

Editorial

The fiftieth anniversary meeting of the Phytochemical Society of Europe: Churchill College, Cambridge, 11–14 April 2007

Highlights in the Evolution of Phytochemistry

It is hard to define exactly when ‘phytochemistry’ as a scientific discipline came into being, but it was certainly more than 50 years ago. It is, however, just 50 years since the official creation of the *Phytochemical Society of Europe* (PSE), as the *Plant Phenolics Group* (PPG), which was formed during discussions in 1956¹ and came into being at a meeting in Cambridge on 9 April 1957.² The initial stimulus for the foundation of the PPG was a meeting held on 11 April 1956, at the Low Temperature Research Station (Cambridge) entitled *Hydroxy-aromatic Acids in Plants*. The report on this meeting in *Chemistry & Industry* (unsigned but undoubtedly penned by E.C. Bate-Smith) concluded “The interest aroused by this and other similar conferences held at intervals for several years has prompted the idea of some informal association of the nature of a ‘standing conference’ to cater for the rapidly-growing field of plant phenolics” (Anon., 1956). The “similar conferences” undoubtedly refers to such meetings as that held in Long Ashton in 1953, at which “...‘phenolics’ were christened and the foundation laid, although unwittingly, for the formation, five years later, of the Plant Phenolics Group.” (Bate-Smith, 1965).

The formative stages of the Phytochemistry Society of Europe

The driving force behind the formation of the PPG came from E.C. Bate-Smith and Tony Swain, both engaged at the Low Temperature Research Station in Cambridge, UK. These researchers were leading lights in the separation, structural elucidation and the taxonomic distribution of phenolic compounds. A proposal suggesting the membership of an organising committee was drawn up by E.C. Bate-Smith in a document dated 22 June 1956,² and

the provisional committee met for the first time on 30 November 1956.³ Shortly thereafter, an announcement appeared in *Nature* (Bate-Smith, 1957a) for the inaugural meeting of the *Plant Phenolics Group*, to be held in the Botany School, Cambridge at 11 am on 9 April 1957. This was well attended (74 inscriptions)⁴ and was followed by the first meeting, entitled *The Oxidation of Plant Phenolics* (Bate-Smith, 1957b). By the first Annual General Meeting (AGM) held a year later in Oxford, 10–11 April 1958, the PPG had already held two further meetings, setting the pattern of three meetings per year that has been followed ever since. The Oxford meeting on the *Pharmacology of Plant Phenolics* was the first to be published in book format (Fairbairn, 1959), also setting a trend that continued until 2003.⁵

A series of successful symposia followed and it was not long before the Group was discussing expanding its interest beyond only phenolic compounds. However, the minutes of the 6th AGM (2 April 1963)⁶ record that “...the majority of members present wish to retain the size and informality of the present Group structure rather than try to build a larger and more formal Society”. Thus, the resolution put forward by J.B. Harborne to change the name to *The Phytochemical Group* was defeated by lack of a two-thirds majority (15 votes for, 12 against), while an amendment proposed by H.E. Nursten to change the name to *The Phytochemical Society* was “heavily defeated”. But by the

¹ Letter from E.C. Bate-Smith 1956 (PSE Archives, Royal Botanic Gardens, Kew: fascicule No. SEC 1).

² E.C. Bate-Smith, 1956. L.T.R.S. Record paper No. 647, 22 June 1956 (PSE Archives, Royal Botanic Gardens, Kew: fascicule No. SEC 2).

³ Minutes 1st Provisional Committee Meeting, 30 November 1956 (PSE Archives, Royal Botanic Gardens, Kew: fascicule No. SEC 14).

⁴ List of members attending the inaugural meeting of the Plant Phenolics Group. (at 28.3.57) (PSE Archives, Royal Botanic Gardens, Kew: fascicule No. SEC 2).

⁵ A full list of the publications of the Proceedings is available at <http://www.phytochemicalsociety.org/pseproc.htm>.

