(Abstract not available)

D. M. Raup, *The case for extraterrestrial causes of extinction*

The dramatic increase in our knowledge of solar system and galactic forces that could cause extinctions has led to strong arguments for the plausibility of extraterrestrial causes of extinction. The evidence from Phanerozoic impact craters is especially important. Proof of cause-and-effect is severely hampered, however, by our inability to determine precise synchronicity of impacts and extinctions. Until this problem is solved, the case will remain circumstantial and controversial.

Palaeontologists can make important contributions by developing a new calculus for treating biostratigraphic data. Following the lead of C. R. C. Paul, the methods need not be mathematically elaborate. Several examples will be developed to illustrate approaches to the fundamental problem of distinguishing sudden from gradual extinctions in the fossil record. The primary conclusion is that extinctions often appear to be gradual, whether or not they actually are. The challenge for future research will be to learn how to recognize truly sudden extinctions, if such exist.

S. M. Stanley, *The role of climate in mass extinction*

Because climatic conditions constitute the most important factor influencing the distribution of life on a geographical scale, climatic change has great potential to cause mass extinction, Many geological and palaeontological patterns suggest that climatic change has, in fact, been the primary agent of mass extinction. One of these is the tendency for crises to strike most heavily at low latitudes, where there is no possibility for migration in response to climatic cooling. Other factors, such as the areal effects of sea-level lowering on marine life, appear to have played only minor roles in global extinctions.

Heavy Plio-Pleistocene extinction in and around the North Atlantic can be linked to climatic change. All strictly tropical bivalve species that inhabited seas of southern Florida during early Pliocene time died out, despite the persistence of broad areas of shallow sea floor. In contrast, huge molluscan faunas of western North America, which were not exposed to severe thermal stress, survived in very small areas during profound events of sea-level lowering.

During Eocene and Oligocene times, heavy extinction coincided with global climatic changes that are revealed by fossil floras and that apparently resulted from plate tectonic movements near the South Pole. The terminal Cretaceous extinctions were followed by a dramatic expansion of deciduous land plants in North America that signalled climatic deterioration. For both land plants and marine invertebrates there was a latitudinal gradient in the intensity of extinction, with the heaviest losses in the south. Boreal gastropods shifted southwards in the Atlantic, and cool-adapted planktonic foraminifera shifted southwards in the Pacific. The three great Palaeozoic extinction events (those of late Ordovician, late Devonian, and late Permian) shared several patterns that implicate climatic change as the primary agent of destruction. Tropical taxa, including reef-builders and calcareous algae, were struck hardest. The crises were protracted, with cool-adapted faunas shifting towards the equator; in the aftermath of each event limestone production was reduced, marine taxa were relatively cosmopolitan and recovery of the reef ecosystem was delayed. In addition, at about the time of each crisis, glacial activity was initiated near one of the Earth's poles.

A. Hallam, *The case of sea-level change as a dominant causal factor in mass extinction*

A correlation between global marine regressions and mass extinctions has been recognized since the 19th century and received explicit formulation, in a model involving habitat-area restriction, by Newell in the 1960s. Since that time attempts to apply the species–area relation to the subject have proved somewhat controversial and promoters of other extinction models have called into

question the generality of the regression–extinction relation. In this study a strong relation will be shown to exist between times of global or regional sea-level change inferred from stratigraphic analysis, and times of high turnover of Phanerozoic marine invertebrates, involving both extinction and radiation; this is valid both on a small and a large scale. In many cases the most significant factor promoting extinction was apparently not regression but spreads of anoxic bottom water associated with the subsequent transgression. The sea-level–/extinction relation cannot be properly understood without an adequate ecological model, and an attempt is made to formulate one in outline.

M. H. Williamson, *Natural extinctions on islands*

Although there is much turnover, i.e. extinction and immigration, on islands, permanent extinction is rare. The relation of these processes to population size and community structure will be discussed with reference to various sets of data. The fate of species introduced, either accidentally or deliberately, also throws light on community structure and the processes leading to extinction.

Mathematical models of ecosystems are still primitive. The extent to which these models help our understanding of extinction will be discussed, as will be the importance of minimum viable population size and the MacArthur–Wilson theory of island biogeography.

J. M. Diamond, *Man-related extinctions: patterns and causes*

Most observed extinctions of species within the past few centuries have been due to effects of man. However, recent archaeological work has greatly expanded the database of man-related extinctions. There are well-documented examples of extinction waves when humans first arrived at many and probably all oceanic islands previously unoccupied by humans. In addition to these clearly man-related insular extinctions, a vigorous debate persists as to whether human arrival on the three most recently occupied continents (Australia, North America and South America) was accompanied by similar extinction waves. This large database illustrates that the causes of man-related extinctions include not only the most obvious ones, namely, overhunting and habitat destruction, but also several others, including trophic cascades and effects of introduced taxa.

