

PHCOG MAG.: Reports Classical Botanical Pharmacognosy Workshop Summary Report: A Historic Event

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As most American society of Pharmacognosy (ASP) members know, last year's annual ASP symposium held in Phoenix, AZ, USA, included a workshop that focused on the challenges associated with preserving classical techniques of botanical pharmacognosy. From the perspectives of the organizers and feedback from many of more than 150 attendees, the event was a great success and highlighted the importance of classical pharmacognosy techniques for assuring the authenticity and quality of traditional and modern drugs derived from medicinal plants. Some of the pre-eminent pharmacognosists in the Western world participated in this historic event. Hopefully this will serve as a springboard for future events and initiatives so that training in the classical techniques of pharmacognosy will be maintained in academia and utilized by manufacturers and researchers of both traditional and modern drugs. Following are some highlights from the presentations.

The Ebb and Flow of Pharmacognosy: A Historical Perspective

The early development of pharmacognosy as a formal discipline was presented by Professor Wolfgang Kubelka, University of Vienna, beginning with the coining of the term "pharmacognosis" in the *Lehrbuch der Materia Medica* of Johann Adam Schmidt in 1811. This was followed by the formal use of the term pharmacognosy in a thesis of C.A. Seydler (1815). Numerous early herbals were presented as examples of early pharmacognostic works, including those of Bock, Brunfels, Dioscorides, and Matthioli; these works served as primary references for the identification, actions, and applications of virtually thousands of medicines, most of which were derived from higher plants at the time.

As highlighted by Professor Kubelka, pharmacognosy has experienced many fluctuations throughout the past 100 plus years. In the early 1800s pharmacognosy was described by Schleiden as "the mother of all disciplines of the natural sciences", while in the *Lehrbuch der Pharmakognosie* (1888) of Mueller it was reported that "pharmacognosy has fallen sleep". In more contemporary times, Professor Geoffrey Cordell reported in the *American Druggist* (1987) that "Pharmacognosy is far from dead. It has survived a long, cold winter and is awakening as the most high-tech pharmaceutical sciences." Professor Kubelka provided examples of the changing face of pharmacognosy in numerous advances in medicine from the early use of modern drugs, such as squill (*Urginea maritima*), the identification of digitalis by Withering (1785) as the active compound in a traditional herbal formula used by a Scottish herbalist, and the isolation of morphine from the opium poppy

(*Papaver somnifera*) by Sertürner in 1805, to the development of taxol from the Pacific yew (*Taxus brevifolia*). Also relevant to the evolution of pharmacognosy is the evolution of drugs; early drugs were primarily based on whole natural product preparations, whereas drug development in the last century has followed the steady progression of chemical isolation, structural elucidation, and development of single agent chemotherapeutics.

The decline of pharmacognosy in the US was outlined by UIC (University of Illinois, Chicago) distinguished professor of pharmacognosy, Norman Farnsworth. According to Farnsworth, pharmacognosy was included in the curriculum of every pharmacy school in the U.S. until the late 1940s and has often been considered as "pharmacy's unique contribution to science." Historically, pharmacognosy was described as a "descriptive" science primarily focused on the identification of plant materials used in drug development. At the time, the primary focus was on botanical, macroscopic, and microscopic characterization of crude drug plants, disciplines typically dropped from today's pharmacy/pharmacognosy curricula, along with information regarding their collection and processing. Botany, Vegetable Histology, *Materia Medica*, and microscopy were a part of the curriculum of early pharmacists and were required throughout their 3 years of study. Over time, the scope of pharmacognosy evolved, with Flueckiger (1879) stating "pharmacognosy is the simultaneous application of various scientific disciplines with the object of acquiring knowledge of drugs from every point of view. "This view was echoed in 1929 by professor of pharmacognosy Richard Wasicky who noted, "Pharmacognosy is a biologic and experimental science, not only microscopic, but chemical, chromatographic, and biologic methods in addition"

The continued development of modern pharmacognosy paralleled the evolution of modern drug discovery. As emphasis shifted from the botanical to the chemical aspects of drugs, so did the focus of the pharmacognosist, relating more closely to natural products chemistry than pharmacy. The development of sophisticated analytical methodologies along with the isolation, structural elucidation, and synthesis of compounds caused the techniques of classical botanical pharmacognosy to lose their importance. Simultaneously, pharmacognosy programs were dropped from the training of pharmacists or were transformed into more specialized disciplines such as "medicinal chemistry" or "pharmaceutical biology". In many cases, the classic botanical techniques of pharmacognosy were completely eliminated. Thus, we see the underpinnings

of an identity crisis in the field of pharmacognosy that has persisted from the beginning of pharmacognosy to the present day. Professor Farnsworth predicted that we would never see the return of pharmacognosy in the training of pharmacists, which raises the question--where will pharmacognosy live in academia?

Renewed Interest in Classical Botanical Pharmacognosy

Worldwide there has been resurgence in the use of traditional herbal drugs and, similarly, a growing interest in scientific investigations of their clinical efficacy and safety. Pharmacognosy, with all of its tools and expertise, plays an integral role in this process, not only for ensuring the authenticity, purity, and consistency of the materials being used and investigated, but also for developing biological models for determining efficacy, historically the domain of the pharmacologist.

