PSNA NEWS

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PRESIDENT'S LETTER

A Preview of the 2002 Annual Meeting in Mérida, México

The evolution of research in phytochemistry illustrates the challenges and opportunities facing plant biology in the next decade. Phytochemistry has been traditionally based on natural product research, from structure determination and cataloguing to establishing biosynthetic relationships, biological activity determination and, to some extent, ecological and evolutionary correlations. As contemporary biochemical and molecular techniques have become routine in the plant biologist's toolbox, they have been incorporated in phytochemical research, to the extent that today it is impossible to conceive of cutting-edge research in phytochemistry without a strong biochemical and molecular foundation. Phytochemistry is, in fact, plant biochemistry although some of the classical plant natural product researchers may not entirely agree. Understanding the biochemical, molecular and evolutionary bases of plant biochemical diversity is, in my opinion, one of the most challenging and exciting areas of contemporary plant biology. This wonderful opportunity is, to some extent, reflected on the increasing visibility of plant biochemical research in the more prominent plant biology journals. What is apparent from these recent examples is that, like every other area of plant biology, phytochemistry will become interdependent with the genomics and post-genomics "revolution".

The last two annual meetings of the PSNA reflect the recognition that molecular and genomic approaches will become every day tools in phytochemical research. The 2000 annual meeting in Beltsville, Maryland was held on the theme of "Regulation of Phytochemicals by Molecular Techniques", and the 2001 annual meeting in Oklahoma City focused on the topic of "Phytochemistry in the Genomics and Post-Genomics Eras". While emphasis on molecular and genomics aspects is important, we also believe that for plant biochemical research to continue to be relevant to plant biology in the future, it must become integrated with other disciplines and also global in scope. This is precisely the rationale for the 2002 annual meeting in Mérida, México. We are bringing together an excellent group of both young and senior speakers that will cover the latest information on the biology of four important groups of plant secondary metabolites in a truly integrative fashion. For each of these groups (alkaloids, terpenoids, phenolics, and glucosinolates) we expect that the plenary speakers and symposium speakers will cover the chemistry, biochemistry, enzymology, genomics where information is available, and ecological chemistry or molecular ecology. Phytochemical research is rather unique among plant biology subdisciplines in that it encompasses a dimension that brings together biology, cultural anthropology and other social sciences. Much of what we know about plant chemistry actually dates back to plant-peo-

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PSNA
Annual Meeting

Integrative Phytochemistry: From Ethnobotany to Molecular Ecology

July 20 - 24, 2002

Mérida, México

The Phytochemical Society of North America (PSNA) is a nonprofit scientific organization whose membership is open to anyone with an interest in phytochemistry and the role of plant substances in related fields. Annual membership dues are U.S. $40 for regular members and $20 for student members. Annual meetings featuring symposium topics of current interest and contributed papers by conference participants are held throughout the United States, Canada, and Mexico. PSNA meetings provide participants with exposure to the cutting-edge research of prominent international scientists, but are still small enough to offer informality and intimacy that are conducive to the exchange of ideas. This newsletter is circulated to members to keep them informed of upcoming meetings and developments within the society, and to provide a forum for the exchange of information and ideas. If you would like additional information about the PSNA, or if you have material that you would like included in the newsletter, please contact the PSNA Secretary and Newsletter Editor. Annual dues and changes of address should be sent to the PSNA Treasurer. Also check the PSNA website at www.psna-online.org for regular updates.

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PHYTOCHEMICAL PIONEERS

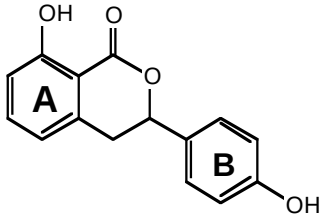
Ragai Ibrahim

A 40-Year Journey in Plant Biochemistry

Looking back over the path of my scientific life of the past 40 years, I recall quite vividly the first turning point in my professional career, after having finished an MSc degree at the University of Alexandria, Egypt, when I came to McGill University more than 40 years ago on a World University Service (WUS) fellowship to study for my PhD degree. It was exactly on Nov 18, 1958 - a Saturday - when I arrived at the Montreal airport and was met by the WUS representative who drove me to the university campus. I walked the corridor of the Botany Department to find an elegant young professor, Neil Towers, caressing a pipe between his lips, while spotting a paper chromatogram on a bench near the entrance of his lab. He quickly determined that I was looking for a supervisor and proposed that I do work on plant phenolics, a novelty at the time. Neil was not disappointed to learn that I had already had a research project to pursue - the biogenesis of the C-N linkage in cyanogenic glycosides. However, I had to abandon that project a few months later, after completing the search for the pertinent methods, when I came across a recent abstract describing the biosynthesis of dhurrin in sorghum by Eric Conn. It was the first, but not the last, time I recognized that name!

I had no regret returning to phenolics and quickly made some original contributions in that new field of research, one of which was the biosynthesis of hydroxybenzoic acids which was published in Nature in 1959 - my first and only paper in this prestigeous journal. This article drew considerable attention from mammalian biochemists, leading to some 300 reprint requests, a hefty number at the time, because it dealt with salicylic, gentisic and *o*-pyrocatechuic acids as plant metabolites, also found in human urine. I isolated and identified the latter acid, for the first time, from the oil of Wintergreen (*Gaultheria procumbens*, Ericaceae), a plant used in folk medicine that we found in the woods of Mount Royal. This work also led to a publication describing the separation and identification by paper chromatography (PC) of plant phenolic acids, which became the hallmark of "Ibrahim and Towers" for a long time. This paper probably encouraged many of the early surveys on phenolic acids by plant scientists, as it drew 185 citations during the time that PC was a popular, and probably the only, separation technique.

The contribution that I was most proud of was resolving the biosynthesis of the phenylisocoumarin, hydrangenol in *Hydrangea macrophylla* roots. It turned out that it incorporates the intact carbon skeleton of a C_6-C_3 precursor into ring B and the 3-carbon side chain, together with three acetate units into the rest of hydrangenol except that, unlike flavonoids, the third acetate unit results in a branched/distorted ring A. This work required the use of various specifically-labeled precursors and high levels of isotope incorporation, since the labeled hydrangenol had to be cleaved to its component rings in order to account for each labeled carbon atom. Resolving this problem would not have been possible without Eric Conn's generous gift of a couple of ^{14}C-labeled compounds that were not commercially available at the time. Following the publication of the preliminary results, I received a letter of encouragement from the late Ted Geissman of UCLA, who was trying to make sure that I could tackle the biogenesis of this molecule. The fact that most of the label of phenylpropanoid precursors was incorporated into the coumarin, umbelliferone and another related compound led to the isolation and identification of a new coumarin derivative, 7-OH-8-OMe-coumarin which we named hydrangetin. This work resulted in three more publications which appeared in 1960-62. In retrospect, it is amazing to realize just how much good science could be achieved with the few primitive techniques available at the time: crystallization, m.p., elemental analysis, UV and IR spectra for structure determination, and the low-sensitivity Geiger-tube for counting radioactivity on paper chromatograms, to the most elaborate technique of combusting labeled compounds to $^{14}CO_2$ and counting the gas in an ion chamber. But these were the 'gold-



Phenylisocoumarin, hydragenol

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rush' days when only a few labs were occupied with the biogenesis of phenolic compounds - Art Neish at NRC, Saskatoon (flavonols), Neil Towers at McGill (dihydrochalcones), and Hans Grisebach in Freiburg, Germany (anthocyanidins), to mention a few.

Working with Neil was a lot of fun, since we had only a few years difference in age, both enjoyed smoking the pipe and having a few beers once in a while. We got along very well, in spite of the rumors and jokes he used to circulate on my successes with women in the lab (as a bachelor at the time). One of these jokes suggested that I was caught holding the hand of a pretty graduate student, and when Neil asked me what I was doing, I said I was just admiring her watch! One of the extracurricular activities in Neil's lab, reserved for experienced students, was to 'biosynthesize' around Christmas time a potent concoction of an alcoholic, herb-spice-orange peel-based liquor, from a recipe claimed to be derived from the Benedictine Monks. That sublime liquid was used to stimulate original scientific ideas and help animate the working environment. However, I did not realize at the time what a privilege it was to work with a guy who later became a Gold Medalist of the Canadian Society of Plant Physiologists, a Fellow of the Royal Society of Canada and, more recently, the winner of the 2000 Pergamon Prize!

I missed the opportunity of doing postdoctoral work in Canada or the U.S., since I had to return to Alexandria at the end of my leave of absence to assume the position of Lecturer in the Faculty of Science, a period that was characterized by the lack of research funds and facilities in addition to a heavy teaching load. However, my return to Canada in 1966 (after experiencing a few adventures!) marked the second turning point in my career when I joined Sir George Williams University in Montreal (later to become Concordia University in 1974 after a merger with Loyola College). With the inception of a Biology MSc program, which I helped to develop, it allowed me to train a few graduate students in a variety of research projects that produced good, publishable results - a period that was marked by a good deal of 'soul-searching' to select a niche that I could develop into a long-term research program. My first sabbatical leave was spent in Hans Grisebach's laboratory in Freiburg, Germany, a beautiful city bordering France and Switzerland, and combining the best gastronomy of the three countries. This stint allowed me to interact with a wonderful group of scientists, including Klaus Hahlbrock, Ulrich Matern, Joe Schröder, Dirk Scheel, Heinrich Sandermann and to meet Jonathan Poulton who was a postdoc with Professor Grisebach at the time. It also gave me the opportunity to purify and characterize, for the first time, the coniferyl alcohol glucosyl-transferase from rose cell cultures and demonstrate its common occurrence in plants.

My appointment in 1980 as an adjunct professor in the Department of Chemistry and Biochemistry at Concordia marked another turning point in my career, as it gave me access to PhD students and allowed me to launch a viable research program. Due to the efforts of a number of dedicated graduate students, who are currently prominent faculty members and senior scientists in the pharmaceutical industry, we were able to make several original contributions to our knowledge of the later reactions in flavonoid biochemistry. Some of these included the discovery of a number of novel, substrate-specific and position-oriented methyltransferases and glucosyltransferases and their ordained sequence in polymethylated flavonol (PMF) glucoside synthesis; resolution of the flavonol 2'- and 5'-*O*-glucosyltransferases using monoclonal antibodies; the localization of PMF glu-cosides by immunofluorescence and immunogold labeling techniques and, more recently, the cloning of genes encoding a number of these enzymes. We also delved into the enormous variety of prenylated isoflavones in lupin roots - having been encouraged by a collaboration with Satoshi Tahara of Hokkaido University - and demonstrated their role as phytoanticipins of germinating lupin, as well as the substrate specificity of lupin root prenyltransferases. This work led to the discovery that lupiwighteone, a mono-prenylated isoflavone together with a C_4 sugar acid, erythronic/tetronic acid, act as molecular signals in Rhizobium-Lupinus symbiosis.

It was Barbara Timmermann of the University of Arizona who drew my attention, during one of the PSNA meetings, to the ubiquity of flavonoid sulfation in plants, that led us to synthesize some 40 different sulfated flavonoids and allowed the characterization of four, position-specific sulfotransferases (STs) in *Flaveria bidentis* (Asteraceae), and determination of the sequence of sulfation in polysulfated compounds. This was followed by the cloning of two (flavonol 3- and 4'-STs) of their genes, and the study of the structure-function relationships that determine their position specificity. Work on sulfotransferases drew much interest from mammalian biochemists and pharmacologists who were interested in phenolic and steroid sulfation as mechanisms involved in xenobiotic detoxification and steroid hormone regulation and, for the first time, plant biochemists were ahead of their animal counterparts.

These were the 'heydays' that marked the peak of my research career and resulted in more than 170 refereed publications, 40 review articles and book chapters, as well as the training of some 30 graduate students and research associates, to whom I am very grateful and proud of their asso-

Ragai Ibrahim

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ciation and continuing relationship. Since my retirement from teaching in 1997, I have focused my research efforts on the methyltransferases, which are hard to remove from under my skin, and their potential use in the metabolic engineering of flavonoid methylation in target plants. This just sums up some of the highlights of my 40-year journey in plant biochemistry, and I hope that my successes have far outweighed my failures - I wish you the same in your career!

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President's Letter

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ple interactions in hunter-gathering societies, early agriculturists and early medicinal traditions. In fact, ethnobotanical research came of age when botany and chemistry merged to become the first generation of bioprospecting work a few decades ago. Unfortunately, with very few exceptions (such as the 1996 annual meeting on "Functionality of Food Phytochemicals" in New Orleans) ethnobotanical contributions have been virtually absent from our meetings. We believe that a plant biochemical meeting that attempts to highlight the continuum from traditional knowledge on plant chemistry through our emerging knowledge of molecular genetics will stimulate much needed dialogue between various levels of inquiry and, hopefully, lead to new collaborations.

We plan on integrating several disciplines in each of the sessions at the 2002 meeting in Mérida. I would like to highlight some of the speakers, topics and unique aspects of this meeting. Eloy Rodriguez, James A. Perkins Professor of Plant Biology at Cornell, has kindly agreed to be our opening keynote speaker for the meeting. Eloy has a distinguished career as a phytochemist and is a very charismatic and engaging speaker. Among his notable recent contributions has been his work on the interface of ecology and phytochemistry suggesting that many species of animals are able to use plants as "medicine". Eloy is also an inspiring role model for minority students and has spearheaded both at Texas and at Cornell, numerous initiatives to encourage students from underrepresented groups to pursue a career in biology. We know very few people who are as committed as Eloy to both innovative research and the development of human resources in the sciences.

Richard Dixon, Director of the Noble Foundation Plant Biology laboratory in Ardmore, Oklahoma will chair the first symposium on phenolics. Rick is the Past-President of the PSNA and has a distinguished record of research on the biochemistry of isoflavonoid biosynthesis. We have asked Rick and all other session chairs to work with the speakers in encouraging talks not only on their individual research programs but also to take the larger view in each of their presentations. This should help the audience appreciate the continuity between the various levels of inquiry. We have also asked the session chairs to provide a brief overview of the session, an introduction to each talk that creates a logical bridge with the preceding/upcoming talk, and to moderate a discussion period that also emphasizes connections and novel approaches. The session on phenolics will be led by Ragai Ibrahim, one of the founding members of the PSNA and one of the world's experts on the enzymology of the flavonoid pathway. A more specific aspect of flavonoid biochemistry which is still under active investigation, namely the origin of acetate moieties for phenolic compounds, will be covered by a Mexican researcher, Mario Rocha from the Biotechnology Institute at the Universidad Autonoma de México. Two young investigators will provide exciting views on molecular evolution and metabolic diversity in the flavonoid pathway. Dr. Joseph Noel of the Salk Institute, a recent CAREER awardee, has developed a method for the efficient expression in bacteria of every key enzyme in the phenylpropanoid pathway, allowing detailed crystallographic and functional studies that were not possible just a few years back. He will share some of his recent findings. Eric Grotewold from Ohio State University has discovered that the overexpression of transcription factors in corn cell cultures leads to major and unexpected diversions of intermediates into various branches of the phenolic pathways. He will discuss the implications of his findings for our understanding of how metabolic diversity is generated. Finally, Heidi Appel will provide an ecological perspective on flavonoid chemistry through her long-term effort to understand interactions between the tannins in oak leaves and gypsy moths.

The terpenoid symposium will be chaired by Edmundo Lozoya from the Centro De Estudios Avanzados at Irapuato. The session will be introduced by Joe Chappell from the University of Kentucky, who will use his many contributions to isoprenoid biochemistry to highlight the generation of diversity as variation on a few basic enzymological themes. One of the recent "tours-de-forces" in chemistry of plant natural products has been the total chemical synthesis, almost 10 years ago, of the diterpene alkaloid paclitaxel (taxol), found in the bark of the yew tree (*Taxus* spp.) and now established as a major anticancer drug.

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FOOD FOR THOUGHT

PSNA Meetings in 2003, 2005, and 2006?

It was agreed in 1998 by the Executive Committee of the PSNA that our annual meetings would alternate between Canada, the U.S.A., and Mexico. Since the majority of the PSNA membership is from the United States, it was also agreed that our annual meetings would be held two consecutive years in the U.S.A. for every year it is held either in Canada or México. Since 1998, successful annual meetings have been held in Pullman, Washington (1998), Montreal, Canada (1999), Beltsville, Maryland (2000), Oklahoma City, Oklahoma (2001) and this year we are looking forward to our get-together in Merida, México. Last year we also agreed to a Canadian offer to host our 2004 annual meeting in Ottawa as a joint gathering of the PSNA and the International Society of Chemical Ecologists (ISCE). However, the membership of the PSNA should be aware we have yet to select a meeting site for 2003. According to our current plan, this meeting should be held in the U.S.A. At this point we run the risk of not holding a meeting next year, unless one of our distinguished colleagues from the United States steps forward and offers to host the event. In fact, we hope the membership will also respond with enthusiastic offers to host PSNA annual meetings in the U.S.A. in both 2005 and 2006! Naturally, we are optimistic that our American colleagues will respond and we fully expect several offers to be submitted to the PSNA Secretary, Peter Facchini (pfacchin@ucalgary.ca). He will compile the list for discussion at our annual business meeting in Mérida. Please give this appeal serious thought since it is imperative that we identify parties capable of organizing the meeting, especially for 2003.

