Foreword

This volume presents the Proceedings of an International Symposium on 'The Biology of Pteridophytes' held at the Department of Botany, University of Edinburgh, and the Royal Botanic Garden, Edinburgh from 12 to 16 September 1983. The week's pre-Symposium field excursion through Britain is reported separately in the *British Pteridological Society Bulletin* **3** (1984), 21–28. This was the first international gathering to consider pteridophytes as living organisms, although in April 1972 there had been an international meeting at the Linnean Society of London on the taxonomy of ferns which was published under the title 'The Phylogeny and Classification of Ferns', as Supplement No. 1 to the *Botanical Journal of the Linnean Society*, **67**, 1973.

The idea for the Edinburgh meeting arose when I was editing a multi-author volume, '*The Experimental Biology of Ferns*', published in 1979 by Academic Press. It became obvious then that lack of space would make it impossible to include contributions from all those who were adding significantly to our knowledge of the subject. Moreover, no attempt was made in that book to represent adequately the field-orientated and less experimental studies, or the non-fern members of the Pteridophyta. The remedy for these deficiencies was clear: an international symposium with more contributions and a wider coverage than the book, followed by publication of the proceedings for those who could not attend. Furthermore, such a meeting would also help to maintain the momentum of the current revival of interest in pteridophyte biology.

The choice of venue was easy to make. Not only was Edinburgh convenient but it was an established and popular centre for international meetings, with a University Botany Department and a world renowned Botanic Garden to provide appropriate facilities. Moreover, these two institutions, with their long tradition of botanical teaching, have been in touch with all the developments in pteridology since its origin.

The study of ferns and their allies can be said to go back to Morrison's report, in *Plantarum Historiae Universalis Oxoniensis Pars Tertia* of 1699, that ferns could be raised from spores. Botanical teaching in Edinburgh also goes back to the late 17th century, and in that same year, 1699, James Sutherland, the first Professor of botany in what was then the Town College, was also made King's Botanist in charge of the Royal Garden. That marked the beginning of the joint history from that common origin of what is now the Royal Botanic Garden (RBG) and the Edinburgh University Department of Botany. Pteridology in some form or other has been taught in Edinburgh throughout the ensuing three hundred years. In 1794, the first published description of stages of the fern life cycle appeared in the *Transactions of the Linnean Society* (**2**, 93–100). The author was John Lindsay, a pupil of John Hope, one of Sutherland's successors as Professor of Botany and Keeper of the Garden. In 1886, teaching first took place in the RBG lecture hall where much of this Symposium was held. It was not until 1958, after more than 250 years of shared history, that the Garden and University separated. It was appropriate that, 25 years later, and in the

year of the University's Quatercentenary, they came together again for this meeting.

With the encouragement of those whom I consulted, I started planning this Symposium in 1978. Within a year, I had achieved respectability for the meeting by obtaining the agreement of the Royal Society of Edinburgh, the Linnean Society and the British Pteridological Society to be sponsors. Also during the first year, I was fortunate in obtaining the help of Dr C. N. Page as co-organiser. His influence in ensuring that laboratory interests were properly balanced by field studies was as invaluable as his help in many other aspects of organisation. In this we were supported by the other members of the Organising Committee: Dr David Cutler (Secretary, Linnean Society), A. C. Jermy (President, British Pteridological Society) and W. H. Rutherford (Executive Secretary, Royal Society of Edinburgh). At a later stage, the newly-formed International Association of Pteridologists also became a sponsor of the meeting. The various forms of support and encouragement provided by all four Societies is gratefully acknowledged but special mention must be made of the Royal Society of Edinburgh. Through Mr Rutherford and his staff, the R.S.E. provided indispensable assistance with planning, administration and accounting both before and during the meeting despite the extra duties incurred as a result of the celebrations that same year of the Society's 200th Anniversary. It is difficult to believe that the meeting could have taken place at all, let alone have been successful, without their help.