Colin Tudge, *The rise and fall of* Homo sapiens sapiens

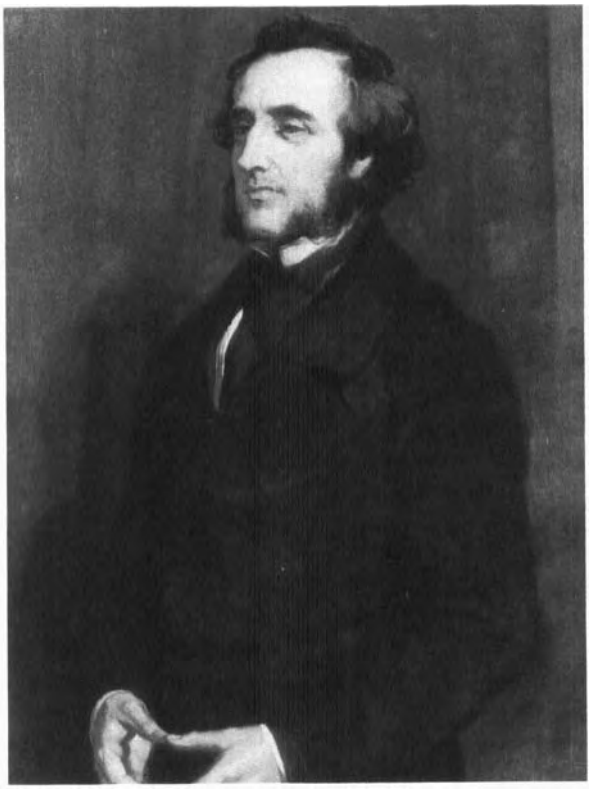
(Abstract not available)

Natural Products as Pharmacological Probes and in New Pharmaceuticals

On February 25, 1988 The Linnean Society held a joint meeting with The Pharmaceutical Society of Great Britain as part of the Bicentenary celebration programme. Although there are no formal links, a number of outstanding individuals have been active in both Societies. Jacob Bell, F.L.S., founder of the Pharmaceutical Society is given honourable mention in the History of the Linnean Society as being "one who was distinguished in other fields of endeavour". While Daniel Hanbury, former Treasurer of the Linnean Society and Jonathan Pereira "the well known pharmacologist" were prominent members of both Societies. When the Pharmaceutical Society of Great Britain's School of Pharmacy opened on Tuesday May 17 1842 it was Anthony Todd-Thomson, F.L.S. who gave the opening lecture on Medical Botany at 8.00 a.m. "to a numerous and attentive audience". Before 1900, six of the chairmen of the

annual Conference of the Pharmaceutical Society were F.L.S. but since that time it has been a rare event for a Linnean Fellow to chair that particular conference.

The meeting held on "Natural Products as Pharmacological Probes and in New Pharmaceuticals" was organized by Prof. J. D. Phillipson (The School of Pharmacy, University of London) as a forward-looking meeting, some eight speakers being invited to talk about their research into plant and animal products which are of current interest to pharmacology and which might provide leads to new drug discoveries. Following the welcome by Prof. W. G. Chaloner, the first speaker, Prof. N. G. Bisset, (Pharmacy Department, King's College London) set the meeting into context by having a brief look into the past, tracing the origins of the two Societies and linking them with the birth of



Jacob Bell.

Pharmacognosy, a term first defined in 1815. The Linnean Society founded in a London coffee house in February 1788 predates the Pharmaceutical Society of Great Britain which originated in a London tavern—the Crown and Anchor—in April 1841. The dependence of medicine on natural remedies began to fade as synthetic drugs such as aspirin appeared in the late nineteenth century, followed by arsenicals and in the 1930s by the antibacterial sulphonamides. The pendulum swung in favour of synthetic medicinal agents. There were, however, significant contributions to medicine from natural sources and, in particular, the major advance in antibacterial chemotherapy did not develop from the

sulphonamides but from a group of bizarre natural products which became known as the antibiotics. Higher plants have contributed from the 1950s to the present date with the antihypertensive alkaloid reserpine from *Rauwolfia serpentina*, vinblastine and vincristine, anticancer alkaloids from *Catharanthus roseus* and more recently the novel Chinese antimalarial drug artemisinine from *Artemisia annua*. Professor Bisset argued that plants (and animals) are a vast reservoir of chemical structures which can be utilized as probes at cellular and molecular levels and also act as templates for the development of new drugs. 80% of the World's population continue to rely on mainly plant medicines in their systems of health care utilizing some 20,000 plant species which are largely uninvestigated scientifically and hence the potential of natural products for realizing new medicinal agents is considerable.