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Is it Time for a Change?

Throughout the history of the PSNA, our society has followed a strict policy of electing a new President whose term lasts just a single year. Several years ago, the issue of extending the term of the Society President from one to two years was raised at an annual business meeting of the PSNA membership. Although this issue was discussed extensively, no conclusive decision was reached. The effect of this inaction has had some consequences, since it has become increasingly more difficult to find suitable candidates who are willing to serve the PSNA in the very important capacity of President. In addition, the short term of the President contributes indirectly to the lack of continuity and knowledge required for the smooth running of the Society. This reality was evident this year when some confusion was encountered concerning the organization of the annual meeting to be held in Mérida, México this summer. Fortunately, the problem has been resolved in a timely manner, and we appear to be on track again for another outstanding annual meeting. However, it must also be noted that we have yet to select a site for our 2003 annual meeting (see the above article entitled "PSNA Meetings in 2003, 2005, and 2006"). It seems that we are beginning to operate too close to the edge. Again, the problem appears to be that, from time to time, no one is really sure who is in charge of the Society. Would extending the term of the President to two years contribute to more timely decision making? Opinions from the membership on this topic would be greatly appreciated. Please send your comments and opinions to the PSNA Secretary, Dr. Peter Facchini (pfacchin@ucalgary.ca). He will post them on the PSNA Web site. This open forum could be followed by a more detailed discussion at the annual business meeting in Mérida.

If sufficient consensus can be reached, the Executive Committee might wish to pass a motion for a vote to extend the mandate of the President of the PSNA to two years. This is an important decision that requires careful consideration by our members.

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SOUTH OF THE BORDER

What's Brewing? Coffee!

Introduction

Would you like a cup of coffee or tea? This is a question that you can hear any place around the world. Coffee and tea are two plants that people use to produce beverages. In fact, coffee is, after oil, the major commodity in the world. Actually, we know that caffeine is the major component in the stimulatory action of these two drinks, and the flavor and aroma are the result of the combination of an important number of compounds. Caffeine is also a strong insecticide, and has been described as a natural herbicide. These plants are fertile soil for biochemists, molecular biologists and phytochemists.

History

The use of coffee as a beverage is surrounded by legends and history. However, classic writings from Egypt and early Greeks and Romans have no mention of coffee. The history of coffee can be traced to northern Africa. The Arabian Doctor Rhazes, made the first written account of coffee around the year 940 A.D,. The earliest coffee was grown in Ethiopia and cultivation spread to Yemen in southern Arabia, where the custom of roasting beans began around 1200 A.D. In the fifteenth century, coffee came to Mecca, center of the Islamic world. Coffee houses developed there and Muslim pilgrims spread news of this wonderful tonic drink to every corner of the Islamic empire, including Spain, Egypt, Iran, and Turkey. Gradually, coffee spread to all of Europe. More information on the history of coffee can be found at the Web site: http://www.warbuckscoffee.com/briefhis.htm.

Folk medicine

Coffee has been known in early medicine in Arabia, Europe, and America, for many and diverse purposes. It has been reported to be an analgesic, aphrodisiac, anorexic, antidotal, cardiotonic, CNS-stimulant, counterirritant, diuretic, hypnotic, lactagogue, nervine, and a stimulant Coffee is also a folk remedy for asthma, atropine-poisoning, fever, flu, headache, jaundice, malaria, migraine, narcosis, nephrosis, opium-poisoning, sores, and vertigo. For more information about the use of coffee in folk medicine visit the following Web site: http://www.hort.purdue.edu/newcrop/duke_energy/Coffee_arabica.html).

Trade

The major producers of coffee are Brazil, Colombia, Indonesia, Vietnam and Mexico, and it is the main source of foreign exchange for several countries. There are two species that constitute most of the coffee trade: *Coffea arabica* and *C. canephora*.

Turkish coffee merchant

Research

The use of low-level stimulants, such as caffeine is part of almost every culture on Earth. In the case of caffeine six plant species are used: coffee (*Coffea arabica* L. y *C. canephora* Pierre ex Froehner), tea (*Camellia sinensis* (L.) O. Kuntze), cacao (*Theobroma cacao* L.), mate (*Ilex paraguariensis* St. Hil.), guaraná (*Paullinia cupana* H.B.K.) and cola (*Cola acuminata* (P. Beauv.) Schott et Endl). Since such beverages are consumed daily, or at least very frequently, its active principle is a regular component of the human diet. For adults the daily intake of this compound is around 3 mg kg^{-1} (1). Caffeine is a purinic alkaloid. These compounds are derived from xantine or uric acid, with a neutral or acidic character. Such alkaloids are widely distributed in the plant kingdom and have been found in at least 90 species (1).

The interest in the study of caffeine biosynthesis has three components: the first is its role as a defense product in those plants that produce it; second is the fact that the caffeine contributes to the quality of the coffee in the cup; the third component comes from the human physiology. Actually there is a controversy around the possible physiological role that caffeine can play in the human body. The possible effects produced by caffeine are: palpitations, gastric disturbs, anxiety, increase in the blood pressure and insomnia. As a consequence there is an increase in the demand for coffee without caffeine.

Recently, the pathway for the caffeine biosynthesis has been determined using different techniques in tea and coffee leaves: AMP $\rightarrow$ IMP $\rightarrow$ xantosine 5'-monophosphate $\rightarrow$ xantosine $\rightarrow$ 7-methylxantosine $\rightarrow$

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THE UNKNOWN PHYTOCHEMIST

Baloney-omics

What is it with all the new terms in the biological sciences these days? I mean, I can understand that new words are coined when something *new* is developed. But, is it really necessary to change the name of techniques and disciplines from descriptive terms that have served us well for decades to more politically appealing words and phrases that pay homage to the emerging dominance of "genomics" in modern biological research? When the whole genomics thing really got rolling a few years back, the word "genomics" seemed exciting, powerful, and a bit mysterious partly because few people really understood what it meant. The novelty of the term conveyed the importance of the revolution about to be hurled upon us. But, we soon started hearing other words, like "proteomics". This term created confusion at first. It sounded very technical. Some of us felt left out because we really didn't understand what proteomics was all about. Many others pretended to understand especially when the rumor got out that proteomics was just a fancy-schmancy way of saying that you knew how to run a 2-D polyacrylamide gel. But, no! Proteomics was much more than that! Hasn't your department invested in a MALDI-TOF mass spectrometer yet? How do you intend to join the proteomics revolution? Okay, so we learned all we could about proteomics and how it was going to change the world. And, yeah, okay, fine, it does represent more than just running 2-D gels. But, just as we were getting comfortable with the infusion of "genomics" and "proteomics" into the modern lexicon, along comes "metabolomics". Or is it "metanomics"? Apparently, one term was no longer enough to represent the vast potential of such mind-boggling technologies. At that point, many

of us started to understand what was happening. The genomics revolution had given rise to "omic-mania". It then became possible to actually predict changes in terminology. No longer would it be acceptable for the "in" crowd to describe their routine HPLC analyses at a PSNA annual meeting. Now, the beautiful people of science were doing "metabolic profiling". "What's the difference" many of us asked sheepishly, barely masking our growing inferiority complex? Oh, there's a BIG difference, we were told. Metabolic profiling and other genomic technologies produce so much more data that you couldn't possibly fit it all into your insignificant, prehistoric brain…you'll need a computer. And so, we witnessed the birth of the bioinformatist, who conducts research *in silico*. Why waste your time with filthy organisms, smelly chemicals, and long hours in the lab when you can use computers to sift through reams of data while you sit by ready to re-boot at the first sign of trouble?

That's when the avalanche really began. Messenger RNA became the transcriptome, proteins became the proteome, metabolites (including our beloved natural products) were relegated to the metabolome, Clearly, the new terminology must be sanitized for our own protection. Having a genome just wasn't enough. Soon we learned of the vacuolome, the chloroplastome, yada, yada, yada. Anyway, my point is, why stop there? I believe that it is our turn, not to mention our right, to jump on the bandwagon. Out with secondary metabolism. In with "phytochemicalomics". And take note, you heard it here first!

Do you have a "strong" opinion about a phytochemical issue that you wish everyone could read, but don't want anyone to know its you? The Unknown Phytochemist column might be just what you've been waiting for. This tongue-in-cheek submission is the first (and perhaps the last) of its kind. All submissions will be carefully edited for good taste. Thank you to the author of this entertaining piece, whose identity shall forever remain anonymous - the Editor.

Dry Bones, Israel

CURRENT OPINION IN CHEMICAL ECOLOGY

Phytochemicals Link Heaven and Earth: Induced Plant Responses Mediating Interactions Between Root and Shoot Herbivores

Although mankind may like to think that plants produce phytochemicals mainly for human benefit, one of the primary roles of these so-called secondary metabolites is to defend their producers against attacks of herbivores, pathogens and other phytophages (Fraenkel, 1959; Harborne, 1989). Many plants indeed increase the production of defensive compounds in response to phytophage attack (Karban and Baldwin, 1997; Agrawal et al., 1999). These induced defenses can directly affect phytophage by increasing their mortality or decreasing their growth rates (van Dam et al., 2000; van Dam et al., 2001). Additionally, attacked plants may produce indirect defenses, such as volatile compounds or extra-floral nectar. Indirect defenses attract predators or parasitoids to the damaged plant, which increases the probability that the phytophages are found and consumed by their natural enemies (Dicke and Sabelis, 1988; Wäckers and Wunderlin, 1999). Eventually, the plant may benefit from both direct and indirect induced responses if they decrease loss of biomass and increase net seed production (fitness) compared to plants that do not induce their defenses.

So far, the chemical-ecological aspects of induced responses in plants have been studied almost exclusively on above-ground phytophages and their natural enemies. There is, however, ample evidence that root phytophages, such as nematodes, bacteria, fungi or arthropods, also induce defensive plant responses. Similar to their aboveground counterparts, root-induced responses may also affect root phytophages and their soil-dwelling natural enemies (van Tol et al., 2001; van Dam et al., 2002). Both root and shoot phytophages may elicit systemic responses if the signaling compounds that are produced are transported throughout the entire plant and alter chemical profiles of undamaged organs (Karban and Baldwin, 1997; Agrawal et al., 1999). Thus, by inducing the plant's defensive responses, root feeders may alter host quality for shoot herbivores, and vice versa. Eventually, such interactions may affect the performance of above-ground (AG) and below-ground (BG) phytophages - and their natural enemies - and consequently, the eventual amount of damage the plant will suffer.

Because there are no explicit studies yet on how inducible compounds mediate interactions between AG and BG phytophages, I can only support the idea that they do by combining separate studies on shoot or root induction processes. As an example, I will use the induction of glucosinolates in the Brassicaceae. Glucosinolates are a very diverse class of plant compounds known to deter feeding by generalist insect herbivores, pathogens and nematodes (Fahey et al., 2001). When plant cells are ruptured, the glucosinolates that are stored in the vacuoles are metabolized by the enzyme myrosinase that is stored in specialized storage cells. This enzymatic reaction yields toxic products such as isothio-cyanates and nitriles, that are even more potent feeding deterrents against a wide range of phytophages (Brown and Morra, 1997; Rask et al.,2000). Both myrosinase and glucosinolate levels increase systemically after herbivore feeding, pathogen infection or after application of induction hormones such as jasmonic acid and salicylic acid (Bodnaryk, 1994; Ludwig-Müller et al., 1997).

The different types of glucosinolates are known to differ in induction profiles and biological activities. Here I will focus on the role of 2-phenylethyl glucosinolate (nasturtiin) which is found in the roots and shoots of several economically important *Brassica* species (Kiddle et al., 1994; Ludwig-Müller et al., 1997).

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The Bertha Armyworm causes severe damage to canola and other crops

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Nasturtiin and its breakdown products are known to be nematicidal, fungitoxic and inhibit microbial growth (Potter et al., 1999). Shoot treatment with jasmonic acid - which is widely used to mimic induced responses after insect feeding - also increased root levels of nasturtiin (Ludwig-Müller et al., 1997). This indicates that shoot herbivores may very well alter the suitability of the roots as food for nematodes feeding on the same plant. Whether the reverse is true so far remains unexplored, but studies with nematodes on cultured tobacco have shown that nematode feeding indeed may increase shoot levels of defensive phytochemicals, such as nicotine (Davis and Rich, 1987). If nematodes indeed increase shoot glucosinolate levels, this may even affect aboveground natural enemies of specialist herbivores on Brassica plants that use these compounds for their own defense (Müller et al., 2001). If these specialist herbivores, that are not deterred by the induction of glucosinolates, become more resistantto their own enemies, inducing plants may eventually suffer more damage than non-inducing plants.

The above example, and a few other examples of well-studied biologically active phytochemicals (van Dam et al., 2002) show that there is a significant potential for induced responses to mediate interactions between above- and belowground phytophages and their natural enemies. This awareness will not only change our views on which natural selection pressures have played a role in the evolution of induced chemical defenses in plants, but also will have consequences for the application of induction hormones for 'plant immunization' in agricultural systems. Therefore, it is about time that those studying induced responses 'go underground' to include root-induction processes and their interactions with shoot-induced responses in their studies. This is publication 2948 NIOO-KNAW Centre for Terrestrial Ecology, Heteren, The Netherlands

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A parasitic wasp laying eggs on a canola leaf

President's Letter

continued from page 5

As is the case for many complex phytochemicals, we are still far from an understanding of how taxol is synthesized in Taxus cells. Kevin Walker,a young investigator from Washing State University will discuss recent progress in the enzymology and molecular biology of taxol biosynthesis. We now are beginning to have good examples of how genomics and biochemistry can make a powerful combination in the study of plant secondary pathways. Another young researcher at the University of Michigan, Eran Pichersky, will discuss his exciting work on the synthesis of terpenes and phenolics in the leaf trichomes of species of the mint family, with focus on two novel gene families that appear responsible for a wealth of scents and flavor compounds. The session will be closed by Maria Luisa Villareal from the Biotechnology Institute at Cuernavaca, who will address how biotechnological approaches can help in the preservation of biodiversity from traditional medicinal plants.

Although it is widely accepted that the immense diversity of plant natural products can be mostly explained as variations on a few major themes, we are still far from developing a conceptual framework to explain the evolution of plant secondary metabolites. This is due, at least in part, to the lack of suitable genetic models. This is quickly changing as the result of the completion of the Arabidopsis genome sequence. Although this species is not known for its chemical diversity, as a member of the Cruciferae it expresses a fair number of glucosinolates, a relatively small (by comparison with phenolics, alkaloids and terpenes) family of sulfur-containing secondary metabolites derived from aliphatic or aromatic amino acids. Using genomic information, mutant and ecotype screening and classic biochemical analysis, Jonathan Gershenzon and colleagues at the Max Planck Institute for Chemical Ecology are establishing a sound basis for our understanding of the biological significance of glucosinolates. Jonathan has kindly agreed to lead a short symposium highlighting recent advances in glucosinolate biology, biochemistry and chemical ecology. He will also present a plenary lecture on the function of volatile terpenes.

The emphasis of the Arthur Neish Young Investigator Symposium will focus on promising new faculty members. We have chosen to highlight the work of two young men and two young women. Jorge Vivanco of Colorado State University, a recent CAREER awardee, will talk about his recent efforts to develop a metabolic profiling system applicable to the study of root exudates, one of the least understood aspects of root phytochemistry. Argelia Lorence, a postdoctoral associate at Virginia Tech, will talk about her recent collaboration with Mexican colleagues, which identified a novel group of allelochemicals from the Convolvulaceae with antiherbivory properties. Melina Lopez, a recent faculty member at the IPN in Sinaloa, will discuss her work on novel aspects of medicarpin biosynthesis. Finally, Sergio Peraza from CICY will complete this session by addressing his work on traditional Mayan medicinal plants with promise in the treatment of protozoan parasites.

The final symposium of the meeting on alkaloids will be chaired by Dr. Vince De Luca, a recent President of the PSNA and a newly chaired professor at Brock University in Canada. Vincenzo has made fundamental contributions to our knowledge of the compartmentation of alkaloid biosynthesis, using the *Catharanthus* tryptophan-derived alkaloid complex as a model. Jeffrey Cordell, one of the founding members of PSNA, will lead the session with an overview of the ethnobotany and chemistry of alkaloids as well as a perspective on future research. Peter Facchini, Canadian Research Chair in Plant Biotechnology at the University of Calgary, will provide a cell biological overview of alkaloid biosynthesis. This is a particularly challenging area of research in the case of alkaloids, as it is well known that multiple cell compartments participate in their biosynthesis. Vincenzo De Luca will complement this picture with a molecular view, and the session will be closed by Dieter Ober with a perspective on the ecological *raison d'être* of alkaloids.The outstanding line up for the regular session will be complemented by several keynote and plenary session speakers. In addition to Eloy Rodriguez and Jonathan Gershenzon, Barbara Timmermann will give a summary of a seven-year-old project on Biodiversity Prospecting. This is an excellent example of the challenges involved in academia-industry partnerships in developed and developing countries. Xavier Lozoya, one of the most renowned investigators on Mexican medicinal plants, will discuss how traditional knowledge may be integrated with molecular approaches in a way the benefits all partners and fosters sustainable development of novel products and industries. Mercedes Lopez from CINVESTAV will provide a combined industry and academic perspective on the use of phytochemistry in the development of traditional and modern fermented products. Finally, Robert Bye will close the meeting with an overview of plant-people interactions in Mexico from pre-Columbian to modern times.