⁶ Minutes 6th Annual General Meeting of the Plant Phenolics Group 2 April 1963 (PSE Archives, Royal Botanic Gardens, Kew: fascicule No. SEC 16).

next year resistance had faded and, following a successful motion put forward by J.B. Pridham and seconded by J.B. Harborne, the name *The Phytochemical Group* was adopted as of 1 May 1964.⁷

The Phytochemical Group was short-lived. At the 3rd AGM on 11 April 1967, the motion proposed by the Committee to adopt the name *The Phytochemical Society* was carried unanimously.⁸ Thus, when the 10th anniversary of the first annual general meeting was celebrated with a meeting in Cambridge (1–3 April 1968), the organisation had already undergone two name-changes. An account of the first ten years of the Society that summarizes key aspects of the advances in research into phenolics and the role of the PPG in promoting this research was published in *Nature* (Bate-Smith, 1965).

By now, there was increasing awareness of *The Phytochemical Society* from continental Europe, and at the 5th AGM on 27 March 1972 Professors C.F. van Sumere and M.H. Zenk were co-opted to the Committee “to represent the views of the European membership”.⁹ Adding this European dimension soon had its effect, but even though the first meeting held in Continental Europe on *The Chemistry and Biochemistry of Plant Proteins* was organised by Prof. van Sumere in Ghent in September 1973 (Harborne and van Sumere, 1975), it was not until an Extraordinary General Meeting in London held on 4 January 1977 and following a postal ballot of the members that *The Phytochemical Society of Europe* came into existence, there being 162 votes in favour of the change of name, 20 against and 1 abstention.^{10,11}

Thus, this year we celebrated both the original foundation of the *Plant Phenolics Group* in 1957 and the creation of *The Phytochemical Society of Europe* 20 years later in 1977.

The fiftieth anniversary meeting

To reflect on the advances in phytochemistry in 2007 is, in many ways an arbitrary decision, relating purely to the anniversary of the founding of one particular scientific group. The exploitation of plant products undoubtedly has occurred for thousands of years, well before the first

known records of herbalist activities, such as in the *Ebers Papyrus*, the *Rhizotomikon* and *De Materia Medica*, and can be inferred from, for example, traces of mixed compounds found in archaeological remains (Regert et al., 2003). Thus, a meeting such as that held in Churchill College, Cambridge, 11–14 April 2007 merely presents a snapshot of how a small number of people see the subject at a given moment in time. Nevertheless, it enabled us to reflect on how the subject had evolved since the foundation of the science, and to stand back and assess the health of the field of phytochemistry through a series of invited lectures by acknowledged experts in the different fields that make up the discipline. The meeting, of which this Special Issue forms the record, had an unashamedly European focus, since the dual aim was to celebrate the role played by the European phytochemical community and the PSE in particular in the development of the field. Therefore, even those speakers invited from ‘overseas’ (N.G. Lewis, R. Molyneux, P. Waterman, M.H. Zenk) are all of European origin. Furthermore, the speakers were not asked to present a classical overview of their theme, but rather to give a personal reflection on how it had evolved, what highlights led to this evolution and to speculate on how it might evolve in the future. Choosing whom to invite to speak was not an easy task, especially given the great wealth of expertise in phytochemistry present in Europe today. Three criteria were paramount: excellence in science; a role played in the organisation of the PSE; awardees of one of the Society’s prizes. Even with these constraints, the choice was not simple, and a meeting of two or three times the length of that organised would have been required to accommodate all the potential speakers.

The programme attempted both to cover those areas in which substantial advances had been made, as well as to present the role of the tools (NMR, MS, chromatography and molecular biology) that have played a critical role in changing the way in which the subject is studied. It is interesting to note that it was due to the skills in paper chromatography for the separation of phenolics developed by E.C. Bate-Smith and his colleagues in the early 1950s that both structural and taxonomic investigations of these compounds became possible (Grayer and Williams, 2007). The increased ease with which structural studies could be made by exploiting the rapidly-evolving and ever-more sophisticated spectroscopic methods of MS and NMR were illustrated in a number of talks, especial emphasis being put on the role these techniques played in defining biosynthetic routes when combined with stable-isotope labelling. The regulation of gene expression, a subject barely developed in plants in the 1950s, has progressed beyond all recognition, thanks to the tools developed for molecular biology. The power of this approach was also well illustrated, including the potential it has for the metabolic engineering of plants and the exciting potential thereby to create new products.