The phorbol esters are one group of plant constituents which play an important role in studying the ways in which intracellular transduction occurs across cell membranes. Dr F. J. Evans (The School of Pharmacy, University of London) has made extensive investigations into the diterpene constituents of the Euphorbiaceae and over 100 compounds have now been obtained. Phorbol esters substitute for the second messenger diacylglycerol and activate protein kinase C but not all of these natural diterpenes act in the same way. The sapintoxins, for example, fully activate protein kinase C, whereas daphnetoxin does not, and yet other closely related compounds only partially activate protein kinase C. Some phorbol esters, although not all, are tumour promoters, i.e. they promote tumour growth after a subthreshold dose of a carcinogen is administered, and it is intriguing to know why some of the compounds possess this activity whereas others do not. All of the compounds which are pro-inflammatory stimulate mitogenesis and also prostaglandin secretion but only some of them have the ability to aggregate platelets. It is now realised that different diterpene esters have varying co-factor requirements, e.g. Ca^{+2} concentration, and indeed protein kinase C is not homogeneous in character but exists as a number of isoenzymes. Such detailed investigations help in a fuller understanding of both carcinogenesis and inflammation, whilst inhibitors of protein kinase C are potentially useful for the development of new anti-inflammatory agents.

A number of animal toxins act on the nervous system and have proved useful in elucidating the mechanism of nerve action. Prof. A. L. Harvey (Department of Physiology and Pharmacology, University of Strathclyde) described how tetrodotoxin obtained from the puffer fish, blocks sodium channels and can be used to localize and to count the number of sodium channels present within a nerve. Dendrotoxin, derived from the deadly green mamba, is a polypeptide of some 60 amino acid units and containing three disulphide bonds. It acts by augmenting acetylcholine release causing rapid firing of neurones and studies with dendrotoxin have revealed that there is a subset of calcium dependent potassium channels. Scorpion venom and bee venom constituents have proved to be selective blockers of calcium-dependent potassium channels. The use of animal toxins to determine nerve action mechanisms could prove to be the starting point for designing new treatments for Alzheimer's disease.

Feverfew is an old herbal remedy which has found current popular use in the U.K. for the relief of migraine. Dr P. J. Hylands (Xenova Ltd, Slough) gave details of the clinical trials which have demonstrated that the herb does reduce

the frequency of migraine effects in some patients and completely stops attacks in other patients. Sesquiterpene lactones such as parthenolide have been implicated as the active ingredients.

Traditional medicines are used throughout the world for the treatment of many diseases including malaria which is currently a major threat to world health because of the resistance of the causative protozoa *Plasmodium falciparum* to the clinically used drugs such as chloroquine and also because of the resistance of the vector mosquito to insecticides. Cinchona has provided the classical drug quinine which has served as a model compound for the synthesis of numerous antimalarial drugs. In recent years, Chinese scientists have succeeded in isolating the sesquiterpene artemisinine, which is the active ingredient of the Chinese antimalarial herb *Artemisia annua*. Artemisinine is used clinically in China and has proved to be effective against cerebral malaria. Dr M. J. O'Neill (The School of Pharmacy, University of London) discussed other antimalarial natural products, and in particular recent studies with species of Simaroubaceae which are used pantropically for the treatment of malaria. The active constituents are a series of bitter terpenoids known collectively as quassinoids and several of these have marked activity against *P. falciparum in vitro* and *P. berghei* in mice. Minor differences in the structures of the isolated quassinoids can produce marked changes in antiplasmodial activity and these studies may lead to possible new antimalarial drugs.

Dr P. M. Dewick (Department of Pharmacy, University of Nottingham) indicated that clinically useful anticancer drugs have been developed from the lignan which occurs in *Podophyllum* species. These clinical agents are obtained by semi-synthesis utilizing the natural lignan as a starting material. New sources of such lignans are required and possible economic alternatives include the use of taxonomically related species or possibly the application of plant tissue culture techniques.

Interferons are now manufactured industrially utilizing mass cell culture of mammalian cells. It is technically feasible to produce lymphoma cells in 8000 litre tanks in order to obtain a pure preparation of alpha interferons stated Dr N. B. Finter (Wellcome Biotechnology, Beckenham). This technology has taken over from the former 'cottage industry' approach and other industrial applications include the production of a foot and mouth vaccine in 2000 litre quantities.

The immune response to cancer was discussed by Dr M. J. Crumpton (Imperial Cancer Research Fund). Lymphoid cells in particular are responsible for specificity of action, acting on B cells, moderators of humoral immunity, and T cells which regulate B cell response. T cells have antigen receptors and if this is lost they become killer cells. One method of cancer treatment is to remove lymphocytes from patients, allow cell proliferation under laboratory conditions and then inject them back into the patients. An imaginative approach to cancer chemotherapy has been the development of magic bullets by linking together a toxin such as ricin with an antibody specific to tumour cells. Clinical trials are now in progress.