This year's annual meeting promises to be informative and stimulating. I encourage you to come to Mérida for both the outstanding science and the opportunity to experience some famous Mexican hospitality.

Hector E. Flores
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ACROSS THE POND

A Canadian Postdoc in Germany

A trip across the Atlantic for a period of postdoctoral work is a common part of the career of many European scientists. North American research groups often have a German or Scandinavian postdoc as part of their multicultural makeup. But the reverse, with scientists making the trip from the New to the Old World to do research, is not so common. When I chose to go to Germany for postdoctoral work after finishing a PhD in 1998 (with Neil Towers at the University of British Columbia), I was swimming against the tide. I had received an NSERC postdoctoral fellowship and used the chance to expand my scientific base, to build on my phytochemical background by studying molecular aspects of plant secondary metabolism, but also to live somewhere different for a few years. I decided to join the research group of Toni Kutchan first at the University of Munich, and since 1999 at the Leibniz Institute of Plant Biochemistry (IPB) in Halle.

My time here has been both scientifically and personally rewarding. Germany has long been a world leader in plant biology and plant biochemistry, and when I look back at the last few years I can see the benefits of being part of this base of knowledge and expertise. My initial plan of a two-year stay has stretched into four and I now have my own research group that uses functional genomics tools to dissect out biosynthetic pathways in *Cannabis sativa* and tobacco. It has also been eye-opening to learn about other ways of doing science and living in a country different from my own.

German speaking countries have a unique scientific culture. Yes, they have a reputation for their rigid Herr Professor Doktor hierarchy (which does exist) but this is mellowing with time and with generational change. When I arrived I wasn't aware of the differences between the university systems in North America and Germany. For example, the "Diplom" is roughly equivalent to a master's degree, involving course work and exams followed in the natural sciences by a six to eight month period of lab work. I say roughly because the Diplom doesn't approach the level of practical experience gained during the two to three year MSc degrees that my Canadian colleagues did. A German PhD takes about three years, with no course work, and PhD students start to get

Guesthouse of the Leibniz Institute

impatient when they are in the lab much longer than that. Of course with thesis writing and waiting for examining committees the whole process is more like 3.5 years but this is still somewhat shorter than for a PhD in Canada or the US. After a PhD, German researchers aiming for an academic career in science will often go abroad for a year or two, and then return as a group leader and/or a "Habilitant". The Habilitation is a major difference between academia in North America and Germany, and can be thought of something approximating an assistant professorship. It involves a period of five or more years, under the guiding eye of a senior professor, where one develops as an independent researcher. It requires the writing of a Habilitationschrift (a sort of second thesis) and a defense before an examining committee. The Habilitation also ends with having to find a new job - academics rarely, if ever, obtain a permanent faculty position at the university where they habilitated. The Habilitation is being hotly debated at present as some would replace it with an assistant professor position while others support it as a valuable and still important part of the German scientific system.

Halle, where I moved after a year and a half in Munich, is a city of 250,000 inhabitants located about two hours south of Berlin in the former East Germany. It's a fascinating and dynamic time to be in one of the "Neue Länder" (New States) which were part of the Eastern Bloc for more than 40 years. A massive amount of construction is being undertaken to bring the former East up to the level of the West. In East Germany, the old cities had fallen into disrepair as citizens moved into high rise worker housing in the suburbs. Now the crumbling 19th Century and older architecture in cities like Halle is being restored and renovated. Baustellen (construction sites) are ubiquitous, which may make driving and walking the streets here somewhat hazardous, but they also mean that your neighbourhood is constantly changing, with stores and cafés springing up overnight in previously derelict buildings. Situated in a former industrial heartland, high unemployment and a long closed society have meant that Ausländerfeindlichkeit (anti-foreigner feeling) is sadly high in cities like Halle. This doesn't translate into problems for a Canadian scientist but it is a cause

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PHYTOCHEMICAL SOCIETY OF NORTH AMERICA
2002 ANNUAL MEETING

July 20-24, 2002
To be held at Hotel *El Conquistador*
Paseo de Montejo No. 458, Mérida, Yucatán,México

"Integrative Phytochemistry: From Ethnobotany to Molecular Ecology"

Tentative Program

Saturday, July 20: 4:00 - 6:00 pm - Registration

6:00 - 9:00 pm: Welcoming Reception and Dinner
Keynote Address: Eloy Rodriguez (Cornell University)
"Plants, People and Ethnomedicine: From Chimps to *Homo sapiens*"

Sunday, July 21: 8:30 am – 1:00 pm - Symposium I: Phenolics (Chair: Richard Dixon)

Ragai Ibrahim, Concordia University, Montreal, Canada
"The Enzymatic Basis of Flavonoid Biodiversity"
Mario Rocha, IBT, UNAM, México
"Provision of Acetate Units for Flavonoid Biosynthesis
Joseph Noel, Salk Institute
"Structural, Functional, and Evolutionary Basis for Methylation of Plant Natural Products**"**
Erich Grotewold, Ohio State University
"Transcription Factors and Metabolic Diversity"
Heide Appel, Penn State University
"Flavonoids and Plant-Insect Interactions"
Plenary Talk: Barbara Timmermann, University of Arizona
"Drug Discovery from Biological Diversity – The International Cooperative Biodiversity Groups Program in Latin America"

3:00 – 5:00 pm: Poster Session

Monday, July 22: 8:30 am – 1:00 pm - Symposium II: Terpenes (Chair: Edmundo Lozoya)

Joe Chappell, University of Kentucky
"The Chemical Wizardry of Isoprenoid Metabolism in Plants"
Kevin Walker, Washington State University
"Taxol Biosynthesis: Stepping Along its Way"
Eran Pichersky, University of Michigan
"Two Novel Gene Families are Responsible for the Synthesis of Numerous Plant Scents and Flavors"
Maria Luisa Villareal, Universidad Autonoma del Estado de Morelos, Mexico
"Production of novel bioactive steroidal saponins and triterpenes in cell and tissue cultures of native Mexican medicinal plants"
Nikolaus Fischer, University of Mississippi
"Constituents of North American Magnolias: Structure, Chemistry, Biogenesis and Biological Activities"

Symposium II: Terpenes - continued

Plenary Talk: Xavier Lozoya, Instituto Mexicano del Seguro Social
"Integrating Cultural Tradition and High-Tech R&D in the Development of Novel Phytoproducts"

3:00 – 7:00 pm - Symposium III: Glucosinolates (Chair: Jonathan Gershenzon)

Jed Fahey, Johns Hopkins University
"Biological Activity of Glucosinolates"
Erik Andreasson, University of Copenhagen, Denmark
"Compartmentation of Glucosinolate Synthesis and Catabolism"
John Rossiter, University of London, England
"Novel Myrosinase in Aphids feeding on Glucosinolate-containing Plants"
Dan Kliebenstein, University of California
"Molecular and Genomic analysis of Glucosinolate Pathway Evolution
Ute Wittstock, Max-Planck Institute for Chemical Ecology, Germany
"Glucosinolate Hydrolysis in Plants and Insects: Implications for Plant-Herbivore Interactions"
Plenary Talk: Jonathan Gershenzon, Max Planck Institute for Chemical Ecology, Germany
"Puzzling perfumes- investigating the formation and function of volatile terpenes released from plant foliage"

Tuesday, July 23: 8:30 am – 1:00 pm - Arthur Neish Young Investigator Symposium

Jorge Vivanco, Colorado State University
"Metabolic Profiling and Functional Characterization of Root Exudates: The Secondary Metabolite Story"
Argelia Lorence, Universidad Autonoma de Morelos, México
"Holes in the Membranes: How allelochemicals in the morning glory family dispose of enemies"
Sergio Peraza, Centro de Investigacion Cientifica de Yucatan, Méxcio
"Bioassay-Directed Studies of Yucatecan Medicinal Plants with Antiprotozoal Activity"
Melina Lopez, Instituto Politecnico Nacional, CIDIR, México
"Novel Aspects of Medicarpin Biosynthesis"
Plenary Talk: Mercedes Lopez, CINVESTAV, Irapuato, México
"Chemistry of Flavor, Aroma and Volatiles in Traditional Fermented Plant Products"

3:00 – 5:00 pm: Tour of the Botanical Garden at CICY

6:00 – 9:00 pm: Dinner and Awards Ceremony
Closing Address: Robert Bye, Director of the Botanical Garden., Universidad Nacional Autonoma de México
"On Plants, People, and Phytochemicals"

Wednesday, July 24: 8:30 am – 12:00 pm - Symposium IV: Alkaloids (Chair: Vincenzo De Luca)

Jeffrey Cordell, University of Chicago
"A Perspective on Alkaloids: Past, Present, and Future"
Peter Facchini, University of Calgary, Canada
"Cell Biology of Alkaloid Biosynthesis"
Vince DeLuca, Brock University, Canada
"Molecular Biology of Plant Alkaloids"
Dietrich Ober, Technical University Braunschweig, Germany
"Chemical Ecology of Plant Alkaloids"

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"Integrative Phytochemistry: From Ethnobotany to Molecular Ecology"

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NORTHERN EXPOSURE

Of Mines and Men

It could be argued that the expanding use of herbal remedies in North America has now contributed to the first steps in the legalization of a traditionally problematic narcotic plant. Although no one has ever been busted for trafficking *Echinacea* or St. John's Wort, the marijuana plant continues to be a major source of social and economic concern. Marijuana is a species with both strong proponents and bitter detractors. Now, in addition to its role as a world-renowned exporter of canola, controversial figure skaters, and cold fronts, Canada has made a mark on the marijuana debate. On April 7, 2001 the Canadian government proposed new regulations for the legalization of marijuana and other substances for certain medicinal purposes. The legislation affects drugs containing cannabinoids (such as marijuana, hashish, and hash oil) and psillocybin (the active ingredient in magic mushrooms). Despite its questionable virtues, marijuana is no doubt a phytochemically and biochemically interesting plant, boasts an impressive cultural "heritage", has widespread socio-economic implications, and is now providing law-abiding Canadians with something to think about between Olympic gold-medal victories in ice hockey over their neighbours to the south (sorry, couldn't resist).

Let's start with some interesting trivia that is unlikely to become an official Trivial Pursuit category. *Cannabis sativa* is cultivated or grows wild in most countries in tropical or temperate zones, including Canada. The plant, which probably originated in Asia, has been cultivated for a long time. Street language has given marijuana several different names, including pot, grass, and weed in English-speaking countries. In India, medium quality marijuana is called bang and high quality marijuana is known as ganga. It is also called ganga in Jamaica, kif in Morocco, and dagga in South Africa. *C. sativa* also produces an amber-coloured resin which, in an almost pure form, is a drug called charas in India and hashish in Western and Middle-Eastern countries. As for the word marijuana, its etymology is not clear. Some sources suggest that it is the contraction of two first names that are popular in Mexico, Maria and Juana. Others think that the term comes from the Mexican word mariguano, which means intoxicant, or the Panamanian word managuango, which means the same thing. The plant has many uses. It provides strong textile fibres used for the manufacture of wires and cables. The fibres can also be used to make blankets, clothes, flags, and boat sails. The seeds contain oil, of similar quality to linseed oil, used to manufacture soap and paint.

The first description of *C. sativa* comes from a medical treatise attributed to the Chinese emperor Chen-Nong from around 2,700 B.C. Archeological discoveries in Egypt dated between 3,000 and 4,000 years old also reveal the ancient exploitation of this plant. The Greek historian Herfodotus mentions that inhaling smoke from *C. sativa* was a funeral purification rite of the Scythians, who were a people that spoke Iranian and lived between the Danube and the Don rivers beginning in the 12th century B.C. The oldest of the Veda, which are sacred Hindu books written in Sanskrit after 1,800 B.C. describes the properties of *C. sativa*. Similarly, the Avesta, which is the holy book of the Zoroastrians, who originated in Northern Persia, dates from 600 B.C. and mentions that the resin of *C. sativa* produces drunkenness. In Europe, marijuana use did not develop socially or medicinally until the return of Napoleon's expeditionary forces from Egypt in 1798. Western medicine began to take a much greater interest in *C. sativa* due

There really is a place called Flin Flon (centre of the map).

to the work of two authors: O'Shaughnessy, an English doctor who returned from India in 1843 and Moreau de Tours, a Frenchman who wrote about the medicinal use and abuse of marijuana in 1848. The use of *C. sativa* in Europe only began to gather a significant following in 1844 when the Club des Hachichins was founded in Paris. Its members included Balzac, Hugo, Baudelaire, and Gautier. The first Canadian colonist to grow marijuana was apparently the French apothecary Louis Hébert who travelled to Québec in 1606 with the explorer Samuel de Champlain.

The popular use of marijuana gained considerable notoriety during the 1960s. More recently, some health care professionals have publicly endorsed its use for therapeutic benefits associated with four serious disorders. First, by lowering eye pressure it is purported to control glaucoma. Second, it is believed to reduce spasms in victims of multiple sclerosis. Third, it has been suggested to reduce nausea and suffering in patients undergoing chemotherapy and other cancer treatments. And finally, it is widely claimed to help those with AIDS to fight depression and regain the appetite they need to survive. It is also felt by some that marijuana can help those suffering from certain diseases, such as migraines and emphysema. The role of tetrahydrocannabinol (THC) as the active narcotic compound in marijuana has long been recognized. There are currently drugs sold legally in several countries that contain THC. In Canada, the two approved drugs sold in pill form that contain active ingredients derived from marijuana are Marinol and Cesamet. Presumably, these medications, which have passed the strict drug submission procedure and received a notice of compliance and an identification number, offer patients suffering from the aforementioned disorders with legal solutions to THC-associated therapy.

Proponents for the legalization of medicinal marijuana argue that prescription medicines containing THC are expensive, unpalatable, and often ineffective for many patients. However, *smoking* marijuana (so the argument goes) provides immediate relief of nausea, a loss of appetite, and other symptoms associated with the disease such as cancer and AIDS. Moreover, the holistic attitudes of herbal remedy advocates would contend that THC is but one of many compounds found in inhaled marijuana smoke, and that it is this chemical cocktail that is essential for the palliative treatment of certain conditions. Of course, people who currently chose to ignore laws about the use of illicit plant materials, even for therapeutic purposes, were at risk of arrest, fines, court costs, property forfeiture, incarceration, probation, and criminal records.

The Canadian answer to this dilemma has been to create a medicinal marijuana policy, which came into effect on July 30, 2001 and allows people who have been granted an exemption from narcotics laws to possess pot and grow it, or have someone else grow it for them. So far, only a few hundred people have been approved with several thousand applications pending. Allan Rock, the former Minister of Health in Canada, says that the use of marijuana to help people suffering chronic pain is based on logic and common sense. "Its a matter of simple compassion and reflects the views of Canadians in general", Rock said. Although Rock's comment might be interpreted by the rest of the world as an explanation of why Canadians are so laid back, there is no truth to that rumour what-soever. His comments were made after a tour of Canada's only legal marijuana growing operation deep underground in an old copper mine with a bustling hydroponics lab carved out of the rock hundreds of meters below the surface. There, a dense forest of marijuana plants bask under the blinding glare of powerful halide lights. "Its an incredible experience to see this operation" said Rock. "Its obvious we have good growth", he noted. Upon his return to the surface, he cut a ribbon at the entrance of the mine as he stood beside an RCMP officer in full uniform. "Let's open this mine and get the plants to patients as soon as we can", he concluded. Interesting,

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"Gold" Mine

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how, in the minds of some Canadian politicians, at least, there is an apparent *shortage* of marijuana. After visiting the "gold" mine (as one official put it), rumour has it that Rock and his entourage stopped for Chinese take-out, but this report could not be confirmed.

Anyway, even such apparently liberal policies have not satisfied everyone in Canada. Critics claim the exemption policy is too restrictive, that the mine won't produce enough pot to meet the anticipated demand, and that the weed won't be of sufficiently high quality to satisfy seasoned users. Indeed, it has also been suggested that the subterranean grow operation under contract by Prairie Plant Systems of Saskatoon, Saskatchewan is absurd. The $5.7-million price tag for the facility seems odd when most Canadians (like citizens of almost any country) can buy high-grade marijuana at discount prices in their own communities. On the other hand, the mine has prompted groups in other countries to hold up Canada's new policy as an example of compassion that should be followed by other governments. Whatever.