Inevitably, given the role of phenolic compounds in the early years of the Society, and the body of work in this area

⁷ Minutes 7th Annual General Meeting of the Plant Phenolics Group 13 April 1964 (PSE Archives, Royal Botanic Gardens, Kew: fascicule No. SEC 16).

⁸ Minutes 3rd Annual General Meeting of the Phytochemical Group 11 April 1967 (PSE Archives, Royal Botanic Gardens, Kew: fascicule No. SEC 16).

⁹ Minutes 5th Annual General Meeting of the Phytochemical Society 27 March 1972 (PSE Archives, Royal Botanic Gardens, Kew: fascicule No. TRES 50).

¹⁰ Minutes Extraordinary General Meeting of the Phytochemical Society 4 January 1977 (PSE Archives, Royal Botanic Gardens, Kew: fascicule No. TRES 51).

¹¹ Minutes, 10th Annual General Meeting of the Phytochemical Society, 5 April 1977 (PSE Archives, Royal Botanic Gardens, Kew: fascicule No. SEC 16).



Fig. 1. The 'Founding Fathers' of the Phytochemical Society of Europe. From left to right: Tony Swain (1922–1987), Jeffrey Harborne (1928–2002), E.C. Bate-Smith (1900–1989).

contributed by the 'Founding Fathers', this group of compounds featured heavily in the programme. Presentations ranged from personal reminiscences of these three 'giants' of European phytochemistry (Fig. 1), their scientific discoveries, how they influenced thinking and guided younger researchers, to the current status of phenolic compound research involving studies of enzymes and genetic regulation, and the numerous ways these compounds impact on human health and disease.

Throughout the meeting, a considerable number of presentations were grouped round the other vast group of plant products, the nitrogenous compounds. Talks covered early studies, noting that the alkaloid morphine (*'principium somniferum'*) was probably the first plant secondary product isolated and for which a distinct biological activity was recognised. As was nicely illustrated, following a long period of 'structure collecting', these complex molecules started to be grouped on the basis of common structural features and then predictions were made as to common aspects of their biosynthetic origin (Robinson, 1955), for which evidence was produced experimentally by labelling and by studying enzyme activities. Before long, the first genes were being identified and isolated, and alkaloid biochemistry entered the molecular age (Kutchan et al., 1988).

While a significant part of the meeting was devoted to studies of plant products *per se*, these were interwoven with investigations relating to their biological roles both *in planta* and as bioactive compounds exploited in various ways by mankind. One session was devoted to their usefulness in aiding the classification of plants, chemotaxonomy or chemosystematics – there was some debate on the semantics of these terms! Another covered ecological phytochemistry: the roles that different phytochemicals play in plant defence and communication, and how knowledge of, for example, the intervention of phytochemicals in plant–insect interactions might be exploited in biological crop protection strategies. How phytochemicals play a role in human

health formed another major theme of the meeting, the programme including talks covering modern approaches to the discovery of useful compounds, their action in disease control, and the perception of phytochemicals by the public in relation to food and diet.

The meeting concluded with a special session, in which three ex-Chairmen of the PSE were invited to give their own very personal views on the subject. The three invited speakers, Kurt Hostettmann (Chairman 1988–1990) Rob Verpoorte (Chairman 1994–1996) and Willi Alfermann (Chairman 1996–1998) – to put them in chronological order – are not only acknowledged as having each made substantial contributions to phytochemistry, but also have made especially important contributions to the PSE. All have been dedicated committee members, Chairmen and organisers of conferences. All have encouraged young scientists both as researchers and to be active in the PSE. This session was used as an occasion to recognise these exceptional contributions to the life of the PSE through the award to each of a Silver Medal of the PSE. The laudations that accompanied these presentations follow this Editorial.

But we must not forget to thank all those who are currently actively pushing phytochemistry forward on all its frontiers, and especially that small select group who attended the PSE50 anniversary meeting. Delegates were, predictably, strongly drawn from Europe, but there were representatives from all over the world, from 35 countries. A good meeting is created by the delegates and the thanks of the organising committee is extended to all of you who came and made this meeting so memorable. We thank too those speakers who gave of their time and, many of whom, have provided us with their thoughts in written form to publish in the present record of the meeting.