The meeting also derived great benefit from the support and assistance given by Professor Michael M. Yeoman, Regius Professor of Botany in the University of Edinburgh, Professor Douglas M. Henderson, Regius Keeper of the Royal Botanic Garden, and members of staff of both institutions. Equally deserved are thanks to the organisers' four assistants, Marian Barker, Patrick Hadfield, Kathryn Kavanagh and Alison Skene, who carried out their many and varied tasks during the meeting competently and cheerfully, and to members of staff of the University, Edinburgh District Council and Lothian Region Council who helped to provide the day-to-day requirements of accommodation, catering, transport and entertainment for the participants in the Symposium. The organisation of the preceding field meeting was undertaken by the British Pteridological Society and its success was due to the efforts of Clive Jermy and Kathryn Kavanagh, who shouldered most of the work in this. Financial donations from the Royal Society of London, the British Pteridological Society, and May and Baker Ltd are also acknowledged with gratitude. In helping to make the Symposium possible, all these people have contributed directly to the production of this published record of the scientific programme.

The fieldwork and Symposium programme was planned to represent the widest possible range of topics so as to bring together all types of pteridologists and all approaches to the subject and thus to stimulate new interactions between them. It is a reflection of the growing activity in pteridology, and perhaps an argument for further meetings of this kind in the future, that we had to be selective in the choice of topics in order to fit the programme within the constraints of a 5-day meeting. One criterion in this selection was that these published proceedings should be complementary to 'The Experimental Biology of Ferns' in content and authorship. Thus, for example, gametophyte development received limited attention in the Symposium, despite interesting new developments, because this subject was extensively covered in 1979.

Similarly, fern classification, covered comprehensively at the 1972 Linnean Society Conference, was also excluded as part of a consideration of the mechanisms of speciation. Nevertheless, despite the wide ranging and incomplete list of topics covered, the coherence of the programme was ensured by having the dynamic activities of living pteridophytes as the underlying theme and the link between all the diverse interests.

This Symposium, at which over 20 different countries were represented, provided the first opportunity at an international level for the exchange of information and views over the whole spectrum of pteridophyte biology. It was for many who came the first opportunity to meet like-minded colleagues from overseas. It was also often the first direct contact between field-orientated taxonomists and ecologists and the laboratory-based physiologists and biochemists, even when, as in some cases, they were working on the same group of plants. The concentrated attention on one species or group of species by several people with different interests and approaches produces a more integrated view of pteridophyte biology than is possible with the more usual 'mosaic' impression provided by a variety of unco-ordinated, specialised investigations of many different species. A particularly good opportunity to obtain this more complete understanding is provided by the so-called 'economic ferns' such as *Pteridium aquilinum*, *Matteuccia struthiopteris* and *Azolla* spp., where we are investigating almost every aspect of their biology. For this reason, these ferns were chosen as the subjects of a special session in this first Symposium, but the treatment was necessarily brief. Each of these species would merit further, more detailed, consideration at a future meeting. If the recently stimulated research into the biology of *Matteuccia* continues to develop, a comprehensive consideration of this species will be of particular interest. In habit and habitat, *Matteuccia*, unlike *Azolla* and *Pteridium*, is typical of many fern species, none of which has been studied in relation to all the major biological processes or at all stages of the life cycle. The opportunity for a concerted approach towards understanding the whole biology of a single species, of fundamental interest to all pteridologists, only occurs when commercial interest in the application of this understanding provides the incentive and the resources. Other groups which briefly featured in this Symposium but deserve special attention in the future include the heterosporous ferns and the fern allies.