So where does Canada hide its high-tech, state-of-the-art, government-run marijuana mine? It's near the town of Flin-Flon, Manitoba (pop. 7,000), which is 650 kilometers northwest of Winnipeg near the Saskatchewan boarder. Not really much to see there - but you can buy a T-shirt proudly proclaiming the fact that you've visited the marijuana-growing capital of Canada. Anyway, all of this has got me thinking - I wonder how the Feds would feel about growing other "interesting" crops (for legitimate purposes only, of course) on the arctic tundra. "Hello, Prime Minister Chretien? I was thinking…"

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Coffee

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→ 7-methylxanthine → theobromine → caffeine as the main biosynthetic pathway in coffee (2-4). Additionally, there is a report showing the direct conversion of xantosine monophosphate into 7-methylxantosine (5).

Coffea arabica

Caffeine biosynthesis in coffee is carried out in both leaves and fruits. This is the general picture.

However, it is very interesting that for a plant so important, very little is known about the properties of the enzymes involved in the biosynthesis of caffeine and nothing of the enzymes involved in its degradation. This field of research has many opportunities to generate new knowledge. The regulation of both pathways, the determination and purification of the enzymes involved in the degradation of caffeine, the isolation and cloning of the genes coding for those enzymes, are only a few of the questions we can try to answer.

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Across the Pond

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for concern, especially because science thrives on exchange of people of all nationalities.

This reconstruction has also brought rapid scientific change with a steady stream of Deutschmarks (and now Euros) being spent to improve scientific infrastructure in the East. This support, and the talent it has retained and attracted, has made the IPB an extraordinary place to be doing research. Facilities, instrumentation and expertise exist for the full spectrum of plant biochemistry, from the synthesis of natural products to genomic analysis of metabolic pathways. As well, the IPB is situated within a region that includes such notable German plant research institutes as the Max Planck Institute of Chemical Ecology in Jena, the MPI of Molecular Plant Physiology in Golm and Europe's largest plant breeding institute in Gatersleben. Small meetings and both formal and informal collaborations add to the scientific opportunities here.

Of course, anyone who has visited Europe for its museums and castles knows that it is rich in history and classical culture. Halle is in the heartland of German culture: it is the birthplace of Händel, and the haunts of Bach, Goethe, Schiller and Nietsche among others are all within one-hour train ride. Martin-Luther-Universität Halle-Wittenberg, as the University of Halle is officially known, is one of the oldest in the Germany and celebrates its 500 anniversary in 2002**.** For the phytochemist, it is also worth noting that Halle is the birthplace of the alkaloid, as the term was coined in 1819 (from the Arabic "al-qaliy") by a pharmacist working in a Löwen Apotheke just off the city's main square. The pharmacy is still in operation today.

Language is probably the one factor that looms large when a young researcher considers working in Europe. Having only spent time in labs in Germany, I can only comment on the situation here. In the lab, it's not a big problem as most young German scientists speak English. Conversing with some technical staff presents more difficulties but when you consider a centrifuge is a "Zentrifuge" in German, these can be overcome. Life outside of the lab is another story, especially in Halle where the generations educated during "DDR-Zeit" (during East-German communism) learned Russian rather than English. This is when you have to put your language circuitry to work and pick up enough for the basic necessities of life. And after too much of life in the provinces one can always escape to Berlin for a movie in English.

Market Church and Red Tower in Halle.

Coming to Europe has been an interesting experience, and one that I recommend others consider when choosing where to postdoc or when providing direction to their soon-to-be-finished PhD students. Salaries are comparable with those found in Canada and the U.S. (in the range of 30 000 Euro) and you are entitled to those six weeks of paid holiday each year. There are some concerns of course; the danger of getting disconnected from colleagues in North America and ending up out-of-loop in terms of jobs back home, and the need to endure long flights and jetlag to attend meetings and visit family. There are several funding programs aimed at bringing scientists from abroad to Germany to do research, such as those offered by the prestigious Alexander von Humboldt Foundation (visit www.avh.de, which is aimed primarily at postdocs and established scientists or try the DAAD Web site www.daad.de, which is aimed more at graduate students).

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I Want You!

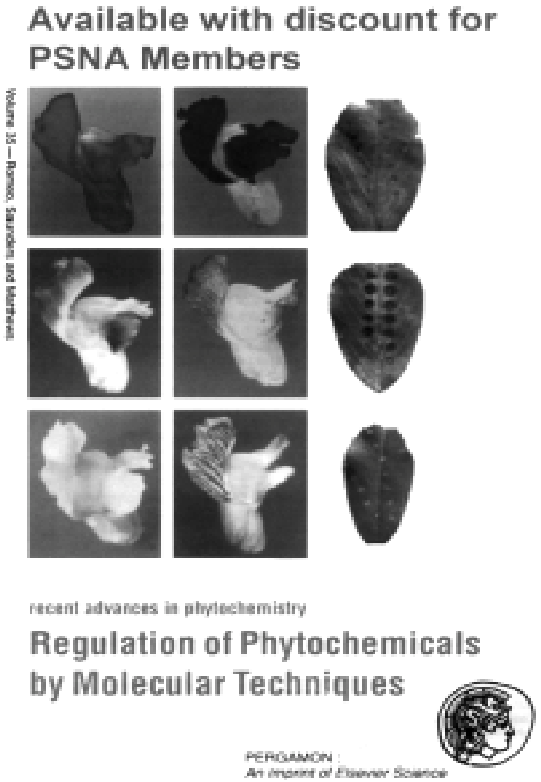
To Write for PSNA News

(For more information, contact the Editor)

Elsevier Publishes Volume 35 of Recent Advances in Phytochemistry

Volume 35 of Recent Advances in Phytochemistry - *Rn of Phytochemicals by Molecular Techniques*, the symposium volume resulting from the 2000 PSNA Annual Meeting in Beltsville, MD is the second volume in this series published by Elsevier. Volume 35 provides a snapshot of the use of molecular tools to study and modify the chemistry of plants, and is available for purchase by PSNA members at a significant discount.

The past decade has seen major advances in the development and use of molecular tools to understand gene expression in plants. We are at a point where modification of genetic expression to alter the chemistry of crop plants can be utilized on a commercial basis. In some cases, plants are acting as biofactories to produce medicines previously unavailable and/or at a fractrion of the cost of older synthetic chemistry technology. New tools to study, understand and harness the power of this revolutionary new field are being developed each year.



Contributors to this timely volume explore a wide range of topics that include:

- ✓ development of tools for the study of gene expression in plants
- ✓ role of phenylpropanoid and isoprenoid pathways in genetic modifications of plant chemistry
- ✓ genetic modifications to alkaloids in plants
- ✓ modifications to plant chemistry and its effect on other plants, animals and the environment
- ✓ pharmaceutical production in plants
- ✓ the use of plant viruses to modify plant gene expression

The PSNA, under terms of our contract, can sell you this volume at a **40% discount**. To purchase Volume 35 please contact the Treasurer, Charles Cantrell.

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Please make check or money order payable to the **Phytochemical Society of North America.** Payment must be made in U.S. dollars, drawn on a U.S. bank. Traveler's Checks or Canadian Postal Money Orders, payable in U.S. dollars, are also acceptable. We are unable to accept payment via credit card.

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M. Phenolics
N. Pigments
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P. Stilbenes
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PSNA NEWS

Phytochemical Society of North America
Sociedad Fitoquímica de América del Norte
Société Phytochimique de L'Amerique du Nord

Volume 42, Number 2 October 2002

PRESIDENT'S LETTER

The Challenge

Will mankind be able to create a balance between sustainable development and the exploitation of biodiversity? Will our modern societies find a way to respect our planet as did the ancient people of the world, and at the same time improve the welfare of those living in poverty and protect the environment? Undoubtedly, this is a major challenge. Mankind must be able to bring welfare and health to all people around the world, and at the same time preserve our natural resources for generations to come. Phytochemists around the world and our Society have the great opportunity to participate in achieving this goal.

Recently, two events have occurred. These events were separated by thousands of kilometers, but were very close in their philosophy and goals. One of them took place last July in Mérida, México where our Society accomplished the annual ritual of getting together and updating the state-of-the-art in our research field. In the other event, which took place only a few weeks ago in Johannesburg, South Africa, we saw many different organizations and 104 countries join together at the World Summit on Sustainable Development of the Earth. The meeting was attended by at least 21,000 people including more than 9,000 delegates, 8,000 NGOs and 4,000 members of the press. The major outcome was a document, the Plan of Implementation, which committed governments to address five priority areas: a) water and sanitation, b) energy, c) health, d) a global effort to combat desertification, and e) the protection of biodiversity and improvement of ecosystem management.

In the case of health-related issues, the participating countries agreed to phase out, by 2020, the use and production of chemicals that harm human health and the environment. This resolution is in addition to ongoing actions to fight HIV/AIDS and to reduce water borne diseases and health risks caused by pollution. Commitments were also made to reduce losses in biodiversity by 2010, to restore fisheries to their maximum sustainable yields by 2015, to establish a representative network of protected marine areas by 2012, and to improve the access of developing countries to environmentally-sound alternatives to ozone depleting chemicals by 2010.

During the PSNA meeting in Mérida we heard talks ranging from ethnobotany and drug discovery through biological diversity to the molecular biology of secondary metabolism. It was clear from both of these conferences that nature continues to be the major source of chemical diversity. Biological organisms produce a diversity of novel secondary metabolites that exhibit a wide-range of medicinal activities. This is why biological prospecting can serve as a potentially strong tool for the development of local economies and the conservation of biodiversity. The development of pharmaceutical, agricultural, and industrial products from

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2003 PSNA Annual Meeting

Secondary Metabolism of Model Systems

August 9 - 13, 2003
Peoria, Illinois

The Phytochemical Society of North America (PSNA) is a nonprofit scientific organization whose membership is open to anyone with an interest in phytochemistry and the role of plant substances in related fields. Annual membership dues are U.S. $40 for regular members and $20 for student members. Annual meetings featuring symposium topics of current interest and contributed papers by conference participants are held throughout the United States, Canada, and Mexico. PSNA meetings provide participants with exposure to the cutting-edge research of prominent international scientists, but are still small enough to offer informality and intimacy that are conducive to the exchange of ideas. This newsletter is circulated to members to keep them informed of upcoming meetings and developments within the society, and to provide a forum for the exchange of information and ideas. If you would like additional information about the PSNA, or if you have material that you would like included in the newsletter, please contact the PSNA Secretary and Newsletter Editor. Annual dues and changes of address should be sent to the PSNA Treasurer. Also check the PSNA website at www.psna-online.org for regular updates.

PHYTOCHEMICAL PIONEERS

Nikolaus Fischer - "Ein Wanderer" and "Einwanderer" in Science

Prologue

At the PSNA meeting in Mérida, México, I was asked by Peter Facchini to write an article for the Fall 2002 PSNA Newsletter Series *Phytochemical Pioneers*. After the very interesting readings of Neil Towers' "Memories of a Budding Scientist" and Ragai Ibrahim's "Journey in Plant Biochemistry" in the previous two newsletters, I felt very honored to be in the good company of two phytochemists that I respect and admire. I have decided to write about individuals, that are my "Pioneers", but not only in Phytochemistry. I wish to add individuals that have had significant influences on my career and my life in general from my childhood to the present.

At the Mérida meeting, I showed a slide of Jeffrey Harborne, that I had taken in the fall of 1986 during the Phytochemical Society of Europe meeting in Lausanne, Switzerland. At the time of my presentation in Mérida, I did not know that Jeffrey had died just one day before, on July 21, 2002. The photo resembles the way I wish to remember Jeffrey Harborne, a quiet, somewhat shy person. He made immense contributions to phytochemistry and chemical ecology as a scientist, an editor and as a prolific writer. As a writer, he was a critical analyst with a quick pen and a great gift for detecting and summarizing new and significant contributions to our field of science. Jeffrey was never my mentor, but he has had a positive influence on my career and my life and has given me guidance in my budding years as a scientist. It is about individuals like Jeffrey that I wish to write about in this newsletter.

A brief comment on the above title. In the German language "Ein Wanderer" translates into "A Wanderer" on a journey. However, the English translation for "Einwanderer" is "Immigrant". Both terms apply to my life's journey.

My Life's Journey and Scientific Odyssey

I had no choice! I was born into Hitler's Third Reich three years before the Second World War started. My family lived in a small farming community named Kunzendorf on the river Biele in the then German Province of Selesia, which is now a part of Poland. My father Ernst was a mechanic with a little repair shop for motor cycles and my mother Luzia took care of the Shell gas station. She very much enjoyed serving the customers that were travelling to the popular health spa Bad Landeck; for my mother this represented a window to the world. My older brother Siegfried and I grew up in a caring, large family of farmers. Even the war years had little negative impact on our life, except that our father had been drafted in 1939, serving in the German Army from day one of the war. I wish to mention one little story from the war period. In 1943, a family from Bremen had been evacuated due to heavy bombardments of their hometown "Oma Rabe", "Mama Fifi" and her children Helga and Heiner lived next door in the house of my grandparents. During their short stay, I enjoyed the company of Helga, the girl from the big city. This girl is now my wife for over 30 years.

At the end of the Second World War, our carefree small-village life changed dramatically. My father did not return from the war; he was missing in action since 1944. Over 50 years later, in 1996, my mother was informed by the Red Cross, that father had died in a Russian prison camp near Wolgograd one month before the end of the war. Our mother was a widow at age 33 and never remarried until her death at age 90 last year.

In April 1946, my mother, my brother and I had to leave Selesia just with our possessions that each of us could carry. After a long odyssey on railroad cattle cars, we were transported west and were resettled in a small village in Westfalia in the British Zone of Germany.

From left to right: B. M. Fraga, Kurt Hostettmann, Jeffrey B. Harborne, J. D. Phillipson, Tony Swain, Klaus Fischer at the 1986 PSE Meeting in Lausanne.

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I went to Elementary School and then to Middle School in a neighboring town, which was rebuilding from heavy wartime bombardments. Our barrack-style classroom was used as a dancing hall on weekends. Books were uncommon during the first years after the war. Our teachers were strict, competent and very caring. I was an average student and chemistry was a particularly difficult subject for me; it simply did not turn me on. My science teacher, Dr. Ehlers, was not happy with my performance, but there was no laboratory experience. In addition, at that time my greatest interest and main passion was playing my violin, which I had acquired for very little money and had taught myself, playing for two to three hours every day. In school, my performance in chemistry was slowly drifting towards a failing grade. My brother Siegfried, who had been an excellent student at home in Selesia, loved chemistry, but was not able to continue his education due to the post-war turbulent times. He knew how to trigger my interest in chemistry. I received from him a present that gave new directions to my future life and career: a chemistry laboratory kit. My tortured violin had a long rest. Chemical experiments became my obsession; at graduation from Middle School in 1954, I received a B grade in chemistry. I had earned it and was very proud of it! After recognizing my sincere interest in chemistry, my science teacher recommended that I attend a two-year school for Chemical Technicians (in German: Chemotechniker). One of the best programs was in Isny, a small south German town just north of Lindau on Lake Constance in the State of Wuertemberg-Hohenzollern. This very rigorous program emphasized laboratory techniques to prepare students for careers in industry and governmental laboratories. One of the most memorable events during the time in Isny was a 1955 class trip to Lindau to attend the annual Chemistry Nobel Laureate Meeting. There I was in the same room with the giants in the field. I remember standing near Staudinger, a natural products chemist in his early career; then he expanded his field to mimic the synthesis of natural polymers to become one of the fathers of synthetic polymer chemistry. I was excited but also saddened by the fact that I could never be part of the academic community, since my middle school background was at an academic dead end. A high school degree was necessary to enter the university. For me a university degree had to remain a dream. In my final examination in the spring of 1956, one of the outside examiners in organic chemistry was Professor Heinrich Hellmann from the University of Tuebingen, the man to whom I am still very thankful for opening the door for my higher education.

After a very successful oral exam, he asked me about my future plans. I told him about my dilemma, that I had no choice but to find a job in industry. To my greatest surprise, he pointed out that the State of Wuertemberg-Hohenzollern had introduced a new law, which allowed qualified students from technical schools in the state to study in their field at the University of Tuebingen. This university is one of the oldest in Germany, founded in 1477. I was the first member of our greater family who had the opportunity to receive a university education.

After the Second World War, Tuebingen held a unique position in the German academic world. The city was untouched by the war and many eminent scientists, including a number of Nobel Laureates, were on the faculty at this university. The director of the Chemistry Institute was George Wittig, who was transferring to the University of Heidelberg in 1956, but his Nobel Prize winning research was done in Tuebingen. The Nobel Laureate Adolf Butenandt of adrenal cortical hormone fame (Nobel Prize together with Ruzicka, 1939) was forced by the Nazi regime to decline, but he accepted the Prize after the war. Butenandt was also the discoverer of insect sex pheromones. I vividly remember the weekly seminars, which were impressive "performances" by the faculty and the visiting speakers. From a student's point of view, these were intimidating gatherings. Attendance was mandatory from the chemistry freshmen to the almighty German Professor. Students rarely asked questions, but in my first year, I asked a visiting speaker about the stability of organic compounds exposed to X-ray irradiation, then a powerful novel area of structure determination. The new director of the Institute of Organic Chemistry (his name will not be mentioned) stood up and shouted into the audience: "What a stupid question!" I was thankful that the speaker cited several examples of instability of compounds during X-ray analysis, but the damage was done. This was my first and last question I asked in my graduate career and many years thereafter. This man might have been a good scientist, an educator he was not! But I learned a great lesson the hard way with a very positive outcome. I never forgot this incident and it made me a better and more respectful and caring educator and mentor of my students and postdoctorals in my later academic career.