It is always difficult to speculate what developments will occur over a 50 year period, or even over 10 years. Who would have imagined in 1957 that by 2007 the manipulation of genes at the level of DNA would be routine? Or, that the fledgling technique of NMR would have reached its present level of sophistication (Slichter, 1998)? It is hard to imagine that further fundamental concepts of analytical methodology will be invented, but it is evident that those tools that are currently available can still be further improved. There is an ever-increasing demand for greater sensitivity, selectivity and speed in analysis. The trend in chromatography and separation science is towards the faster analysis of smaller quantities of sample. Despite the recent advances in the development of new stationary phases, these are unlikely to give the broadness in applicability for so many different classes of natural products for analytical and preparative needs. Consequently, development of other high-resolution separation methods which rely on physical properties such as solubility may become increasingly important. An example where this might occur is in the technique of high-resolution partition chromatography, which will benefit from tightly controlled and accurate variation of solvent composition and temperature. Combined with coupled spectral techniques, such improvements in

separation will make possible not only the investigation of the rapidly disappearing flora around us but will also allow study of precious items such as herbarium collections, unique specimens and microscopic organisms.

Improved analytical tools will simplify the solution of structural problems of thousands of metabolites, and help in establishing general rules of structure/function relationships. It is likely that full structure elucidation of components on extracts will be possible by acquiring 2D and 3D NMR datasets on the extracts themselves and the datasets can then be mathematically filtered to give spectral information on pure compounds, even when these are very minor metabolites. The analysis of metabolites in single cells is not beyond our imagination.

Understanding how cells and organisms communicate, at both the intra- and extra-cellular levels is still in its infancy. An enhanced ability to look deeper at the interrelationships between metabolites and the fluxes that influence their levels will aid in unravelling the complexity of the biochemical processes and may, ultimately, make possible ‘designer cells’ of an entirely composite nature. At the least, it will enable genetic modification to be targeted in a much more precise way than is currently possible.

Research will continue to be driven by those sectors which exploited plants for the benefit of mankind – as raw materials, as food and as a source of bioactive agents. With the increasing demands of the world population and the higher efficiency of plant production over animal production, plants are likely to play a more and more important role as product sources. Thus, a deeper understanding of phytochemistry can be considered as fundamental to the future wellbeing of the planet.

Nonetheless, to some extent what develops over the next 50 years will be the icing on the cake. The cake itself – the fundamentals of plant metabolism and physiology, of plant product biosynthesis and the regulation thereof, and of the bioactivity of plant products – has been put in place. Many of those at the meeting in Cambridge can look back over these years and feel proud to have played a significant role in creating this core knowledge. Others will be taking it forward in ways that may yet to be conceived.

As already mentioned, three people (Fig. 1) played an especially important role in the early propagation of phytochemistry in Europe and in establishing the PSE and *Phytochemistry*: E.C. Bate-Smith (Harborne, 1989), Tony Swain (Harborne, 1988) and Jeffrey Harborne (Bell, 2002). Sadly, none of them lived long enough to be present in person, but their role was recognised in a special session on the ‘Founding Fathers’. Of these three, Jeffrey Harborne was the youngest; he remained in Europe; he edited *Phytochemistry* for nearly 40 years. Consequently, of the three he made the largest contribution to phytochemistry in Europe over the 50 years being covered in this Special Issue. Jeffrey not only made an outstanding personal contribution to the discipline but also was extremely active in the promotion of this research field in teaching, editing and publishing. We have therefore invited two of his for-

mer close colleagues, Renée Grayer (now of the Royal Botanic Gardens, Kew, UK) and Christine Williams (of Jeffrey’s former Group at the Plant Science Laboratories, Reading, UK), to prepare an extended overview of the contribution made by Jeffrey Harborne to phytochemistry.

The Phytochemical Society of Europe and *Phytochemistry*

This meeting was greatly aided organisationally and financially by the support it received from Elsevier through Dr. James Milne (Publisher – Organic & Inorganic Chemistry, Elsevier UK) of the journal *Phytochemistry*. Although these two European organs for phytochemistry – the Society and the journal – have much history in common, the latter has never been, sadly, a publication of the Society and it is perhaps pertinent to use this opportunity to clarify the origin of this situation. *Phytochemistry* is a few years younger than the PSE, volume 1 issue 1 having appeared in October 1961. As early as 1958, Robert Maxwell of Pergamon Press had approached the PPG with the proposition that publishing the Proceedings of the meeting be entrusted to Pergamon.¹² Although the first Proceedings were published by Academic Press (Fairbairn, 1959), Pergamon did publish the second Proceedings (Pridham, 1960) and these publishers shared the series over the next ten years.

