

PHYTOCHEMICAL SOCIETY OF NORTH AMERICA

Newsletter

**Volume 29
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Executive Committee PSNA 1989-90

Dr. David S. Seigler
Past-President, PSNA
Department of Plant Biology
289 Morrill Hall
University of Illinois
Urbana, IL 61801
(217)333-7577

Dr. Jonathan Poulton
President, PSNA
Department of Botany
University of Iowa
Iowa City, IA 52242
(319) 335-1322

Dr. Brian E. Ellis
President-Elect, PSNA
Department of Plant Science
University of British Columbia
Vancouver, B.C., Canada V6T2A2
(604)228-3451

Dr. Helen M. Habermann
Secretary, PSNA
Department of Biological Sciences
Goucher College
Baltimore, MD 21204
(301) 337-6303

Dr. Kelsey R. Downum
Treasurer, PSNA
Department of Biology
Florida International University
University Park
Miami, FL 33199
(305)348-3419

Dr. Helen A. Stafford
Editor-in-Chief, PSNA
Biology Department
Reed College
Portland, OR 97202
(503)771-1112

The Phytochemical Society of North America is a non-profit scientific organization whose membership (currently over 400) is open to anyone with an interest in phytochemistry, the role of plant substances, and in related fields. Annual membership dues are \$15.00 for regular members and \$8.00 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. A newsletter is circulated to members several times a year to keep them informed of upcoming meetings and developments within the Society.

If you would like additional information about the PSNA or if you have material to be included in the newsletter, please contact the Society Secretary. Annual dues and changes in addresses should be sent to the Society Treasurer.

PHYTOCHEMICAL SOCIETY OF NORTH AMERICA NEWSLETTER

FEBRUARY, 1990

VOLUME 29, NUMBER 3

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CALL FOR NOMINATIONS

The PSNA constitution specifies that members are responsible for nominating candidates for election of officers. A new Vice President (President-Elect) is elected each year and automatically becomes President the next year or any time that the office of President may be vacated. The President of PSNA is not eligible for re-election to this office at a later date and cannot succeed himself (herself) as President. The Secretary and Treasurer are elected for three-year terms (which end in 1990 and 1991) and may be re-elected.

A form is provided (see center section of the newsletter) for submitting nominations for President-Elect and Secretary. Please complete the nominations form and mail it to Dr. David S. Seigler, Department of Plant Biology, 289 Morrill Hall, University of Illinois, Urbana, IL 61801. Nomination forms must be mailed by April 1, 1990. Election ballots will be distributed to members on May 1, 1990. All members, including those who joined in the past year, are urged to participate in the society's election process.

REPORT OF THE TREASURER

The Treasury of the Phytochemical Society of North America continued to grow during 1989. The Society ended the year with assets totaling \$48,382.32 which represents an increase of 6.2% over the course of the year. The attached Financial Statement shows that the major sources of receipts during 1989 included: membership dues (\$4,447.24); royalties from sales of *Recent Advances in Phytochemistry* (\$3,341.62); and donations from governmental (USDA) and industrial (American Cyanamid and Monsanto) sources (\$2,950) for support of annual meetings. Interest from checking (\$574.93) and savings (\$2,919.91) totaled \$3,494.84 for the year. Revenue from membership dues grew during 1989 by a modest amount (up \$210.24 over 1988), however royalties were down considerably compared to 1988 (down \$483.50; a 12.6% decrease). This is the second year of decreasing royalties - a rather alarming trend. Expenditures during 1989 included: meeting-related expenses (\$2,358 from 1988 and a total of \$2,936.44 from 1989); secretarial expenses (\$3,200); Editor-in-Chief expenses (\$2,000); and treasurer expenses (\$762.96). The level of support for student travel and best paper awards was equivalent to 1988. Nine students received travel awards to attend the meeting in Vancouver (\$1,735); two awards (\$100 ea.) for best paper were presented to Thomas Glendening and Lilian Latchinian. Increased printing costs associated with production of the PSNA Newsletter accounted for higher secretarial costs during 1989. Our new Editor-in-Chief, Dr. Helen Stafford, was allocated \$2,000 at the annual Executive Committee meeting in Vancouver for expenses related to publication of *Recent Advances in Phytochemistry*. Treasurer expenses were down slightly from 1988.

Savings are currently divided between two 6-month CD's (\$19,215.72 earning 8.00% and \$19,199.59 earning 7.75%). These CD's are staggered so that one matures every three months for quarterly access to additional funds. Remaining funds are maintained in an interest earning checking account paying 5.00%.

Membership continued to grow during 1989. We closed the year with 410 members - the largest membership yet. The

most notable increase was in Canadian members which grew by more than 30%. Annual meetings continue to be the major source of new members (31 members joined in Vancouver), however, brochures and advertising by current members also accounts for a substantial number of new memberships. I encourage all PSNA members to continue to recruit new members. If you still have brochures from the fall newsletter, please give them to interested colleagues, students, etc. at your institution. Contact Helen Habermann for additional copies of the brochure or photocopy the application form on the back page of any newsletter. Included among the many advantages of membership that might be pointed out to prospective members are: i) reduced registration costs at annual meetings; ii) significant discounts (25-40%) on volumes of *Recent Advances in Phytochemistry*; and iii) receipt of the PSNA Newsletter and biennial Directory of members (set for publication in March, 1990).