The lectures clearly indicated that natural products derived from both plants and animals continue to be of relevance as probes in order to understand physiological mechanisms. The scope for new drug development utilizing this information and the diversity of biological effects of natural products, is

enormous. It was an interesting meeting which was appreciated by the packed audience and it served as a useful reminder to both of the two Societies that Medicine will continue to rely heavily on natural products.

J. D. PHILLIPSON

Library

Readers using the Library will sometimes have noticed that we have a number of voluntary helpers each engaged in specific tasks. It may be helpful to let Fellows know of the existence of some of these projects. The longest term helpers have been a team from the North Kent branch of the National Association for Decorative and Fine Art Societies (NADFAS) who have been coming regularly on Thursday mornings since 1977. Under the leadership of Mrs Mary Forbes they have been cleaning books and manuscripts from the Strongroom and cataloguing the bound volumes of reprints or *opuscula*. Mrs Forbes is usually accompanied by Mrs Sybil Downs, our "dirty book cleaner" and Mrs Melba Coombs our specialist in cleaning vellum books and now working on the Linnean manuscripts. Alternate weeks bring Mrs Ann Peacock, Mrs Peggy Mayow and Mrs Pat Bratton, all of whom struggle to catalogue the sometimes obscure items among the bound and loose reprints.

Other helpers come in to work on particular projects as time permits. Dr Ethel Barrow has been helping for many years, first on the books in the Strongroom and then on cleaning some of the manuscript collections. She is currently cleaning, mending and reboxing the Certificates of Recommendation for Fellowship and looking at the occupations given for the earlier Fellows. Mrs Jenny Brazier is the most recent recruit and having just catalogued a collection of drawings of Indian fruits, is now beginning to find out what the detailed contents are of a series of large scrap books made by A. E. L. G. Gunther containing illustrative material, mostly on vertebrate faunas of the world, dating from the 1870's onwards. Mrs E. Clifford has almost finished cataloguing the geological manuscripts held by the Society. Mr Desmond Cull first started work on the papers belonging to R. H. Jeffers but has also sorted J. E. Smith's carpological collection and also indexed the papers of the Society for the Promotion of Natural History. Mr Ray Desmond gives invaluable assistance as Honorary Archivist and is currently cataloguing the many drawings forming part of the manuscript collection. Mrs Diane Furley has almost completed a calendar of the E. M. Holmes correspondence, mostly with other cryptogamic botanists during the period 1880–1890. Mrs Iris Hughes is doing a similar job on the correspondence of Richard Pulteney, an early Fellow of the Society. Mrs Maria Perry has been translating the correspondence of the Italian Foreign Members in the Smith correspondence into English. Lastly, Margot Walker, having now catalogued our portrait collection and written a short life of our founder James Edward Smith, has been sorting and calendaring the George

Bentham papers, mostly family letters detailing his travels in Europe and daily life on return to England. They are remarkable for the almost total absence of any references to botanical matters.

Donations

We were happy to be able to add a new letter to the Smith correspondence thanks to John Collins of Maggs Bros. who presented us with a letter from J. E. Smith to Dawson Turner dated 3rd September 1815. This letter is in a lighter vein being a letter of introduction for an acquaintance with greetings for the newly increased Turner family. Donations of books are listed below and we continue to express our thanks to those giving us journals and/or reprint collections, especially F. N. Hepper, Professor Pontecorvo and P. W. Sowan. Other donations include:

A. Armstrong	Dobzhansky, Theodore, *The Roving Naturalist, Travel Letters, edited by Bentley Glass.* 327 pp. American Philosophical Society, Philadelphia, 1980
S. & K. Bjurenstam	Ribbing, E., *Carl von Linne, hans personlighet och livs garning.* 291 pp., illustr. Lindblad, Uppsala, 1918.
F. H. Brightman	Carpenter, Kenneth J., *The History of Scurvy and Vitamin C.* 288 pp., illustr. University Press, Cambridge, 1988.
	Dong Zhiming, *Dinosaurs from China.* 114 pp., illustr. col. British Museum (Natural History) & China Ocean Press, London, 1987
	Reardon, Terence B. & Flavel, Stanley C., *A Guide to the Bats of Southern Australia.* 83 pp., illustr. some col. South Australian Museum, Adelaide, 1987
	Stebbings, R. E., *Conservation of European Bats.* 246 pp., illustr. maps. Christopher Helm, London, 1988.
Dr H. M. Burdet	Geneva, Conservatoire et Jardin Botanique, *Complements au Prodrome de la flore Corse: Dipsacaceae,* by D. Jeanmonod. 40 pp., illustr. Jardin Botanique, Geneva, 1988.
	Wues, T. J. & Jeanmonod, D., *Morphologie Florale, en Microscopie Electronique à Balayage.* 167 pp., illustr. Conservatoire et Jardin Botanique, Geneva, 1988.
J. Burton	Botting, Douglas, *Wild Britain.* 224 pp., illustr. col. maps. Collins, London, 1988
H. B. Carter	Carter, Harold B., *Sir Joseph Banks, 1743–1820.* 671 pp., illustr. maps. British Museum (Natural History), London, 1988.
Rt. Hon. the Earl of Cranbrook	Cranbrook, Earl of, *Riches of the Wild: Land Mammals of South-East Asia.* 95 pp., illustr. some col. maps. Oxford University Press, Singapore, 1987.
Dr J. H. Crothers	Field Studies Council, *A Key to the Adult British Water Beetles,* by L. E. Friday (AIDGAP, from Field Studies