After my undergraduate years from 1957 to 1961, I joined the research group of a young Dozent, a brilliant young chemist and pianist, Guenther Opitz, who came out of Butenandt's research group and later became Wittig's successor in Heidelberg. My dissertation research was a synthetic-mechanistic project directed towards the formation and chemistry of sulfene, a group of ketene analogs. After major initial difficulties, the research project had a positive ending. This new and novel method for the synthesis of alkenes from aliphatic sulfonic acids is a variation of the Wittig alkene synthesis.

After my graduation in the summer of 1965, I wanted to get the "American experience", and do a year of postdoctoral work in the United States or Canada. My application had a very fast positive response from Tom Mabry, who at that time was rapidly building a cutting edge natural products research program in the Department of Botany at the University of Texas in Austin. As I learned later, it was pure luck. My letter had arrived on the same day when Jacques Kagan had informed Tom, that he was leaving for a faculty position at the University of Illinois at Chicago. My postdoctoral experience in Tom's lab was exciting and refreshing after several grinding years in graduate school. His graduate students Al Wohlpart and Gene Miller and the postdoctorals Ken Markham from New Zealand and Mike Thomas from England introduced me to natural products chemistry and NMR spectroscopy. Mike and Ken were working with Tom on the classic book on flavonoids. On a private note, I will always fondly remember Mike and I watching the soccer world championship final between England and Germany. It was a great game, but Mike had the last laugh.

Tom, a typical Texan, was contagiously enthusiastic, encouraging and very generous. It was a carefree and enjoyable period and we worked hard and played hard. In Tom's research program, the application of natural products toward the new field of chemotaxonomy used different chemical markers. I was introduced into the sesquiterpene lactone area by Gene Miller. Tom brought many eminent scientists to the UT campus. Visiting professors during this time were Jacques' brother, Henry Kagan from France, and "Mr. Chemical Fundamentalist" André Dreiding from the University of Zuerich.

During the spring semester 1966, the whole research group was actively involved in the planning of the logistics of the sixth annual meeting of the Plant Phenolics Group of North America. The organizers chose as a symposium topic "The role of chemistry in modern biology" with emphasis on the use of natural products in systematic botany. Many of the big names in the field attended the meeting: Holger Erdtman from Sweden,Ted Geissman from UCLA, Hans Griesebach from Freiburg, Germany and Werner Herz among others. The meeting was a great success and several months later led to a reorganization of the Phenolics Group into the Phytochemical Society of North America. Our society, the PSNA was born and Tom Mabry was the first president.

In early 1967, we attended the first Mardi Gras Symposium in Organic Chemistry at Louisiana State University (LSU) in Baton Rouge. The chemistry department at LSU was also looking for a natural products chemist. After the obligatory interview process, I joined the LSU faculty in August1967, in spite of my DSP-66 visa. My laboratory had no air conditioning and running chromatographic columns was nearly impossible in this tropical summer climate. But I was able to get some research done, usually late at night due to the extreme heat during the day. My first paper at LSU was in collaboration with the NMR specialist, the late Norman Bhacca. We determined the conformation in solution of a germacranolide-type sesquiterpene lactone by the then novel method, the Nuclear Overhauser Effects. *Tetrahedron Letters* turned us down, but the prestigious chemistry journal *Chemical Communications* accepted without changes this frequently referenced paper.

The dean of our college was very optimistic about getting my visa changed, but in the spring of 1968, I was informed that I had to return to Germany for at least two years, before I could apply for a green card. Back to Europe! At the time it appeared that my career was put on hold, but looking back, it was a blessing in disguise. I joined Dreiding's group in Zuerich and learned from the master in the fundamentals in organic chemistry, in particular, stereochemistry. Our group meetings were exercises in the logic of approaching chemical problems with stereochemistry representing the foundation of all considerations. My research project contributed to the understanding of the biosynthesis of the betalamic acid portion of betalains from dopa. Contrary to the previous hypothesis, these alkaloidal pigments in cacti and red beet were formed by aromatic cleavage, not between but next to the catechol moiety of dopa. This unexpected pathway is found in many biosynthesis textbooks; my only contribution to the teaching literature. After returning to LSU in the summer of 1970, the days were filled with teaching and the nights with research. In collaboration with Tod Stuessy at Ohio State, whom I knew from his graduate years in Austin, an extensive chemical study of the genus *Melampodium* was initiated. Tod and his students provided us with very valuable plant collections from Texas to Central America. The chemical analyses occupied our efforts for a whole decade with multiple new structures and publications on the isolation, structure elucidation and chemistry of the melampolide-type sesquiterpene lactones. Now my strong stereochemical foundation gained in Zuerich payed off in the extensive configurational and conformational analyses of sesquiterpene lactones. *Melampodium* and several hard-working graduate students secured my tenure and promotion to Associate and Full Professor at LSU-many, many thanks!

My first sabbatical in the fall of 1977 was spent in Ferdinand Bohlmann's laboratory in Berlin, Germany. I had first met Bohlmann in Monterrey, Mexico, where I was a regular attendee of Xorge Dominguez's annual natural products symposia. Bohlmann was hard to ap-

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proach and the word arrogant came to mind. After knowing him better, I learned that he was a shy person. After extensive investigations of polyacetylenes, Bohlmann had entered the terpenoid field and produced many publications on the chemical constituents of the Compositae. He was one of the ten most prolific authors worldwide and I often referred to *Phytochemistry* as the "Bohlmann journal". He had the discipline of a Prussian officer. He arrived early in the morning, taught his organic chemistry class at 7:30 am and then set up a chromatographic column. In a lab saturated with ether/petroleum ether, he generally took care of his correspondence at the lab bench while collecting fractions. Generally, he completed one plant extract per day, ran all necessary spectral data and interpreted them on the spot. At noon he disappeared to his office and wrote the manuscript. His photographic memory was invaluable in structural work! I learned then that some people are more equal than others.

While in Berlin, my wife Helga and I started collecting the literature for a comprehensive review on sesquiterpene lactones in the Zechmeister series, *Progress in the Chemistry of Organic Natural Products.* This review of nearly 350 pages appeared in 1979, covering close to1000 naturally occurring lactones. During the early 1980s we investigated the chemistry of several major genera of the Asteraceae, mainly *Calea*. A collecting trip with my friend and LSU taxonomy colleague Lowell Urbatsch to Jamaica and the mountain areas of Venezuela is still a very pleasant memory.

More and more sesquiterpene lactone papers appeared in the literature. This field had become a mature area of research and it was time to move on. At that time, Bruce Williamson, a fire ecologist joined the LSU Botany faculty. He got me excited about his fire hypothesis related to the long-standing question, why did the Florida Scrub and the adjacent Sandhill plant communities remain as separate entities over time? Our investigations led to a number of significant chemical and ecological findings related to plant-plant interactions (allelopathy) in several dominant species in the Florida Scrub. The most significant and exciting outcome included the first case of a photochemical activation of nontoxic plant constituents into potent phytotoxins in a cascade of chemical events. We had great fun and convincing results, but the contribution of allelopathy in plant-plant interactions seems to be still in the doghouse of chemical ecology. I learned then that scientists can be a highly conservative bunch.

Another collaborative project at that time involved Hector Flores in Plant Pathology and Martin Hjortso in Chemical Engineering at LSU. We studied the biotechnological potential of "hairy root" cultures and learned that "hairy roots" are excellent systems for studying biosynthetic pathways of root constituents, using ^{13}C- labeled precursors. The 1990s were highly active years of a collaborative bioassay-guided search for anti-tuberculosis agents from higher plants. Again, our collaboration with Scott Franzblau, then at the Hanson's Disease Center stationed at LSU, provided no new anti-TB drugs, but we learned about many essential structural features from our structure- activity studies essential for future developments. Greater details on this story can be obtained from the present treasurer of our Society.

After 32 years on the LSU faculty, I retired and moved to the Magnolia State, Mississippi. I joined the Department of Pharmacognosy in the School of Pharmacy at the University of Mississippi as Professor and Chair and, as a balance to my administrative duties, find enjoyment in the study of the genus Magnolia and related taxa.

Epilog

Looking back on a career of over 35 years of research in natural products chemistry, I realize now that we had extensive and highly successful collaborations between our chemistry group and scientists in various areas of biology. This was well before most granting agencies knew how to spell the word "collaborations". I accept that these areas of science are now "mature", and have lost the cutting edge status in modern natural products research. But long-lasting friendships grew out of our scientifically rewarding endeavors. These close friendships with colleagues, former students, postdoctorals and visiting scientists still remain when all the scientific accomplishments disappear into the shadows of new findings and developments. My journey as an active researcher is now slowly coming to an end and I am observing with great interest the new developments that advance the field of Phytochemistry to the next level of understanding. The new tools of molecular biology provide insight into the formation, location and ecological function of natural products. Understanding all details of biosynthetic pathways as well as the pharmacological functions of natural products will not only provide new knowledge but lead to new sources for medicinal drugs and agriculturally useful products.

After a long journey, the "wanderer's cane" in the field of natural products is now in the hands of the next generation of scientists. All my best wishes for the journey. Don't forget that it is not the destiny but the journey that makes our lives interesting and fulfilling.

Nikolaus Fischer
Mississippi State University
Oxford, Mississippi
nfischer@sunset.backbone.olemiss.edu

MINUTES OF THE 2002 ANNUAL BUSINESS MEETING

A Whole Lotta Shakin' Goin' On - Or Something Like That

The 2002 Annual Business Meeting was held from 19h00 to 20h15 on Tuesday, July 23, 2002 as part of the PSNA Annual Meeting in Mérida, México. The business meeting was called to order and chaired by Victor Loyola-Vargas, President-Elect of the PSNA. Loyola-Vargas indicated that there was both good news and bad news for the society over the last year. Felipe Vázquez-Flota, local organizer for the 2002 Annual Meeting in Mérida, México provided a summary of the conference. The very successful meeting attracted a total of 92 participants – 44 from the USA, 32 from Mexico, 7 from Canada, and 9 from other countries. The registrants included 26 students who entered 15 posters into the best paper competition. Funding for the meeting was obtained from the PSNA (US $5,000), the Centro de Investigacion Cientifica de Yucatan (CICY) ($3,000), Pfizer Canada ($2,000), and two local sponsors, Difision ($500) and Meriequipos ($500) for a total of $11,000. Approximately $9,000 was expected from the registration fees, and another $8,500 was awarded to Hector Flores from the National Science Foundation (USA) in support of the meeting. The NSF funds can only be used in the United States and will be dispensed to invited speakers from the USA to cover travel costs. It was anticipated that the conference organizers should have sufficient funds to cover the costs of the meeting.

The Society Treasurer, Charles Cantrell, distributed financial reports for 2001 and the first 5 months of 2002. The Society's finances are healthy as reflected by an increase in total assets by more than $15,000 in 2001. The most significant reason for the increase in assets was the self-sufficiency of the 2001 PSNA Annual Meeting in Oklahoma City. The Neish Symposium Account has increased to over $35,000 as the result of a donation through Rick Dixon from the Noble Foundation in Ardmore, Oklahoma. However, the Neish Account generated less than $700 in interest in 2001, which is considerably less than the $2,000 required per year in support of young investigators invited to the meeting. Suggested alternatives to the current investment strategy were requested. Cantrell also discussed the status of membership in the Society. Membership in the Society has fallen steadily over the last several years. In 2001 there were 371 members, down from 408 in 2000. The main reason for the drop was the purging of members at the end of 2000 that had not paid dues in 2 years or more. Approximately 50 more members were purged at the end of 2001 for the same reason. Thus, overall membership in the Society can be expected to have declined further at the present time. The most disturbing trend is the loss of Mexican members over the last few years. Currently, the number of Mexican members stands at nine. It was agreed that immediate action is required to increase Mexican involvement in the Society.

John Romeo, Editor-in-Chief of the Recent Advances in Phytochemistry book series, provided an indication of the status of the relationship with the new publisher, Elsevier, and a summary of book sales. The switch to Elsevier has resulted in a better quality book with a relatively rapid production period. The publisher also aggressively advertises the books. The only drawback is the amount of work necessary to prepare the book for publication since Elsevier requires camera-ready manuscripts. Cumulative sales of the books are strong, but two more recent volumes are currently lagging behind to some extent. The Society has agreed to purchase 75 copies of each volume for sale to its members. Last year, 64 out of these 75 copies of Volume 36 were purchased at the meeting in Oklahoma City. However, significant numbers of the Society's stock of Volumes 34 and 35 remain to be sold. Members were encouraged to purchase the books.

Secretary and Newsletter Editor, Peter Facchini, discussed the status of the newsletter. A well planned vote of confidence by the membership in attendance pre-empted Facchini's plan to inform the Society that he would end his term on the Executive Committee at the 2003 annual meeting. He agreed to serve an additional two years as Newsletter Editor. Facchini stated, however, that the existing structure of the Executive Committee places too much of a burden on two individuals – the Treasurer and the Secretary and Newsletter Editor. He suggested that the Executive Committee should be expanded to include two separate appointments – one for the Secretary and another for the Newsletter Editor. Facchini would remain as the Newsletter Editor for two more years, but suggested that another member be elected to serve as the Society Secretary. This individual would be responsible for all Society communications, such as the Web site, e-mail announcements, and the distribution and counting of ballots, among other things. Currently, these tasks are split among other Executive Committee members and would be best consolidated. There was general agreement for the suggestion, which will proceed to a ballot for consideration by the Society membership.

Several other changes to the structure of the Society were discussed. First, it was suggested that the

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STUDENT TRAVEL AWARDS

PSNA Supports Graduate Student Participation at the 2002 Annual Meeting

Erin K. Wallace, Salk Institute, La Jolla, California, USA

Ana Cuevas Pardo, Universidad de Puerto Rico, Departemento de Biología, San Juan, Puerto Rico

Beth Jackson, Department of Biochemistry and Cell Biology, Rice University, Houston, Texas, USA

Diane Martín, Biotechnology Laboratory, University of British Columbia, Vancouver, British Columbia, Canada

Renée LeClair, Department of Biochemistry, Rice University, Houston, Texas, USA

Fabiola Domínguez, Labotarorio de Fitofarmacos, Unidad de Investigación en Enfermedades Neurológicas Centro Medico Nacional Siglo XXI IMSS, Mexico

Andrea Medina, Department of Agronomy and Horticulture, New México State University, Las Cruces, New México, USA

Maria Eufemia Morales-Ribio, Faculdad de Ciencias Biológicas, Cuidad Universitaria, San Nicolas de los Garzas, Nuevo Leon, México

Maryam Farzad, Biology Department, Georgetown University, Washington, DC, USA

Cristian Jiménez Martínez, Departamento de Graduados e Investigación en Alimentos, ENCB-IPN, Casco de Santo Tomas, México City, Mexico

Mariana Domínguez, Instituto de Química, Universidad Nacional Autonoma de México, Coyoacan, México City, México

María Santos Cervantes, Instituto de Química y Ciencias Biologicas, Universidad Autonoma de Sinaloa, Culiacán Sinaloa, México

Matthew Hemm, Department of Biochemistry, Purdue University, West Lafayette, Indiana, USA

Ramón Robles Zepeda, Unidad de Biotecnología e Ingenieria Genetica, Centro de Investigación y de Estudios Avanzados, Irapuato, Guanajuato, México

Andrew Burt, Ottawa-Carleton Institute of Biology, University of Ottawa, Department of Biology, Ottawa, Ontario, Canada

Travis Walker, Department of Horticulture and Landscape Architecture, Colorado State University, Fort Collins, Colorado, USA

Octavio Morales Calvo Gomez, Unidad de Biotecnología e Ingenieria Genetica, Centro de Investigación y de Estudios Avanzados, Irapuato, Guanajuato, México

Rocío Ivón Ventura-Perez, Departamento de Ecologia Vegetal, Instituto de Ecologia A.C., Antiqua Carretera a Coatepec, Xalapa, Veracruz, México

Maria del Pilar Nicasio, Centro de Investigación Biomédica del Sur, Instituto Mexicano del Seguro Social, Xochitepec, Morelos, México

Best Student Presentations

Matthew Hemm, Department of Biochemistry, Purdue University, West Lafayette, Indiana, USA

Ileana Echevarria Machado, Centro de Investigacion Cientifica de Yucatan, Mérida, Yucatán, México

THE UNKNOWN PHYTOCHEMIST

Why Didn't the Chemical Ecologist Cross the Road?*

In the last issue of PSNA News, one of our more enlightened colleagues contributed an anonymous article bemoaning the insidious nature of the terminology adopted by the emerging field of genomics. One can only guess at the identity of this misguided soul, but a bit of forensic investigation might shed some light on what makes this person tick. My approach here will be a type of criminal profiling - and make no mistake, the poorly disguised bluntness of the blows struck by this felonious, pseudoscientifically inclined boywonder were nothing short of criminal. The unfortunate victims of the dastardly culprit in this investigation are the brave-hearted pioneers willing to carve out new trails into previously uncharted territory. Such a flattering description could only be used to portray one type of modern day phytochemist - yes, I said *phytochemist* - the molecular biologist. Once again, this maligned group of dedicated scientists comes under attack from one of the "others". Years of involvement in phytochemical societies without any serious repercussions have led molecular phytochemists to believe that they were becoming accepted into the sacred world of "gag-me-with-a-benzene-ring-and-show-me-structures-until-I-puke" natural products research. Anyway, I'm getting off track here. It is important to stay focused on the task at hand. Who was that masked stranger who so viciously preyed on the weakened psyche of the Genome Junkie?