As pointed out by Prof. Sabine Glasl, many plants share a similar constituent profile. In many cases, chemistry alone may not be able to discern the identity of the plant to species, at least not in the practical, time-efficient, and cost-effective manner needed for industry. Professor Glasl provided numerous examples wherein the combination of macroscopic and/or microscopic botanical characterization with thin layer chromatography (TLC) is optimal and, in some cases, superior to more sophisticated chemical analysis alone. She emphasized that old techniques are not necessarily inferior and may in fact be superior to more modern techniques in speed, cost, and efficiency. It has become clear in the evaluation of botanicals used in the development of supplements and modern drugs that authenticity must be determined using a combination of both physical and chemical tests. While often considered an outdated modality, TLC continues to be used effectively worldwide in the quality and identity assessment of plants.

As a counter-point to Professor Farnsworth's perspective, Professor Hildebert Wagner of Munich made a note that paradigm shifts occurring in modern medicine, moving from mono-drug to multi-drug therapies, support a revival of pharmacognosy in the pharmacy curriculum. It has repeatedly been shown that the medicinal activity of many plants is due not to a single constituent or action, but to the myriad of compounds contained within and multiple actions elicited by the botanical. Prof. Wagner suggested that, as modern medicine learns that multi-targeted therapies are more efficacious and oftentimes safer than mono therapies, multi-component herbal drugs might prove to be therapeutically equivalent or superior to individual compounds. Several examples of this were provided, with suggestions for future directions in pharmacognosy to be focused on the multi-component standardization of botanical preparations, elucidation of the total pharmacological profile of botanical using new molecular-biological assays, and the subsequent development of safe and effective plant-based drugs.

Industry Perspectives

Industry perspectives regarding the importance of pharmacognosy to the medicinal plant trade were discussed; it was emphasized that the quality of

medicinal plant products is dependent upon the authenticity, growing, harvest, processing, and storage conditions. It was pointed out that companies must utilize the tools of classical and modern pharmacognosy to appropriately select the plant to be used in the development and regulatory approval of both traditional and modern botanical drugs. This is equally apparent with traditional herbal medicine regulatory models currently in use throughout the European Union and Canada. Training in the complete repertoire of tools and techniques of pharmacognosy, from physical to chemical analysis, is critical in addressing these challenges. The potential for new drug discovery through biological screening of natural products was discussed, as was the need to integrate the knowledge and skills of classical botanical pharmacognosy with the biological assessment of herbal drugs that are the subject of clinical trials.

Botanical Pharmacognosy--The Future?

In an attempt to bring closure to the day's discussions a number of breakout sessions were held to advance ideas for how botanical pharmacognosy would be preserved. Topics of discussion included *Educational Needs*, *Research Tools and Training*, and *Role in Clinical Research & Standard Setting*.

It is clear that the skills and multiple tools of pharmacognosy are needed in the development of modern and traditional drugs derived from natural products. What is not clear is where and how pharmacognosy should reside academically. Some thought that perhaps specialization in botanical pharmacognosy should occur as post-graduate training rather than at the graduate level. However, those who felt that some of the basic skills of botanical quality control were needed at the undergraduate level, offering a better avenue to career paths in the botanical products industry or botanical medicine research, countered this.

Regarding clinical needs, it is clear that those conducting botanical medicine research need to have accurately characterized the products being studied in order to foster experimental reproducibility. This has been highlighted by the National Centre for Complementary and Alternative Medicine (NCCAM), which requires these potential recipients of NCCAM funds. Similar requirements should be made as journals reporting on botanical medicine studies, so that similarly reproducible experiments may be conducted and so an accurate assessment of the findings of the study can be made. Such requirements already exist at the *Journal of Natural Products*, *Pharmacognosy Magazine*, and *Planta Medica*.

Regarding research tools and training, it was noted that students are not aware that industry needs include the development and validation of analytical methods for the measurement of marker compounds in herbal ingredients and products. Neither are they aware that the development of simple biological assays can be of great benefit to supplement companies wanting to validate some level of safety and efficacy of their products. It could also be said that most of the industry is not aware of the valuable roles pharmacognosists can play in both of these areas. A potential solution for this mutual lack of understanding was the development of

industry internships that could be used to orient students to industry needs. This would make them more marketable to industry and would be potentially grantable. Additionally it was noted that industry has a lot of experience to offer to those academic institutes with a consistent interest in the study of botanical products.

Lastly, the tools of botanical pharmacognosy are integral to the development of quality control, regulatory, and pharmacopoeia standards. Compliance with national and international standards requires both physical and chemical characterization of botanicals; in many cases neither will suffice alone. The conclusion of the participants in these forums was "there was not enough time!"

Conclusion

There is no doubt about the value of the modern pharmacognosist in the development of modern drugs and herbal products and the continued evolution of molecular biology. However, the resurgence in the use of traditional herbal drugs worldwide suggests a need for preservation and continued training in the classic techniques, whereby the physical tests of early pharmacognosists can be coupled with the chemical sophistication of modern pharmacognosy and biological screening methodologies. The primary question raised in this forum was not whether the tools of classical pharmacognosy have value (clearly they do), but rather how will the classic tools of botanical pharmacognosy be maintained and in what academic curriculum will these reside; botany, biology, chemistry, nutritional sciences, herbal medicine, pharmacognosy? For now, this remains a question with many potential answers; hopefully, this symposium laid the foundation for further exploration of this important issue. Perhaps the most fitting summary for this report is the following, written by Thomas Edward Wallis, author of *Textbook of Pharmacognosy* (1946) in a letter to professor of pharmacognosy E.J. Shellard in 1956:

"Pharmacognosy is the most liberal and humanistic of all pharmaceutical studies and should be preserved at all costs. Emphasis is changing but that does not mean that the subject is disappearing."

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