	7, 1988). 151 pp., illustr. Field Studies Council, Taunton, 1988.
Prof. R. G. Davies	Davies, R. G., *Outlines of Entomology* (7th edition). 408 pp., illustr. Chapman & Hall, London, 1988.
P. Davies	Davies, P. *The species of plants recorded by James Backhouse (1794–1869) of York in his "recollections of the botany of New South Wales, Van Diemen's Land and their dependencies"* (printout from computer). 88 pp. [not validly published] [1988].
	Davis, P. & Leathart, T. J. (Eds). *The Correspondence of Nathaniel John Winch (1768–1838), an index by author.* 154 pp. Hancock Museum, Newcastle, 1988.
Director, IBPGR	Gepts, Paul, *Genetic Resources of Phaseolus beans.* 613 pp., illustr. some col. Kluwer, Dordrecht, 1988.
	Suzuki, S., (Ed.), *Crop Genetic Resources of East Asia.* 286 pp., IBPGR. Kuala Lumpur, 1988.
Dr P. G. Foster	Foster, Paul, G. *Gilbert White and his Records, a Scientific Biography.* 240 pp., illustr. Christopher Helm, London, 1988.
Dr F. G. Hardy	Newcastle upon Tyne, Hancock Museum, *An Atlas of the Seaweeds of Northumberland and Durham,* by F. G. Hardy & R. J. Aspinal. 150 pp., maps. Hancock Museum, Newcastle, 1988.
Dr K. Harrison	*Exercise Paddington Diamond: Lake Titicaca, Bolivia, May 1987.* 78 pp. Viersen, 1988.
Dr A. Hollman	Owadally, A. W. *A Guide to the Royal Botanic Gardens, Pamplemousses* [Mauritius]. 89 pp. [privately] Port Louis, 1985.
Kyburg Limited	[Lennox-Boyd, Charlotte], *Drawn from Nature, an Exhibition of Natural History & Botanical Drawings from Europe, India and Canton,* 2–30 November, 1988. 23 pp. Kyburg Limited, London, 1988.
Linnean Society of New South Wales	Andrews, Alan E. J., *The Devil's Wilderness, George Caley's Journey to Mount Banks, 1804.* 150 pp., illustr. maps, Blubber Head Press, Hobart, 1984.
	New South Wales, Central Mapping Authority, *Atlas of New South Wales.* 135 pp., illustr. col. maps. NSW, Central Mapping Authority, Bathurst, 1987.
Prof. H. F. Linskens	Stanley, R. G. & Linskens, H. F., *Pollen: Biologie, Biochemie, Gewinnung und Verwendung.* 334 pp., illustr. Urs Freund Verlag, Greifenberg, 1985.
Dora Emilia Mora	Caballero, Rafael Lucas Rodriguez, *Generoso de Orquideas de Costa Rica.* 334 pp., col. illustr. Ediciones Universidad, Costa Rica, 1986.
Dr E. C. Nelson	Threlkeld, Caleb, *Synopsis stirpium hibernicarum, the first Irish flora,* introduced by E. C. Nelson . . . (pp. various), Boethius Press, Kilkenny, 1988.
Dr G. Pilleri	Pilleri, G., *Brains Preserved in a Celtic Settlement Horizon of the La Tene Age,* Switzerland. 23 pp., illustr. Brain