In the absence of DNA evidence, an ill-fitting glove, or a Ford Bronco, we're left to consider the personality of our perpetrator. First, the original incarnation of the Unknown Phytochemist was clearly male. [*Editor's note - there's no way I can publish the explanation of how the*

author of this article determined the gender of the previous Unknown Phytochemist. Let's play nice now, boys and girls.] Secondly, this guy didn't have the [courage] to identify himself. He waited for a suitable opportunity to hide behind a fortress of anonymity. *Spineless* is a word that comes to mind. Third, our culprit seems to have considerable time on his hands judging by the daft nature of the comments he took pains to write down. He would also appear to think that he is humorous in a Johnny Carson kind of way (i.e. wait for the laugh before you go on). I'm guessing he probably looks a bit goofy, has a fetish for Birkenstock sandals, and prefers a wine cooler over a Bud.

Alas, only one type of beast fits the aforementioned description - the dreaded chemical ecologist. Now, this is not intended to be an unsubstantiated attack on chemical ecologists.= Rather this is meant to be an unsubstantiated attack on ecologists in general. These researchers are undoubtedly valuable members of our Society and make important contributions to our overall understanding of phytochemical processes. Moreover, some might argue that it would be inappropriate to single out an entire group of scientists based on such limited evidence or in response to the opinions of a single individual. But, who cares, I'm going to do it anyway because, well, someone needs to be victimized in this ridiculous feature condoned by the Newsletter Editor. [*Editor's Note - Hey, don't blame me. I agreed to it the first time as a forum for the membership to express their views. I had no idea you would all start taking shots at one another. At least, not so soon. Anyway, I need articles so I'll print anything.*]

So, how can I pick on ecologists? One hardly knows where to begin. To maintain a shred of credibility in this article, I'd like to focus on something simple - the way ecologists handle data. Actually, this brings up an even larger issue - how everyone handles data! The way ecologists treat data is at one extreme of the analytical spectrum due to their overbearing preoccupation with - you might want to be seated before reading this - *statistics.* Molecular biologists learned long ago that statistics are a complete waste of time. If your northern blot looks good the first time you do it, why screw it up by doing it again? The second attempt will probably only look worse than the first one, anyway. And, in any case, you can't do a freaking chi-square or ANOVA analysis on a northern blot. You might think that molecular biologists are at the other end of the statistical spectrum with respect to ecologists. But wait! There

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is another. How many times have you seen a paper reporting the content of some natural product in a plant? The graph shows a convincing increase over time, for example, but each data point is, well, a point - nary an error bar to be found. This suggests that the amount of said product is *exactly* said amount in said plant - end of story. Of course, when *you* repeat the experiment your results are completely different than those reported previously. But, their work is published and yours is not. Our phytochemical forefathers have left quite a legacy in this regard. A little (emphasis on *little*) statistics would help a lot. But, as the saying goes, you can always have too much of a good thing.

Ecologists have the uncanny ability to take a whole lot of incomprehensible data, grind it through an arsenal of statistical programs, and *voila*, they can come up with a conclusion - e.g. yes, bears do, indeed, sleep in the woods! *Holy crap!* How do they do that? If my northern blot doesn't work, I'm screwed. *It doesn't work!* I mean, there's nothing on the [profanity] film - or worse. One can't help but get the impression that no data is bad data to an ecologist. All it needs is a little statistical analysis, a little TLC, and out pops a trend. Man, I wish I could do that the next time my 2-D gel shows nothing more than a great, big [more profanity - worse than before] blob of total [excrement]. However, it seems that the transformation of incomprehensible data into publishable figures is not enough. New developments in the art of data analysis in the ecological community continue to emerge. According to my ecologist colleagues, the way graphical data is presented is about to be turned on its ear. Apparently, we've been doing it all wrong - bar graphs, line graphs, the whole enchilada. For example, the new ecology cannot accept the use of *bars* in a *bar* graph. The inflexible environment of a typical journal page forces a bar to be drawn as a two-dimensional object - a *faux pas* according to ecological doctrine. That nasty x-component of a data point that has only a y-value confounds the utility of a bar for anything other than happy hour. For example, the hypothetical graph depicted in Figure 1A is now completely unacceptable. Instead, the data must be shown only as a point representing a y-value (with appropriate statistical overkill, of course), but dispensing with that nasty x dimension as shown in Figure 1B. But, wait, I say. Even the lowly *point* has both x and y dimensions. So, I muse, there is really only one way of properly depicting ecological data, as shown in Figure 1C. Clearly, the results shown in Figure 1A are exactly the same as those shown in Figure 1C. Such a format also dispenses with the need to show *any* statistical analysis, which is conveniently embedded in the data.

Okay, I have to get back to sequencing a genome, mining a transcriptome, analyzing a proteome, and trying to bugger up a metabolome. So I'll end my rant on that note. To conclude, I should say that despite the content of this article and the fact that, like my predecessor, I am a coward and want to remain anonymous, I have nothing but the utmost respect for chemical ecologists. Without them we would never know what our favorite natural products are really doing in the plant. So, whom are we going to pick on next?

*He decided to create a computer model and predict what was on the other side instead.

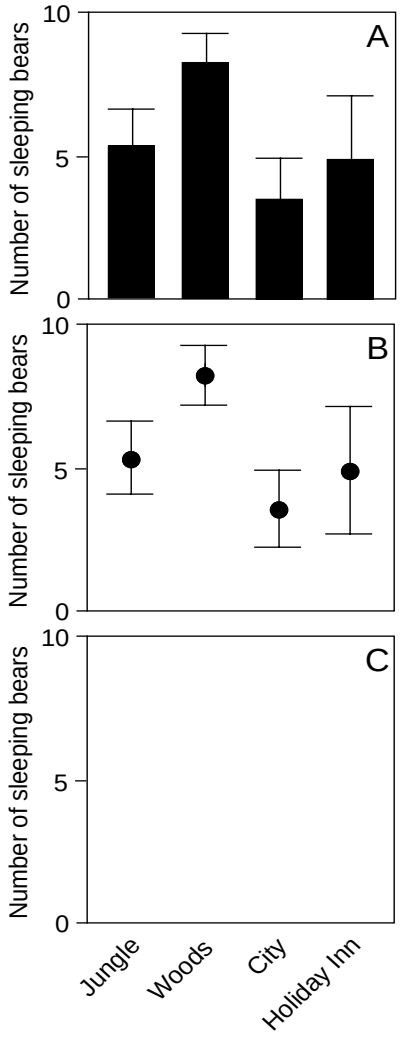

Figure 1. Number of sleeping bears in different places.

Do you have a "strong" opinion about a phytochemical issue that you wish everyone could read, but don't want anyone to know its you? The Unknown Phytochemist column might be just what you've been waiting for. All submissions will be carefully edited for good taste according to the Editor's tolerances, which just so happen to extend pretty far - the Editor.

2002 ANNUAL MEETING STUDENT AWARD WINNERS

Best Student Presentations

This year's winners of the Best Student Paper Award at the PSNA Annual Meeting were Matthew Hemm from Purdue University and Ileana Echevarria Machado from the Centro de Investigacion Cientifica de Yucatan. Below are brief profiles on these two outstanding students.

Matthew Hemm

I am currently a doctoral student in Dr. Clint Chapple's lab at Purdue University. I came to Purdue from the College of William and Mary, a small liberal arts college in Virginia. Having been interested in plants since my early teens when I read books like *Stalking the Wild Asparagus* by Euell Gibbons, I took all the plant science classes offered at William and Mary. I was especially fascinated by the biochemical reactions catalyzed by plants. At the end of my undergraduate career I was interested in continuing my education at a university that offered a wide spectrum of plant biochemistry classes and research opportunities. After visiting Purdue and talking to Clint, Dr. Klaus Herrmann, and other professors, I was impressed by the research going on at Purdue and by the attitude and interests of the professors with whom I spoke. In 1998, I started as a graduate student in the Purdue Plant Biology Program and, soon after, entered Clint's lab.

I will always remember Clint first telling me that genetics is a useful tool for investigating plant biochemistry. It's a little embarrassing for me to remember how skeptical I was of his statement at the time. The past four years of researching phenylpropanoid metabolism through the analysis of mutants blocked in sinapate ester biosynthesis has taught me the value of genetics in investigating biochemical questions.

The focus of my Ph.D. research has been to characterize the block in phenylpropanoid metabolism in the *ref2* (*reduced epidermal fluorescence*) mutant. This mutant was isolated along with a number of other independent *ref* mutants in a screen for plants that show reduced fluorescence under UV light. In all of these mutants, the reduced fluorescence was found to be the result of reduced levels of sinapoylmalate, a hydroxycinnamic acid ester accumulated in Arabidopsis leaves. To understand how the *ref2* mutation leads to this and other phenylpropanoid phenotypes, I isolated the gene by positional mapping and identified it as the cytochrome P450 monooxygenase CYP83A1. The identification of *REF2* as *CYP83A1* was unexpected, considering that CYP83B1, the closest homologue to CYP83A1, had been shown to be involved in the biosynthesis of glucosinolates, another family of secondary metabolites accumulated in Arabidopsis. In light of these results, I revisited the phenotypic analysis of *ref2* plants. Decreased levels of glucosinolates in *ref2* tissues suggested that CYP83A1 also plays a role in glucosinolate biosynthesis, specifically in the production of glucosinolates derived from methionine. Investigating this unexpected link between glucosinolate and phenylpropanoid phenotypes in the *ref2* mutant has been stimulating, and has provided many hours of spirited debate in the lab.

When I'm not discussing data with lab members, my wife and I enjoy escaping from our respective studies by camping in the parks around Indiana. Although we are both only novices, we love the chance to get away from civilization for a while and relax. She nicely tolerates my diversions into investigating interesting plant life, and in exchange I carry her equipment.

I would like to take the opportunity to thank her, Clint, and all past and present members of his lab for their advice and assistance during my graduate school career.

Ileana Echevarría-Machado

Ileana Echevarría-Machado was born on October 2, 1966 in La Havana, Cuba. Married with two children

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MERIDA IN PICTURES

Or How I Spent My Summer Vacation

An old church.

I think I'm lost.

Hey! Get out of my shot.

The conference wasn't the only place with a lot of bull.

A new thing...but, we're supposed to think its old.

Statue of some guy near Wal-Mart. Even in México, it's your preferred source for cheap plastic crap.

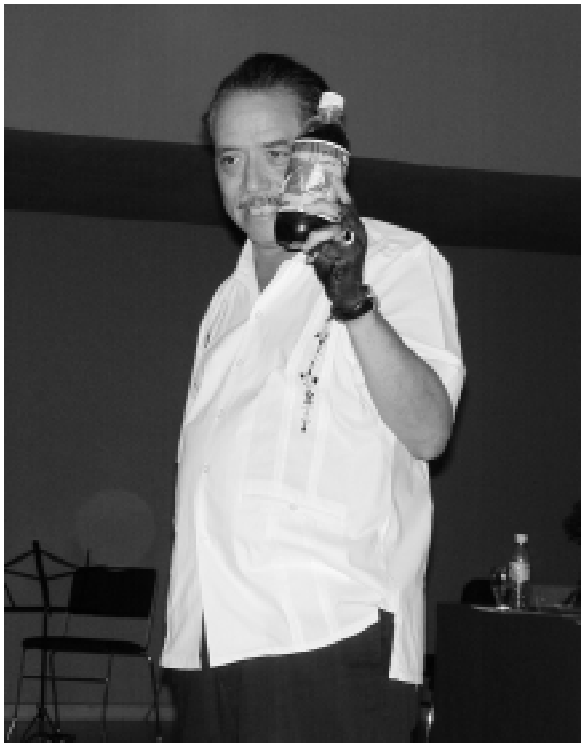
MEMORIES OF MÉRIDA

The 2002 PSNA Annual Meeting: Science with Salsa

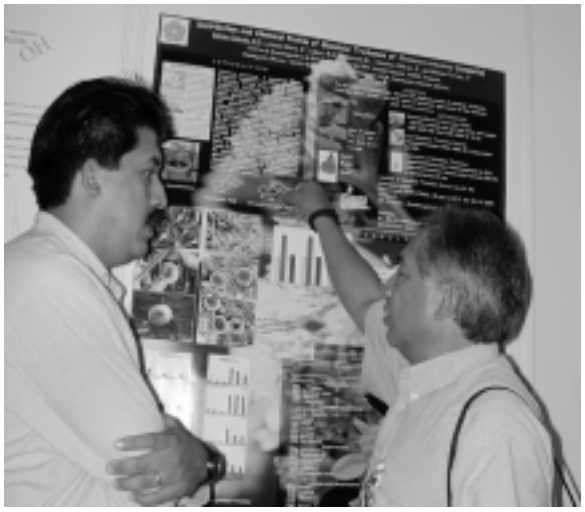
Great entertainment at the Opening Ceremony.

Felipe Vazquez halfway through his 4-hour banquet speech.

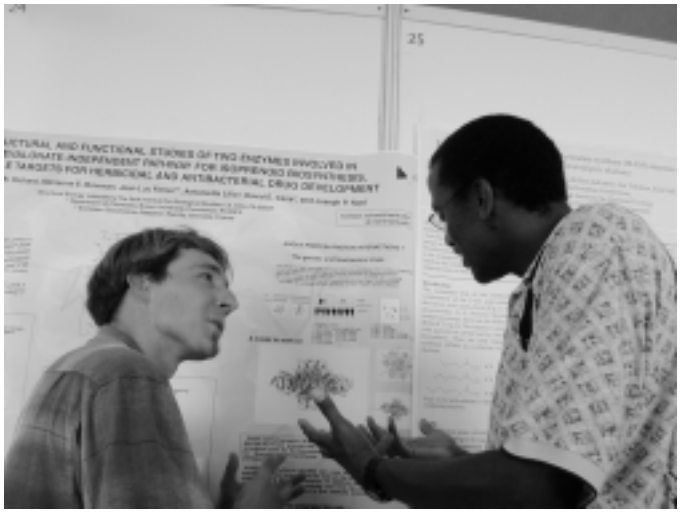
The Three Amigos. What's so funny boys?



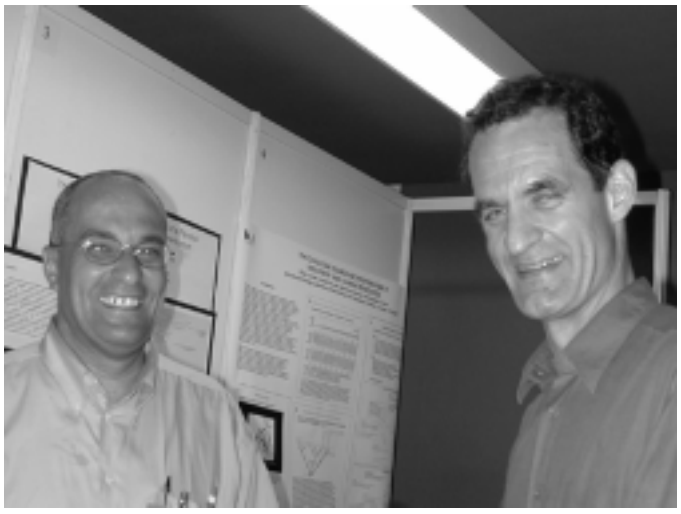
Eloy Rodriguez. The Amazon. Viagra. Purple hands. Trust me...you had to be there.



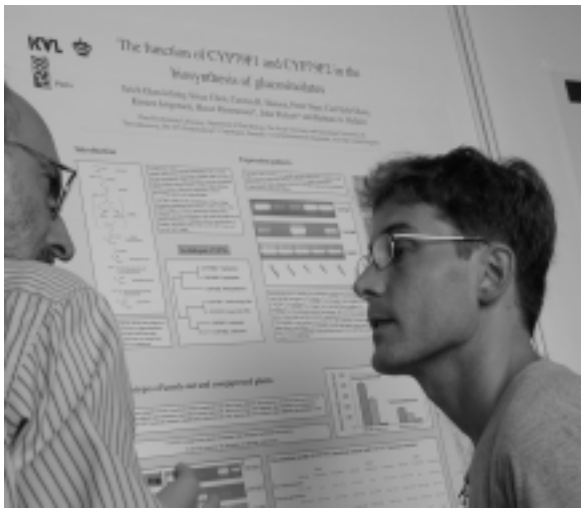
Most discussions were friendly...