The initiative to instigate a new journal in plant chemistry and biochemistry came from Robert Maxwell at Pergamon Press,¹³ who naturally approached the Committee of the fledgling Plant Phenolics Group for advice as to the contents and suggestions for an executive editor. The Committee had already debated at length the difficulties associated with publishing phytochemical work. At the 8th Committee meeting on 29 June 1959,¹⁴ Dr. Ollis presented a paper outlining the problems involved in publishing plant biochemists papers. The Chairman (E.C. Bate-Smith) expressed his view “...that three main complaints could be made against [the current] journals. That papers in plant biochemistry were: (1) rejected, (2) mutilated and (3) unduly shortened.” Amongst the options proposed was to suggest that ‘*and Plant Biochemistry*’ be added to the title of the *Journal of Experimental Botany* (this suggestion was turned down by the Editors). Tony Swain asked “...whether Pergamon should be approached regarding the possibility of starting a “Journal of Plant Biochemistry””, but it was agreed that it would be “undesirable to encourage starting a new journal if other ways and means could be found.”

¹² Maxwell, R., 1956 Letter requesting that the “Proceedings are entrusted to Pergamon Press for publication” (signed by Secretary) (1956) (PSE Archives, Royal Botanic Gardens, Kew: fascicule No. SEC 8).

¹³ Minutes, 3rd Annual General Meeting of the Plant Phenolics Group, 21 April 1960 (PSE Archives, Royal Botanic Gardens, Kew: fascicule No. SEC 16).

¹⁴ Minutes, 8th Committee Meeting of the Plant Phenolics Group 29 June 1959 (PSE Archives, Royal Botanic Gardens, Kew: fascicule No. SEC 17-35).

The results of the referendum on *Phytochemistry* were as follows:–

1.	Agreeing to need for new journal	26
	Against	13
2.	Would publish in the journal	28
	Would not	11
3.	If it is published	
a)	Think PPG should actively be involved	24
	Think not	13
b)	Think Member of PPG should be on Editorial Board	32
	Think not	6
c)	Think PPG name should be used	22
	Think not	17

A total of 40 ballot papers were received. Other comments can be made later.

Fig. 2. Appendix B to the Minutes of the 4th AGM on 11 April 1961, showing the views of the membership towards the projected publication of *Phytochemistry*.

The debate continued at the 9th Committee on 25 September 1959.¹⁵ The Chairman (E.C. Bate-Smith) pointed out that if Pergamon did not start a journal to cater to plant biochemists, it was quite likely that someone else, for example Springer-Verlag, might. He continued "...that it would be better if such a journal were controlled by an Editorial Board which the group had some hand in nominating". However, the concept received minimal support, being seen as too costly ("...Tetrahedron published by Pergamon cost 40 times the J. Chem. Soc. taking into account the number of words per page...") and unnecessary ("...there were already too many [journals] to read").

Despite these reservations, and as it was clear that Pergamon was to go ahead with a new journal, their invitation to Tony Swain to act as executive editor was accepted, as recorded in the minutes of the 10th committee meeting "...Pergamon Press...had now written to Dr. Swain inviting him to act. Dr. Swain had agreed to do so for a limited time, and Dr. Bate-Smith suggested that an account of the committee's discussions on the subject be presented to the A.G.M."¹⁶ The debate was opened to the members at the 3rd AGM, in April 1960. The Chairman informed the members "...that the Committee had learnt that Pergamon Press intended to start a new journal on plant chemistry and biochemistry. The Press had approached himself and Dr. Swain for advice as to the content and suggestions for an executive editor. After consulting with the Committee this advice had been given and the name "Phytochemistry" suggested as a title.... The Press had invited Dr. Swain to act for a limited time [as editor], and had sug-