	Anatomy Institute, Ostermundigen, 1988.
	Pilleri, G., *Contributions to the Paleontology of some Tethyan Cetacea and Sirenia (Mammalia)*, 116 pp., illustr. maps. Brain Anatomy Institute, Ostermundingen, 1988.
	Pilleri, G., *Sirenia in Swiss Collections*. 61 pp., illustr. Brain Anatomy Institute, Ostermundigen, 1988.
Dr G. T. Prance	Prance, G. T. & White, F., *The Genera Chrysobalanaceae ... (Philosophical Transactions of the Royal Society, Series B,* Vol. 320, No. 1197). 13 July, 1988.
The Ray Society	Edees, E. S. & Newton, A. (Ed. D. H. Kent). *Brambles of the British Isles*. 377 pp., illustr. maps. Ray Society, London, 1988.
Royal Botanic Gardens, Kew	Kew, Royal Botanic Gardens, *Kew Index for 1987*. 161 pp. Clarendon Press, Oxford, 1988.
M. Sawls	Sawls, Marion, *A Survey of the Rare and Uncommon Mammals in the Kimberley, Western Australia*. 57 pp. typescript. Murdoch University, August 1988.
Prof. W. T. Stearn	Mech, L. David, *The Wolf, the Ecology and Behaviour of an Endangered Species*. 384 pp., illustr. maps. American Museum of Natural History, New York, 1970.
Prof P. Taquet	Museum National Histoire Naturelle, *Les Arbres Historiques du Jardin des Plantes*. Publ. No. 2. 16 pp., col. illustr. Editions du Museum, Paris, 1986.
	Museum National Histoire Naturelle, *Buffon 1788–1988*. 295 pp., illustr. col. Imprimerie Nationale Paris, 1988.
	Museum National Histoire Naturelle, *Guide—Promenade du Jardin des Plantes*. (Publ. No. 1). 12 pp., illustr. col. Editions du Museum, Paris, 1986.
	Museum National Histoire Naturelle, *La Zoothèque du Jardin des Plantes*. 8 pp. Editions du Museum, Paris, n.d.
	Roger, J. *Buffon, les Epoques de la Nature, Edition Critique* (Memoires Mus. Nat. Hist. Nat. Ser. C. t 10, 1988), 343 pp., illustr. Museum National d'Histoire Naturelle, Paris, 1988.
Prof. V. N. Tikhomirov	Akademiya Nauk SSR, Botanicheskii Institut, *Krasnaya Kniga RSFSR: Rasteniya* (Red Data Book for Plants of the U.S.S.R.). 591 pp., illustr. col. maps. Academy of Sciences, Moscow, 1988.
J. Weston	Schmidt, F. (Ed.), *Neodarwinistische oder Kybernetische Evolution: Berichte über ein Internationales Symposium von 15–17 Juli, 1987*. 247 pp. University printers, Heidelberg, 1988.
	Whitman, J. (Ed.), *The Environment in Israel*. 294 pp., maps. Environment Protection Agency, Jerusalem, 1988.
Prof. J. Wilbert	Wilbert, Johannes, *Tobacco and Shamanism in South America*. Psychoactive plants of the world, R. Schultes & R. F. Raffauf (Eds). 294 pp., illustr. Yale University Press, New Haven, 1987.

Accessions

Accessions from April to November 1988 include:

Albertus Magnus, *Man and the beasts: de Animalibus (books 22–26)*, 516 pp. Mediaeval & Renaissance texts and studies, Vol. 47, New York, 1987.

Aleksandrova, V. D., *Vegetation of the Soviet Polar Deserts.*, translated by D. Love. 228 pp., illustr. maps. CUP, Cambridge, 1988.

Alibertis, C. & Alibertis, A., *Wild orchids of Crete*, 37 pp. 88 pl. Kazanakis, Heraklion, 1985.

Armstrong, J. A. and others., *Pollination and Evolution, based on a symposium. 12th International Botanical Congress, 1982*, 108 pp. Royal Botanic Gardens, Sydney, 1982.

Auffenberg, W., *Gray's Monitor lizard.* 419 pp. University of Florida Press, Gainesville, 1988.

Austin, B. & Priest, F., *Modern bacterial taxonomy*, 145 pp. Van Nostrand Reinhold, Wokingham, 1986.

Australia, Bureau of Flora and Fauna, *Plant indumentum, a Handbook of Terminology*, by Helen J. Hewson. 27 pp., illustr. Australian Government Printing Service, Canberra, 1988.

Beebe, Mary Blair & Beebe, C. William, *Our Search for a Wilderness, an Account of Two Ornithological Expeditions to Venezuela and British Guiana.*408 pp., illustr. Constable, London, 1910

Blofeld, J., *The Chinese art of tea*, 205 pp. illustr. Shambala, Boston, 1985.

Borella, P. & Borella, S., *Danish zoological bibliography, Alphabetical index and systematic index*, 419 pp. & 475 pp. Reitzel, Copenhagen, 1986.

Bramwell, D., Hamann, O., Heywood, V. & Synge, H., *Botanic Gardens and the World Conservation strategy: Proceedings of an international Conference*, 26–30 November 1985, Las Palmas de Gran Canaria, 367 pp. Academic Press, London, 1987.

Brown, L., *Birds of Africa*, Vol. 3, edited by C. H. Fry, S. Keith and E. K. Urban, 611 pp. Academic Press, London, 1988.

Canberra, Bureau of Flora and Fauna, Zoological., *Catalogue of Australia, Vol. 1 Amphibia and Reptilia*, 313 pp. Australian Government Publishing Service, Canberra, 1983.

Cloudsley-Thompson, J. L., *Evolution and Adaptation of Terrestrial Arthropods.* 141 pp. Springer, Berlin, 1988.