...but, the passion of a phytochemist is hard to contain.



Mamdouh Abou-Zaid and Jonathan Gershenzon.



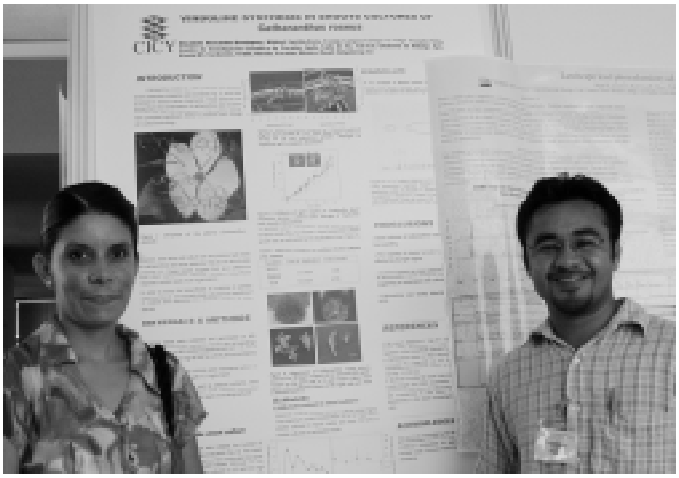
Erich Glawischnig gabbing about glucosinolates.

Dittrich Ober and Hector Flores.

Tour of the Botanical Garden at CICY.

MORE GREAT MOMENTS IN MÉXICO

Can't Wait Until Next Year!



Elisabeta Hernández and Freddie Campos from CICY.

Charles Cantrell ensured his place as the most popular Executive Committee member by handing out checks.

Everything was going great until someone yelled "food fight"!

NEISH YOUNG INVESTIGATOR MINISYMPOSIUM

Speaker profiles

Jorge Vivanco

Jorge Vivanco is an Assistant Professor in the Department of Horticulture at Colorado State University, where his research group studies the biology, biochemistry and ecology of root exudates under a multidisciplinary umbrella. The different projects at Dr. Vivanco's laboratory encompass the root secretion of bioactive secondary metabolites and proteins, with a special emphasis on ribosome-inactivating proteins (RIPs). Additionally, Dr. Vivanco's group is undertaking a metabolomics approach to study the chemical diversity of secondary metabolites present in the root exudates of model plant species such as Arabidopsis. Dr. Vivanco is the recipient of a National Science Foundation Early Career Development (NSF-CAREER) award for his work on RIPs. At Colorado State University, Dr. Vivanco teaches a course on bioactive compounds from plants, which includes an NSF-funded internship to international centers of agricultural research such as the International Potato Center in Lima, Peru.

Dr. Vivanco obtained his B.Sc. degree in Agronomy at the Universidad Nacional Agraria La Molina in Lima, Peru. During this time he did research at the International Potato Center on the effects of RIPs against potato viruses. He then moved to the Pennsylvania State University where he obtained a Ph.D. degree in Plant Pathology under the supervision of Dr. Hector Flores. His dissertation focused on the isolation and characterization of an RIP from an endangered Andean root crop. This project was originally funded by the McKnight Foundation Collaborative Crop Research Program to study the biology of underutilized Andean root crops. After finishing his Ph.D., he joined the group of Dr. Nilgun Tumer as a post-doc in the Biotechnology Institute at Rutgers University to study, in detail, the mechanism of action of RIPs on viral RNAs and mRNAs.Over the last eight years Dr. Vivanco has researched and published several studies focus on bioactive proteins and secondary metabolites produced by plants at the biochemical, physiological, molecular, ecological and applied levels.

Dr.Vivanco's program is currently combining metabolomics, genomics and proteomics to evaluate the potential of a new method of drug discovery by using the inducible biosynthetic and secretory capabilities of the roots to discover new antimicrobials, anticancer and herbicidal compounds, and value-added volatiles.

Sergio Peraza-Sanchez

Dr. Sergio R. Peraza-Sanchez is a Research Associate at Centro de Investigación Científica de Yucatán (CICY) in Mérida, México, the same city where he was born in 1961. In 1986, he obtained a first class honors B.Sc. degree in Industrial Chemistry from the University of Yucatan, having carried out his thesis at CICY. He joined CICY as a Research Assistant in 1987 in the project. "Synthesis of prednisone from hecogenine isolated from henequen plant (*Agave fourcroydes*)". In 1989, he obtained a M.Sc. degree in Phytochemistry from the Monterrey Institute of Technology and Higher Studies (ITESM) in Mexico, under the supervision of one of the most recognized Mexican phytochemist leaders, Prof. Xorge A. Dominguez. After the completion of his M.Sc. degree, in 1990 he joined the Organic Chemistry Department of CICY as a Research Associate working on a project entitled "Detection, isolation, and identification of bioactive metabolites produced by medicinal plants of the Yucatan peninsula". During this time he acquired more experience on the screening and preparation of extracts, using chromatographic and spectroscopic techniques, and establishing different bioassays to direct the process of fractionation, including toxicity against *Artemia salina* and antimicrobial activity. While in CICY, he also acted as the director of three undergraduate theses and gave lectures on Organic Chemistry at the University of Yucatán. Sponsored under the terms of a British Council Scholarship, in 1994 he travelled to Scotland where he stayed four months as a visiting scholar to undertake a course in theory and interpretation of NMR and MS spectroscopy given by Prof. Peter G. Waterman at the Phytochemistry Research Laboratories, Department of Pharmaceutical Sciences, University of Strathclyde. Wishing to acquire more experience and grow as an independent researcher, in 1996 he entered a Ph.D. program in pharmacognosy given at the College of Pharmacy, University of Illinois at Chicago. There, for his thesis dissertation, he worked with extracts of two plants exhibiting cytotoxic activity to isolate new chemical leads with anticancer activity under the guidance of Prof. A. Douglas Kinghorn, editor in chief of one of the most prestigious journals, the *Journal of Natural Products*. In 2001, he returned to Mexico to join his former Chemistry group at CICY where he is currently working as a Research Asso-

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ciate. His main research interest includes the isolation and identification of chemical compounds with antiprotozoal activity produced by native plants collected in the Yucatan Peninsula, with the hope that they can be developed as new drugs to fight the diseases caused by *Leishmania mexicana*, *Trypanosoma cruzi*, and *Giardia lamblia* that affect a large number of local people. For his project, he is getting support in Mexico from the National Council of Science and Technology (Conacyt), and he has been awarded with an International Foundation for Science (IFS) grant. At the present time, he is the director of three undergraduate theses and one graduate thesis (Ph.D.), and he also supervises students from the University of Yucatan carrying on experimental work as part of their undergraduate program in Chemistry. He has been invited to give a series of lectures on natural products isolation at the University of Yucatán and Technical Institute of Mérida. He has also participated in several national and international meetings on the chemistry of natural products. He currently is a member of the *American Society of Pharmacognosy*, *Phytochemical Society of North America*, and *Chemical Society of Mexico*. He is the author of 11 research papers.

Melina López Meyer

Melina López Meyer began her work on natural products as an undergraduate at CICY in Yucatán, México working on the production of thiophenes in *in vitro* cultures of transformed roots of *Tagetes* sp. She obtained her M.Sc. Degree at CICY under the supervision of Dr. Carlos Oropeza and Dr. Jorge Santamaría. By working on this project, Melina gained experience in plant tissue culture and several phytochemical techniques. During this time, Melina became fascinated with the world of plant natural products. In the last year of Melina's M.Sc. program several well-known researchers in plant secondary products were invited to a plant secondary metabolite workshop at CICY. It was then that Melina was introduced to Dr. Craig Nessler, who attended the workshop as one of the major speakers. Two years later, Melina started her Ph.D. studies at the Biology department of Texas A&M University at Dr. Nessler´s lab. At this time, Melina was interested in using a molecular biology approach to learn about plant secondary compound pathways. She worked on the isolation and characterization of tryptophan decarboxylase genes from the Chinese tree *Camptotheca acuminata*. These genes are involved on the early steps of the biosynthesis of the indole alkaloid camptothecin, which has been used as an anticancer drug. After her Ph.D., Melina started a 3 year postdoctoral stay in Dr. Nancy Paiva's lab at the Noble Foundation in Ardmore, Oklahoma working on the cellular and subcellular localization of vestitone reductase, which is an enzyme involved in one of the latest steps of the biosynthesis of the phytoalexin medicarpin in alfalfa. After her training on plant tissue culture, phytochemistry and molecular biology during her M.Sc. and Ph.D. studies, Melina saw her postdoctoral project as a good opportunity to work on the plant secondary metabolites field using cell biology as an approach. During the second part of her stay at the Noble Foundation, Dr. Paiva gave Melina the opportunity to get involved in some other projects. One of these projects caught Melina's interest.

Melina had been working with vestitone reductase in alfalfa. This enzyme specifically reduces (–) vestitone in such a way that the plant accumulates (-) medicarpin. On the other hand, peanut produces (+) medicarpin exclusively. Dr. Paiva had made some previous studies demonstrating that alfalfa pathogens were more susceptible to (+) medicarpin, which is the isomer not produced endogenously in alfalfa. Using a biochemical approach Dr. Paiva predicted the existence of a (+) vestitone reductase and an epimerase in peanut. With the long term goal of engineering alfalfa plants producing both isomers in order to increase their pathogen resistance, Melina worked on the isolation of vestitone reductase from peanut, since previous studies in Nancy's lab indicated that this enzyme was the key step in conferring stereospecificity. By screening a fungal pathogen induced cDNa library from peanut, Melina isolated two different putative peanut vestitone reductase genes. These genes were then expressed in *E. coli* to test their enzyme activity. Surprisingly, both vestitone reductase clones reduced (-) vestitone but not the (+) isomer. Several explanations may account for these observations and more work was required at this point of the project. The finding of a third putative vestitone reductase from an EST project put Melina in contact with the technology of high throughput sequencing and macroarrays.

Melina went back to Mexico, and although she could not get to the end of the peanut vestitone reductase project, the good chances of future collaboration with Dr. Paiva along with her interest in beginning her own research line on plant secondary products keeps her attention and enthusiasm focused in this fascinating field.

Argelia Lorence

Argelia Lorence started her training in 1991 at the Metropolitan Autonomous University (UAM, Mexico) and completed her Bachelor's degree majoring in Biochemical Engineering. She completed an undergrad project and thesis regarding the financial and technical feasibility of producing insect resistant tomato seeds in Mexico

under the guidance of Prof. Rodolfo Quintero. During this time Dr. Quintero was a full time professor at the Biotechnology Institute (IBT) of the National Autonomous University of Mexico (UNAM, Cuernavaca, Mexico), and also the Program Director of the Biotechnology Program for Latin American Countries of the United Nations. This undergrad project was her first contact with plant molecular biology, a path she would continue later on during her professional career. Argelia collaborated for a year with Prof. Quintero as an independent consultant in the United Nation's program cited above. After that period, she joined Prof. Quintero's laboratory at IBT-UNAM where she got her Master's (1995) and PhD (1997) degrees, under the guidance of Professors Quintero and Alejandra Bravo. Her research involved the development of a methodology to study the pore formation activity of the Cry proteins produced by *Bacillus thuringiensis* (*Bt)* on vesicles extracted from the midgut of several pest insect species of importance for Mexican agriculture. She successfully developed a methodology that monitors changes in fluorescence. These changes were caused by the distribution inside and outside the vesicles of a fluorescent dye that moves according to changes in the membrane permeability. Her Ph.D. work also involved the characterization of the pores formed by Cry1Ac wild type toxin and some pore-forming defective Cry1Ac mutants in the presence of its receptor from the cabbage looper (*Trichoplusia ni*) using planar lipid bilayers.

In 1998 Dr. Lorence joined the medicinal plant research group of the Research Center of Biotechnology (CEIB) of the Autonomous University of the State of Morelos (UAEM, Cuernavaca, Mexico) as an Associate Professor. There she started a research group focused on plant metabolic engineering using *Camptotheca acuminata*, the joy tree, as a model system.

For two years her efforts were focused on submitting grants, and teaching undergraduate and graduate courses. In 1999, she was awarded a grant for young scientists from the Mexican Council of Science and Technology (CONACYT) to metabolically engineer *C. acuminata* cell suspensions. This project was a collaboration with Prof. Craig Nessler, who was, at that time, a full time professor and Associate Head of the Department of Biology of Texas A&M University (College Station, TX). Dr. Lorence joined the Nessler lab in January of 2000 with the objective of over-expressing some of the genes that encode for the rate-limiting enzymes of the camptothecin (CPT) biosynthetic pathway into *C. acuminata*. After spending seven months working in Texas, the Nessler lab moved to the Department of Plant Pathology, Physiology and Weed Science (PPWS) of Virginia Polytechnic Institute and State University (Virginia Tech, Blacksburg, VA), where Dr. Lorence completed part of her research and moved back to Mexico in June of 2001. While working in Blacksburg she developed *C. acuminata* hairy root cultures that produce CPT and the water-soluble derivative 10-hydroxy CPT.

Back in Mexico, she continued with her *Camptotheca* research and teaching responsibilities in addition to starting new collaborations. One of these projects focused on the characterization of the pore formation activity of tricolorins, a family of oligosaccharides with herbicidal properties produced by plant species belonging to the morning-glory family (*Ipomoea* sp). This collaborative effort with Prof. Rogelio Pereda-Miranda (Department of Pharmacy,Faculty of Chemistry-UNAM) is part of the PhD work of Ricardo Villatoro-Vera. Using the system Dr. Lorence developed as a graduate student, they were able to generate evidence that strongly suggests tricolorins affect the membrane of other plants, bacteria and other competitors making non-specific pores. Dr. Lorence presented part of the evidence at the Neish Minisymposium for Young Investigators at the PSNA meeting of 2002.

In April of this year Dr. Lorence decided to accept the invitation of Prof. Nessler to rejoin his lab at Virginia Tech where she continues with her research work as a senior post-doc. Her current research is focused on vitamin C production in plants and alkaloid biosynthesis in *Camptotheca* and opium poppy.

Wolfgang Schühly

Wolfgang Schühly studied chemistry and biology at the University of Freiburg / Germany. He graduated in 1994 with a Diploma in Chemistry. In 1995 he joined Prof. Otto Sticher's group at the Swiss Federal Institute of Technology (ETH) Zurich, Switzerland working for his Ph.D. in natural products chemistry. His dissertation focused on the Brazilian medicinal plant *Zizyphus joazeiro* and performed isolation and structural elucidations of triterpenes and saponins and established biological assays (antibacterial and antifungal). He was also responsible for the education of some pharmacy students in practical and theoretical aspects of phytochemistry. In 2000, he came to the United States and joined Prof. Nikolaus Fischer's research group as a postdoctoral fellow at the University of Mississippi. His phytochemical work includes studies on North American members of the Magnoliaceae and Asteraceae and on some alkaloid-containing plants.

In his lecture, W. Schühly presented results from his research on *Magnolia* species from the Southeastern United States. The genus *Magnolia*, which comprises several well known and medicinally important species in Eastern Asia is represented by

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PSNA MEMBERS IN THE NEWS

Rick Dixon Listed Among Top 15 Plant Researchers Worldwide

The past president of the PSNA has been recognized as one of the top 15 plant and animal researchers most cited worldwide over the past decade. Dr. Richard A. Dixon, director of the Noble Foundation's Plant Biology Division, and other top-cited researchers were honored during an awards gala reception in New Orleans in April.

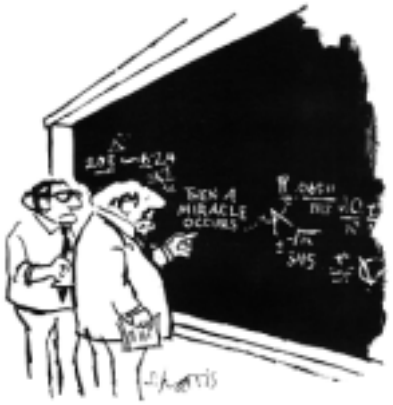
"I am surprised but honored by this award," said Dixon. "It is good to know that the work you do is being read and considered important by others. The excellent support from the Noble Foundation has been a major factor in enabling me to put together the body of work on which this award was based. I also have a wonderful group of highly talented postdoctoral fellows, technicians and collaborators."

Dixon's research program centers on understanding how plants produce natural products, and how this understanding can be applied to generate improved plants. The following are of particular interest: 1) isoflavonoids, which help protect legumes from fungal infection and may also be beneficial to human health through their phytoestrogen activity; 2) triterpenes, complex molecules that act as antifeedants and can negatively affect forage quality, but which also have potential as lead compounds for anticancer agents; 3) lignin, a cell-wall polymer that negatively affects digestibility of forage legumes and grasses; and 4) condensed tannins that help improve ruminant nutrition and reduce pasture bloat, as well as providing a range of potential health benefits to humans.