The erosion, by a Symposium like this, of the barriers isolating different branches of pteridology is important in other ways. Bringing the laboratory and field studies together draws attention to areas lying between them which have been neglected because they were considered to be peripheral to both approaches but which may yet prove to be fundamental. For example, despite the considerable interest in laboratory studies of the cellular events of gametophyte development and in field studies of sporophyte distribution and evolution, we are only just beginning seriously to study gametophyte ecology, which determines dispersal and establishment, and gametophyte reproductive biology, which determines breeding systems and species isolation mechanisms. There is still very little we can say about the factors determining the distribution in nature of mature gametophytes, or the mechanisms, including interspecific incompatibility, which restrict the formation of species hybrids. Several quite basic questions remain to be answered. Are mixed-species populations of gametophytes widespread? If not, what prevents their occurrence, given the wide dispersal of spores of many species? If they are widespread, are there cellular mechanisms,

perhaps involving antherozoid recognition and rejection processes, in the archegonium or egg, which prevent most of the possible hybrid combinations giving rise to viable embryos? The early signs of interest in this area can be recognised in this Symposium, but more work must be encouraged if we are ever to understand properly the life of ferns and their allies. Their life cycle, with its two independent generations, is unique in the plant kingdom and a better comprehension of it is important for the whole of plant science, not merely for pteridology.

This is one example illustrating the necessity of breaking down the barriers between pteridology and the rest of botany, as well as those within pteridology. As a minority and recently unfashionable interest pursued by a few dedicated enthusiasts, pteridology has become inward-looking and largely isolated from recent developments in our knowledge of plant processes. In many under-graduate teaching courses it is still the case, as it was 20 years ago, that pteridophytes appear to have a structure, a life cycle and an evolutionary history, but no biochemistry, physiology, morphogenesis, genetics, reproductive biology or ecology. It is to be hoped that this attitude will soon change. The wide range of botanical topics encompassed by the current research interests represented in this Symposium clearly demonstrates that modern pteridology contains something to interest botanists of all disciplines. Botany as a whole would benefit from more studies of pteridophytes, whether in order to study their unique features for a wider understanding of the whole spectrum of terrestrial plant life, or in order to exploit their advantages as experimental material for the investigation of certain processes, such as cell differentiation, common to all plants. At the same time, pteridophyte studies would benefit from an increased contribution from investigators with experience of other plant groups. Several of the contributors to the Symposium have interests in particular plant processes which initially were directed towards Angiosperms but later extended to pteridophytes. This trend needs to be developed.

For all these reasons, by organising this first international Symposium on pteridophyte biology we created the opportunity for a significant step forward in the history of pteridology. It is however to the credit of the participants that this opportunity was so effectively exploited. Their contributions made the event as rewarding scientifically as it was enjoyable socially. Fortunately, by publishing the proceedings, we can make the scientific programme available also to those many botanists who, though not present at the meeting, would find at least some items of considerable interest. We are therefore very grateful to the Royal Society of Edinburgh for permission to publish the proceedings in their journal, and to Carole Anderson of the R.S.E. staff for editorial assistance, and in particular for her meticulous care in checking the manuscripts through their final stages of publication.

We have attempted to reflect the pteridological diversity of the Symposium in this published volume by including not only the delivered papers but also abstracts of most of the poster contributions displayed. One paper, originally invited but presented in poster form at the Symposium due to the author's commitments elsewhere, is also included now in full. Overall, the order of papers is, in places, slightly modified from that in which they were delivered, where this has helped maintain the flow of topics and ideas through this volume. We hope that these published proceedings will prove stimulating not only to those who attended, but also to many other botanists in other fields of research.

Gilbert White, in a letter written on 2 June 1779 and published in his *Natural History of Selbourne*, wrote:

> 'The standing objection to botany has always been that it is a pursuit that amuses the fancy and exercises the memory, without improving the mind or advancing any real knowledge, and where science is carried no further than a mere systematic classification, the charge is but too true. But the botanist that is desirous of wiping off this aspersion should be by no means content with a list of names; he should study plants philosophically, should investigate the laws of vegetation, should examine the powers and virtues of efficacious herbs, should promote their cultivation; and graft the gardener, the planter, and the husbandman, on the phytologist. Not that system is by any means to be thrown aside; without system the field of nature would be a pathetic wilderness: but system should be subservient to, not the main object of, pursuit.'

The 'standing objection' to the botany of Angiosperms has been gradually, and I think now totally, removed over the last few decades. Misconceptions about the botany of the pteridophytes have remained much longer. They should have been finally removed by these Proceedings.

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