Curtis, T. G. F. & McGough, H. N., *The Irish Red Data Book: I Vascular Plants.* 168 pp. Stationery Office, Dublin, 1988.

Dahlgren, Rolf M. T., Clifford, Howard Trevor & Yeo, Peter, F., *The Families of the Monocotyledons, Structure, Evolution and Taxonomy.* 520 pp., illustr. Springer, Berlin, 1985.

Easterbrook, M., *Butterflies, the Lycaenidae.* 24 pp., col. illustr. Shire, Aylesbury, 1988.

Ewan, Joseph and Ewan, Nesta Dunn, *Biographical Dictionary of Rocky Mountain Naturalists . . . 1682–1932.* (Regnum Vegetabile Vol. 107) 253 pp. Bohn, Scheltema & Holkema, Utrecht, 1981.

Fagerstrom, J. A., *The Evolution of Reef Communities.* 600 pp. Wiley, New York, 1987.

Goodwin, T. H., *History of the Biochemical Society 1911–1986.* 181 pp., illustr. Biochemical Society, London, 1987.

Gramiccia, G., *The Life of Charles Ledger (1818–1905).* 222 pp., illustr. some col. Macmillan, Basingstoke, 1988.

Greuter, W. (Ed.) *International Code of Botanical Nomenclature, 1987.* 328 pp. Koeltz, Konigstein, 1988.

Hammen, L. van der, *Unfoldment and Manifestation.* 181 pp., illustr. Academic Publishing, The Hague, 1988.

Harkonen, *Guide to the Otoliths of Bony Fishes.* 256 pp., illustr. Danbiu, Hellerup, 1986.

Jerusalem, Israel Academy of Sciences and Humanities, *Flora Palaestina, Pt. 4. Alismataceae—Orchidaceae*, by Naomi Feinbrun-Dothan. 2 vols. 462 pp. text, 525 pl. maps. Israel Academy of Sciences & Humanities, Jerusalem, 1986.

Johnson, Timothy H., *Biodiversity and Conservation in the Caribbean: Profiles of Selected Islands.* 144 pp. ICBP. Cambridge, 1988.

Koibong, Li & Leslie, A. Lewis, *A Novel Approach to the Evolution of Micro-organisms.* 61 pp. Vantage Press, New York, 1987.

Lee, Thomas F., *The Seaweed Handbook: An Illustrated Guide to the Seaweeds from North Carolina to the Arctic.* (Reprint of 1977 ed.) 217 pp., illustr. Dover Books, New York, 1986.

Levington, J., *Genetics, Paleontology and Macroevolution.* 637 pp., illustr. CUP, Cambridge, 1988.

Liebherr, James K., *Zoogeography of Caribbean insects.* 285 pp., illustr. maps. Comstock & Cornell, Ithaca, 1988.

Linsbauer, K., *Handbuch der Pflanzenanatomie*: Cytology & morphogenesis of bacteria, by F. Meyer; Anatomie des blattes/blatenanatomie der angiospermes by K. Napp-Zinn; Anatomie des galles, by J. Meyer & H. J. Maresquelle and Les Mycorhizes by D. G. Strullu. Bd IV, T. 2, Bd. VIII, T. 2, b2; Bd XIII, T. 1; Bd. Xiii, T. 2. Bornträger, Berlin, 1983–1988.

Mahon, A., *Grasshoppers and Bush Crickets.* 24 pp. Shire, Aylesbury, 1988.

Meine, Curt, *Aldo Leopold, his Life and Work.* 638 pp., illustr. University of Wisconsin Press, Madison, 1988.

Miller, Anthony G. & Morris, Miranda, *Plants of Dhofar.* 361 pp., col. illustr. maps. Government of Oman, Dhofar, 1988.

Mitchell, Andrew W., *The Enchanted Canopy, Secrets of the Rainforest Floor.* 255 pp., illustr. Collins, Glasgow, 1987.

Nicholson, Dan H., Suresh, C. R. & Manilal, K. S., *An Interpretation of Van Rheede's Hortus Malabaricus.* 378 pp., 1 fig. Koeltz, Konigstein, 1988.

Ogley, Bob, *In the Wake of the Hurricane,* national edition. Froglet publications, Westerham, 1988.

Page, Christopher N., *Ferns, their Habitats in the British and Irish Landscape* (Collins New Naturalist series, No. 74). 430 pp., illustr. some col. Collins, London, 1988.

Pascher, A., *Süsswasserflora von Mitteleuropa*: Bacillariophyceae, teil 2.546 pp., illustr. Gustav Fischer, Stuttgart, 1988.

Pascher, A., *Süsswasserflora von Mitteleuropa*: Chlorophyta II, Tetrasporales, Chlorococcales, Gloenodendrales, by Hanus Ettl and Georg Gartner. 436 pp., illustr. Gustav Fischer, Stuttgart, 1988.