Over the past five years, Dixon's group has discovered many of the genes involved in making these complex molecules, and has provided proof of principle for improvement of forage crops, particularly alfalfa, through genetic modification of the corresponding pathways.

"I see important applications of this work for increasing crop yields through improved disease resistance and providing a true scientific basis for human preventative medicine based on dietary intake," said Dixon. The Indicators ranking is based on total citations to papers indexed from 1991 through October 2001 by ISI, inventors of the Web site evaluation tool, ISI Essential Science Indicators[SM], which was used to identify the top-ranking scientists.

THE "I NEED SOMETHING TO FILL THIS SPACE" SECTION



"I think you should be more explicit here in step two."

"...and, as you go out into the world, I predict that you will, gradually and imperceptibly, forget all you ever learned at this university."

2002 ANNUAL MEETING SUMMARY

The Annual Meeting of our Society was held in Mérida México from July 20 to 24. The Conference was hosted by Centro de Investigación Científica de Yucatan (CICY) and a total of 92 phytochemists from seven different countries attended it. This year´s theme was *Phytochemistry as Integrative Biology: From Ethnobotany to Molecular Ecology*. Works were held at the Hotel *El Conquistador de Montejo* and included five symposia, five plenary talks as well as a poster session. During the Opening Ceremony, which took place on a rainy Saturday evening and was presided by Dr. Alfonso Larqué, CICY's General Director, Eloy Rodríguez (Cornell) presented to us a very interesting point of view about the underlying reasons for our interest in natural products. Eloy mentioned during his talk (of course as a joke), such interest is because natural products make us feel better, either providing us relief from pain or disease, or due to their stimulant properties. On the serious part of his talk, Eloy showed us several examples of the chemical composition of some of the remedies used by the inhabitants of the rain forest of South- and Central America.

On Sunday morning, Rick Dixon chaired the symposium on phenolics which covered aspects regarding the enzymology of flavonoid biosynthesis, its transcriptional regulation, the 3-dimensional architecture of the methyltransferases involved and the ecological relevance of polyphenols. Barbara Timmerman (University of Arizona) presented the inside of the Program on International Cooperative Biodiversity Group. This 9 year program groups Universities from Argentina, Chile, Mexico and the US. During the afternoon session, coordinated by Lourdes Miranda (CICY), a total of 50 posters were presented and discussed. Among them, 15 were competing for two awards. Monday morning was devoted to terpenoids. This symposium was chaired by Edmundo Lozoya (CINVESTAV Irapuato, Mexico) and included talks on the enzymatic basis for their diversity, as well as a new type of methyltransferase involved in their biosynthesis. Other topics covered aspects related to the synthesis of taxol and other biologically active terpenes as well as their importance as medicinal drugs. Monday morning plenary talk was given by Xavier Lozoya, (IMSS, Mexico) who exposed his points of view on the necessity to integrate the traditional knowledge of medicinal plants in the developing of new drugs derived from plants. Glucosinolates were reviewed on Monday afternoon having Jonathan Gershenzon (Max Plank, Jena) as the chairman. Topics related to the medical properties, ecophysiological roles, biosynthetic pathway evolution, and distribution of glucosinolates in plant tissues were discussed. The session closed with a talk by John Rossiter (Imperial College) on the new myrosinase from cabbage aphids. The now traditional Arthur Neish Young Investigator Symposium took place on Tuesday morning. Five young scientists from Mexico and the US, four of them Latin-Americans, participated in this session which was chaired by Luis Manuel Peña (CICY). The last plenary talk was by Jonathan Gershenzon who presented a fascinating study on the formation and function of the terpenes volatilized from *Arabidopsis* leaves. Alkaloids were the topic of the last symposium on Wednesday morning. This session, chaired by Vince De Luca (Brock University), had a nice attendance, despite the animated banquet we had the night before! Speakers covered the recent advances in the synthesis and regulation of indole and benzyisoquinoline alkaloids, as well as the role of the pyrrolizidine alkaloids in plant-insect interactions. Finally, an interesting biotechnological approach towards the production of decaf coffee beans was also presented as part of this session.

Overall, the participants considered this a very productive meeting. For many of them, this was their first experience at a PSNA meeting. Everyone should consider making a serious commitment to continue their participation!

Felipe Vazquez-Flota
CICY
Mérida, México
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President's Letter

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natural resources can be used to promote incentives for conservation by providing an economic return on the sustainable use of those resources. This is true even when natural compounds are used as models to synthesize new drugs or when they are produced by biotechnological methods.

During our recent meeting several research projects were presented, including those underway at the University of Arizona, Cornell University, the Chemistry Institute at the National University of Mexico, and the Mexican Institute of Social Security. These programs provide tools to achieve the goal of sustaining the use of natural resources in relation to the preservation of medicinal plants. These programs are providing the tools to governments to put plants into a prominent position in the list of national priorities, particularly in countries that possess an extensive biodiversity. These research programs must have an integrative approach - in particular, from ethnobotany and pharmacology to the knowledge of how plants synthesize natural compounds. Moreover, models of how new potential drugs are tested must be revised. PSNA members now have the challenge to contribute to the discovery or the synthesis of new natural pesticides and herbicides in order to decrease the introduction into the environment of harmful chemicals. The Arthur Neish Young Investigator Symposium carried out during our meeting, was an example of how new lines of research can provide solutions to the search for new compounds with biological activity. The use of new paradigms can lead to the discovery of new compounds. For example, new emphasis must be put into the pharmacological properties of some proteins and peptides excreted by the roots of the plants, which is a largely unexplored biological frontier. Also, an understanding of how some secondary metabolites work can provide tools for the development of new drugs. Basic knowledge must be the cornerstone for these new developments.

Advances in chemical ecology must continue to provide knowledge on plant-plant, plant animal, and plant-microbe interactions at the chemical level. Molecular biology must help to find answers to questions that the chemical ecologists create - for example, how did the molecules for signal transduction appear during evolution? How are they synthesized and how is their production controlled? Why were some organisms able to acquire resistance against toxic substances, whereas others were not? The scenario for our work cannot be better. I encourage you to take up the challenge and add your grain of sand.

Víctor Manuel Loyola-Vargas
Centro de Investigación Científica
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MEETINGS OF INTEREST TO PHYTOCHEMISTS

Phytochemistry and Biology of Lignans
April 6-9, 2003
Near Cologne and Düsseldorf, Germany

For more information contact:
Maike Petersen
(petersen@mailer.uni-marburg.de)

Phytochemistry of Marine Organisms
September 21-26, 2003
Chania, Crete, Greece

For more information contact:
Vassilios Roussis
(roussis@pharm.uoa.gr)

Plant Chemotaxonomy
July 2-4, 2003
Kew, London, UK

For more information contact:
Monique Simmonds
(M.Simmonds@rbgkew.org.uk)
or Renee Grayer
(R.Grayer@rbgkew.org.uk)

The Changing Face of Natural Products Chemistry
July 12-16, 2003
Chapel Hill, North Carolina, USA

For more information contact:
Nicholas Oberlies
(oberlies@rti.org)

Business Meeting Minutes

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Student Travel Award regulations require modification since under the current scheme all students who attend the annual meeting receive a proportion of the available funds. Clearly, some students attending the meeting are in greater need of support than others. Moreover, it was proposed by the Executive Committee that the Student Travel Awards be allocated through a competitive process. The value of each award should increase to at least $500 depending on need, and the total number of awards should be between 6 and 10. A committee would be appointed to solicit applications and select successful candidates. The committee would be composed of two regular members, serving three-year terms, and a third member from the local organizing committee of the subsequent annual meeting. The committee would endeavor to notify awardees in advance of the annual meeting to encourage more student participation, and provide an opportunity to solicit matching funds from other programs. There was general agreement to implement this change.

A significant deficiency identified within the Society is the presence of continuity on the Executive Committee and strong leadership. To this end, it was suggested that the composition of the Advisory Committee be immediately modified to include several prominent members. These members were identified as Vincenzo De Luca, Rick Dixon, Joe Chappell, and Jonathan Gershenzon. This group has agreed to function as Society advisors for the selection of future meeting sites and themes, the nomination and encouragement of future Executive Committee members, and the advisement of members on various issues. Rick Dixon has agreed to serve a second term as Past-President and will officially join the Advisory Committee in 2003. A suggestion to increase the term of the Society President from one to two years was met with mixed reviews. It was agreed to implement the other suggested changes first and debate the Presidency issue at a future meeting.

Peter J Facchini
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Ileana Echevarria-Machado

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(Luis Manuel,11 and Tatiana,1) she splits her time between lab experiments and house work. Ileana graduated in Biochemistry by La Havana University in 1989. Shortly after, she was offered a position at the Plant Physiology and Biochemistry Department of the National Institute for Agricultural Sciences (INCA) of La Havana. Since then and up to 1998, when she started her doctoral studies, Ileana worked on the biochemical mechanisms of tolerance to adverse environmental conditions in different crops including rice, potato and tomato among others. During that period, Ileana authored 10 articles which were published in different Cuban Journals and was awarded at the Youth Scientific Conferences held in INCA, Cuba twice in 1991 and 1992.

At present, Ileana is an advanced Ph. D. student at the Graduate Program on Plant Sciences and Biotechnology of the Centro de Investigación Científica de Yucatán, (Mérida, Mexico). She must obtain her degree before the end of this year. Her doctoral project focused on the role of polyamines during plant development and on its possible participation in signal transduction pathways which involve the enzyme phospholipase C. She has published three articles out of her results.

Wolfgang Schühly

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8 species in the United States. Some of them have long been used by Native Americans for the treatment of various ailments. *Magnolia* species contain a great variety of interesting and highly active compounds such as sesquiterpene lactones, lignans and alkaloids. His study focuses on the content of selected bioactive sesquiterpene lactones (e.g. parthenolide) in different *Magnolia* species and on the search for lignans, in particular, in *Magnolia grandiflora* and *M. acuminata*. After an overview of the chemistry of *Magnolia*, the emphasis in his presentation was on the lignans from *M. grandiflora* seeds focusing on known and new compounds and their various biological activities. These lignans (e.g. honokiol and magnolol) are compounds with strong anti-oxidant and antifungal activity which is shown in an assay with the anthracnose causing fungus *Colletotrichum* sp. Other biological assays include testing against phytopathogenic fungi. Among the sesquiterpene lactones, the focus was mainly on parthenolide, which exhibits a broad range of activities including the treatment of migraine. *M. grandiflora* is a rich and reliable source of parthenolide and its content in its different plant tissues was therefore investigated.

Wolfgang plans to continue research projects on chemically and ecologically interesting plants and on pharmacological properties of their constituents. His approach links the fields of botany and chemistry for a better understanding of what can be learned by observing nature.

PHYTOCHEMICAL SOCIETY OF NORTH AMERICA

Financial Report - January 1 to December 31, 2001

RECEIPTS:

Dues	$10240.00	(includes $2760 from meeting enrollees)
Plenum/Kluwer (Royalties)	3132.13	
Elsevier Royalties	2598.78	
Page Charges	3360.00	
Business Money Market interest	796.05	
Neish Symposium Acct. interest	687.10	
Fortis/Hartford money market dividend	3.90	
Book sales (RAP - Vol. 35 pre-pub. order)	3000.00*	
Volume 36 pre-publication order	6400.00*	
Volume 34 and 35 bulk orders	2476.00*	
2000 meeting advance return	2000.00	
TOTAL	$34693.96	

*Internal transfers, “taxable” $23293.96

EXPENDITURES:

Executive Committee		
Editor, RAP	$2500.00	(Volume 36 plus some toward Volume 35)
Secretary, newsletter	2000.00	
Treasurer, directory, dues notices, meeting/ballot mailing	1726.29	
PSNA 2001 Travel Awards	4400.00	(One check for $150 not yet cleared)
PSNA 2001 Presentation Awards	500.00	
Elsevier Bulk order, Volume 35	6881.25	
Returned dues check and fee	44.00	
TOTAL	$18051.54	

ASSETS:	(12/31/01)	(12/31/00)	(12/31/99)
Checking account	$4205.80	$2620.09	$4073.65
Business Money Market	41316.83	26951.12	32375.89
Neish Symposium account	25258.39	24571.29	24960.33
Fortis Money Market	113.50	109.60	103.49
Fortis Advantage*	10543.00	11476.74	11796.32
TOTAL	$81437.52	$65728.84	$73309.68

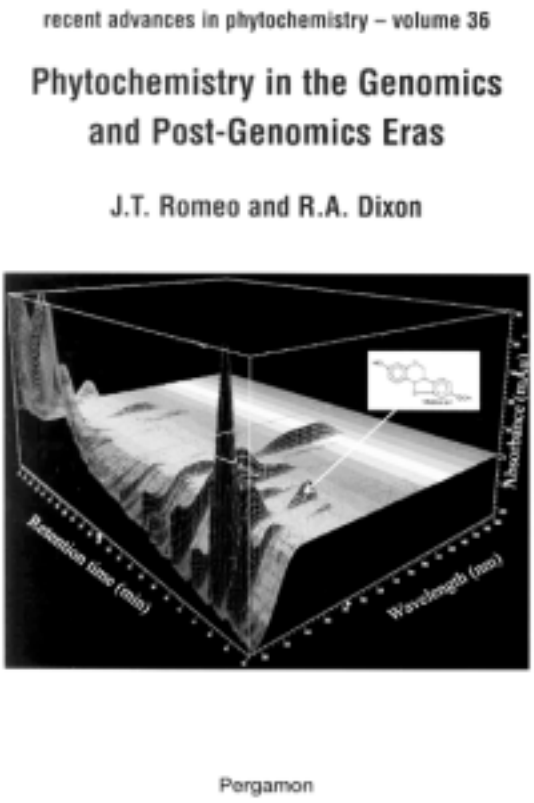
* Investment account, subject to fluctuation. Value down $319.58 in 2000 compared to 1999, and down $933.74 in 2001 compared to 2000.

Reviewed by:
Susan McCormick
Charles Cantrell

Elsevier Publishes Volume 36 of Recent Advances in Phytochemistry

Volume 36 of Recent Advances in Phytochemistry - *Phytochemistry in the Genomics and Post-Genomics Eras*, the symposium volume resulting from the 2001 PSNA Annual Meeting in Oklahoma City, OK is the third volume in this series published by Elsevier. Volume 36 centers on the role of phytochemistry in the rapid developments in biology brought about by the application of large-scale genomics approaches.

Genomics has altered the way in which we view plant biology by providing a global view of cellular processes. Sequencing programs are documenting expressed genes in many species, but we must still identify the function of most genes. Several functional genomic approaches can address plant gene function on a large scale. Plants are combinatorial chemists par excellence, and understanding the principles that relate enzyme structure to function will create unlimited possibilities to generate novel biologically active natural products. Knowledge of the molecular genetics of plant natural product biosynthesis will also facilitate pathway engineering for plant improvement and human benefit. Phytochemistry truly has a great future in the genomics and post-genomics eras.



Contributors to this timely volume explore a wide range of topics that include:

- ✓ Bioinformatics and computational biology
- ✓ Metabolomics as a component in functional genomic studies
- ✓ Metabolite profiling
- ✓ Biopanning by activation tagging
- ✓ Functional genomics of Cytochromes P450 and their role in biosynthesis
- ✓ Sequence-based approaches to alkaloid biosynthesis gene identification
- ✓ Structurally guided alteration of biosyntheses

The PSNA, under terms of our contract, can sell you this volume at a **40% discount**. To purchase Volume 36 please contact the Treasurer, Charles Cantrell.

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☐	**Volume 33 (1998)**	Phytochemicals in Human Health Protection, Nutrition, Plant Defense **(List $165.00, PSNA $99.00)**
☐	**Volume 32 (1997)**	Phytochemical Signals and Plant-Microbe Interactions **(List $95.00, PSNA $57.00)**
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Research Interests (circle up to 4 items):

A. Acetylenes
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H. Lignans
I. Lipids
J Nitrogen compounds
K. Nucleic acids
L. Organic acids
M. Phenolics
N. Pigments
O. Quinones
P. Stilbenes
Q. Sugars/polysaccharides
R. Sulfur compounds
S. Terpenoids
T. Vitamins
aa. Biochemistry/physiology of herbicides
bb. Enzymology
cc. Cell wall chemistry
dd. Chemotaxonomy
ee. Biotechnology
ff. Plant-insect interactions
gg. Plant-microbe interactions
hh. Plant-plant interactions
ii. Chemical reactions/organic synthesis
jj. Biochemistry of secondary metabolism
kk. Fungal metabolism
ll. Growth regulators
mm. Biochemistry/physiology of stress
nn. Industrial applications
oo. Structure identification
pp. Marine natural compounds
qq. Medicinal chemistry
rr. Membrane structure/function
ss. Molecular/immunological techniques
tt. Nitrogen fixation/metabolism
uu. Pharmacology/pharmacognosy
vv. Plant pathology
ww. Plant genetics
xx. Recognition-cell surface interactions
yy. Tissue/cell culture
zz. Toxicology of natural products
OTHER: _____