gested that a representative of the Group should act on the Editorial Board. The Committee had tentatively agreed with this latter suggestion." The Chairman went on to seek the views of the members. A critical and heated discussion ensued in which costs, the need for another journal, the risk that "...Pergamon Press would accept papers for publication merely to swell the size..." (Prof. W. Baker), and the ease of publishing elsewhere were all raised (Fig. 2). The Chairman concluded that a referendum should be sent to members to solicit their views.¹³ Nevertheless, the Committee continued with the project, and the minutes of the 13th Committee meeting prepared by the Hon. Secretary (T. Swain) record that "...a formative committee composed of Profs. T.W. Godwin, R. Brown, M. Thomas Dr. E.C. Bate-Smith, Mr. W.C. Kenneison (of Pergamon Press) and himself would be meeting to discuss the starting of 'Phytochemistry'".¹⁷

The results of the referendum on *Phytochemistry* were presented to the 4th AGM in April 1961 "...which supported the Committees discussion regarding appointment of a member of the Group to the Editorial Board. Dr Friend raised the question as to whether the Member appointed would be named as such in the journal, after discussion it was decided that he should not be".¹⁸ This conclusion, which meant that the opportunity for the PPG to be closely associated with *Phytochemistry* was lost, is hard to understand in view of the actual results of the ballot (Fig. 2), which indicate that the PPG should be actively involved in the publication.

¹⁵ Minutes, 9th Committee Meeting of the Plant Phenolics Group 25 September 1959 (PSE Archives, Royal Botanic Gardens, Kew: fascicule No. SEC 17-35).

¹⁶ Minutes, 10th Committee Meeting of the Plant Phenolics Group 16 December 1959 (PSE Archives, Royal Botanic Gardens, Kew: fascicule No. SEC 17-35).

¹⁷ Minutes, 13th Committee Meeting of the Plant Phenolics Group 7 July 1960 (PSE Archives, Royal Botanic Gardens, Kew: fascicule No. SEC 17-35).

¹⁸ Minutes, 4th Annual General Meeting of the Plant Phenolics Group, 11 April 1961 (PSE Archives, Royal Botanic Gardens, Kew: fascicule No. SEC 16).

It was not until September 1980 that *Phytochemistry* became designated as the official organ of the Society.¹⁹ It gives us great pleasure that the presentations made to the fiftieth anniversary meeting should appear in the format of a special issue of *Phytochemistry* and the editors very much appreciate the help of the UK-based office in the production of this landmark issue.

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Dr Andrew Marston was born in Zambia (1953). He studied chemistry at University College London and obtained a PhD in the Department of Organic Chemistry at Liverpool University, UK. He was then awarded a Royal Society/NATO fellowship to perform postdoctoral research on plant-derived tumour promoters at the German Cancer Research Centre in Heidelberg. He is now a senior research scientist in the group of Professor Kurt Hostettmann, working in the fields of pharmacognosy and phytochemistry. This group, originally situated in the University of Lausanne, has recently moved to the Section of Pharmaceutical Sciences of Geneva University, Switzerland.

Andrew Marston is involved in the teaching of pharmacy students and his research includes the study of active principles from plants used in traditional medicine, with special interests in preparative chromatographic separation techniques, saponins and benchtop bioassays. He is author of 170 scientific publications and co-author of several books.

His distinctions include the Rhône-Poulenc Rorer Award of the Phytochemical Society of Europe (1994). He has been involved in organising meetings on behalf of the PSE and was a member of the committee from 1995–1998.



Dr Richard J. Robins is a Director of Research at the CNRS Laboratory for Isotopic Analysis of Metabolism at the University of Nantes, France. He studied at Oxford University, first for a BA in Biochemistry (1975) and then for a DPhil in Natural Sciences (1978). After a period at the Institute of Food Research (Norwich, UK), he moved to France in 1995. His work has focussed on unravelling metabolic pathways, mostly in plant secondary metabolism, notably by the exploitation of stable isotope techniques. His current interest is in relating enzyme

mechanisms to natural isotopic fractionation.

From 1995–1999 he was Head of the CNRS-associated Research Unit in Nantes, and since then has devoted his time to researching isotope effects in natural products, organising conferences and directing his research group. He was founding Editor of the journal *Transgenic*

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¹⁹ Brown, E.G., 1980, Letter to J.D. Phillipson 12 September 1980 (PSE Archives, Royal Botanic Gardens, Kew: fascicule No. SEC 36).