Radinsky, Leopold, *The Evolution of Vertebrate Design.* 188 pp., illustr. University of Chicago Press, Chicago, 1987.

Royal Society, *Extraordinary Fossil Biotas: their Ecological and Evolutionary Significance. A discussion meeting*, H. B. Whittington and S. Conway Morris. Published in *Phil. Trans. Roy. Soc. Ser. B.* Vol. 311, No. 1148, 1985. 192 pp., illustr. maps. Royal Society, London, 1985.

Sprinsteen, F. J. & Leobrera, F. M., *Shells of the Philippines.* 377 pp., illustr. col. Carfel, Manila, 1988.

Takhtajan, Armen, *Floristic Regions of the World.* 522 pp., maps. University of California Press, Berkeley, 1986.

Tripoli, Al Faateh University, *Flora of Libya: Gymnosperms.* 30 pp., illustr. Al Faateh University, Tripoli, 1986.

Wallace, Arthur, *The Niche in Competition and Evolution.* 175 pp. Wiley, Chichester, 1987.

Watson, L. & Dallwitz, M. J., *Grass Genera of the World.* 45 pp., illustr. col., microfiche, 2 floppy discs. Australian National University, Canberra, 1988.

Yom-Tov, Y. & Tchernov, E., (Eds), *Zoogeography of Israel: Distribution and Abundance at a Zoogeographical Crossroads.* 600 pp., illustr. maps. Junk, Dordrecht, 1988.

Zohary, D. & Hopf. M., *Domestication of Plants in the Old World.* 249 pp., illustr. maps, Clarendon Press, Oxford, 1988.

Zohary, Michael, *Conspectus Florae Orientalis, an Annotated Catalogue of the Flora of the Middle East,* by D. Heller and C. C. Heyn. Fasc. 2–4 maps. Israel Academy of Sciences and Humanities, Jerusalem, 1983–1987.

STOP PRESS

18–22 September 1989

37th Symposium of Vertebrate Palaeontology and Comparative Anatomy

Leicester, U.K. Includes taxonomy, functional anatomy, and other aspects of chordate structure and evolution.

Information: M. A. Taylor, Leicestershire Museums, 96 New Walk, Leicester LE1 6TD, U.K.

PROGRAMME

All meetings will be held in the Rooms of the Society unless another venue is stated in parentheses.

1989	**Start**			
13 Mar	17.30			VI Form Lecture
16 Mar	10.30	*	**Developmental Pathways and Evolution.** Coordinators: Dr F. A. Bisby F.L.S., Southampton University and Dr S. Blackmore F.L.S., British Museum (Natural History)	Bicentenary joint meeting with the Systematics Association
12–16 Apr			(At Taunton) **Evolution and Change in the Bristol Channel and Severn Estuary.** Coordinator: Dr J. H. Crothers F.L.S., Leonard Wills Field Centre	Bicentenary joint meeting with the Estuarine and Brackish Water Sciences Association and the British Ecological Society
19 Apr	17.30		**Kimberley Research Project 1988.** Mr M. J. S. Sands, F.L.S., Royal Botanic Gardens, Kew	Joint lecture with Royal Geographical Society
24 May	16.00	*	**Anniversary Meeting.** Elections and presentation of Awards	
14 Jun	19.00		**Conversazione**	
6–8 July			(At Oxford) **Interactions between Ants and Plants.** Coordinators: Dr D. F. Cutler, F.L.S., Royal Botanic Gardens, Kew and Dr C. R. Huxley, Oxford University	Symposium
13 Sept			(At Oxford) **Kimberley Research Project: Geomorphology,** Coordinator: Prof. A. S. Goudie, F.R.G.S.	Symposium
14–15 Sept			(At Kew) **The Living World of the Australian Kimberley,** Coordinator: Mr M. J. S. Sands, F.L.S.	Symposium
19 Oct	17.00	*	**Animal mitochondrial DNA as a Genetic marker in Systematic & Evolutionary biology.** Prof. R. Harrison, Cornell University	Scientific meeting
2 Nov	18.15		**A new History of the Microscope,** Mr. B. J. Ford, F.L.S.	General interest lecture and book bring and buy
16 Nov		*	**Biospheric Aspects of Global Change.** Prof. W. G. Chaloner, P.P.L.S., Royal Holloway & Bedford New College	Scientific joint meeting with British Ecology Society
14 Dec		*		Scientific meeting
1990				
11 Jan	17.00	*	**The Evolution of Honeybees.** Prof. R. S. Pickard.	Scientific meeting
25 Jan		*	**Society Debate**	
15 Feb		*	**Videodisc & CD**	Specialist Group meeting
28–30 Mar			**Pollen and Spores: Pathways of Diversification.** Coordinator: Dr S. Blackmore, F.L.S., British Museum (Natural History)	International symposium

*Admission of Fellows