Three reminders: i) would those who have not already done so, please remit their 1989 dues to me as soon as possible; ii) members that expect to retire during the next year are reminded that they are entitled to "emeritus status" and exemption from payment of annual dues (please contact me so that I don't continue sending annual dues notices); and iii) if you are planning a move, please get your new address to me as soon as possible so that I can update my records, and so you don't miss any mailings, etc.

Copies of all bank statements and the auditor's report are on file and available for inspection. Please feel free to contact me if you have any questions, comments or suggestions about investments, and/or concerns regarding the PSNA Treasury.

Respectfully submitted,

Kelsey R. Downum
Department of Biological Sciences
Florida International University
Miami, FL 33199

SUMMARY OF PSNA MEMBERSHIP 1979-1989

Year	USA	Canada	Overseas	Students	Total
1979	241	34	32	17	290
1980	245	36	34	29	315
1981	270	37	37	41	344
1982	278	46	40	46	364
1983	264	49	45	*	358
1984	273	52	42	38	367
1985	282	50	41	31	373
1986	279	40	40	38	359
1987	258	42	34	35	334
1988	297	49	45	51	394
1989	303	65	42	52	410

*Data not available

FINANCIAL STATEMENT

CHECKING ACCOUNT

RECEIPTS

Membership Dues	\$ 4,447.24
Royalties	3,341.62
Donations for 1988 Iowa City meeting	
- American Cyanamid	250.00
- Monsanto	700.00
- USDA	2,000.00
Interest on checking	574.93
Mailing List Rental	<u>30.00</u>
 Total Receipts	 \$11,343.79

EXPENDITURES

Meeting related expenses	
- 1988 Symp. Speakers Travel	\$ 2,358.00
- 1989 Student Travel Awards	1,735.00
- 1989 EC Travel	1,001.44
- 1989 Best Paper Awards (2)	200.00
Expenses of the executive committee	
- Secretary (newsletter, etc.)	3,200.00
- Editor-In-Chief	2,000.00
- Treasurer	<u>762.96</u>
 Total Expenditures	 \$11,257.40

CHECKING SUMMARY

Receipts	\$11,343.79
Expenditures	<u>\$11,257.40</u>
 Net Gain	 \$ 86.39

SAVINGS ACTIVITY

Interest	\$2,919.91
 Net Gain	 <u>\$2,919.91</u>

ASSETS - January 01, 1989

Checking	\$ 9,880.62
Savings	<u>35,495.40</u>
 Total	 \$45,376.02

ASSETS - December 31, 1990

Checking	\$ 9,967.01
Savings	<u>38,415.31</u>
 Total	 \$48,382.32

NEW PSNA MEMBERS

We welcome the new members listed below. Their phone numbers and research interests are noted. All are invited to participate in society business and PSNA meetings.

Richard A. Dixon
Plant Biology Division
The Samuel Roberts Noble Foundation
P.O. Box 2180
Ardmore, OK 73402-0000
(405) 223-5810
Interests: Flavonoids, nucleic acids, phenolics, plant-microbe interactions, biochemistry of secondary metabolism, biochemistry/physiology of stress

Wayne Elisens
Department of Botany and Microbiology
University of Oklahoma
Norman, OK 73019-0000
(405) 325-5923
Interests: Nucleic acids, phenolics, chemotaxonomy, plant genetics

Mark Gijzen
Institute of Biological Chemistry
Washington State University
Pullman, WA 99164-6340
(509) 335-3412
Interests: Glucosinolates, terpenoids, plant-microbe interactions, biochemistry of secondary metabolism, recognition-cell surface interactions, toxicology of natural products

Dr. Willy Kalt
Agriculture Canada Research Station
Kentville, Nova Scotia B4N 1J5
CANADA B4N 1J5
(902) 678-2171
Interests: Natural products analysis/production

Dr. Toni Kutchan
Universitat Munchen
Karlstrasse 29
8000 Munchen 2
West Germany
Interests: Biochemistry of secondary metabolism, molecular/immunological techniques

Chun Ping Li
Botany Department
University of Iowa
Iowa City, IA 52242
(319) 335-1311
Interests: Plant biochemistry, secondary plant products

Jean I.M. Rajaonarivony
Institute of Biological Chemistry
Washington State University
Pullman, WA 99164-6340
(509) 335-9179
Interests: Terpenoids, biochemistry of secondary metabolism, enzymology

Thomas J. Savage
Institute of Biological Chemistry
Washington State University
Pullman, WA 99164-6340
(509) 335-3412
Interests: Terpenoids, chemical ecology, biochemistry of secondary metabolism

REVISED POLICY ON GRANTING MEMBERSHIP TO NON-MEMBERS ATTENDING THE ANNUAL MEETING

There is obvious confusion associated with trying to decide whether non-members attending the joint ISCE/PSNA meeting this summer should be identified as non-members of ISCE or PSNA. Should they be granted a one year membership in either or both organization(s) as a consequence of higher non-member registration fees? Free memberships resulting from attendance at recent annual meetings have resulted in growth in numbers of PSNA members. In some cases such free memberships can cause significant expense to the society. Ordinarily, a member is not removed from the mailing list until

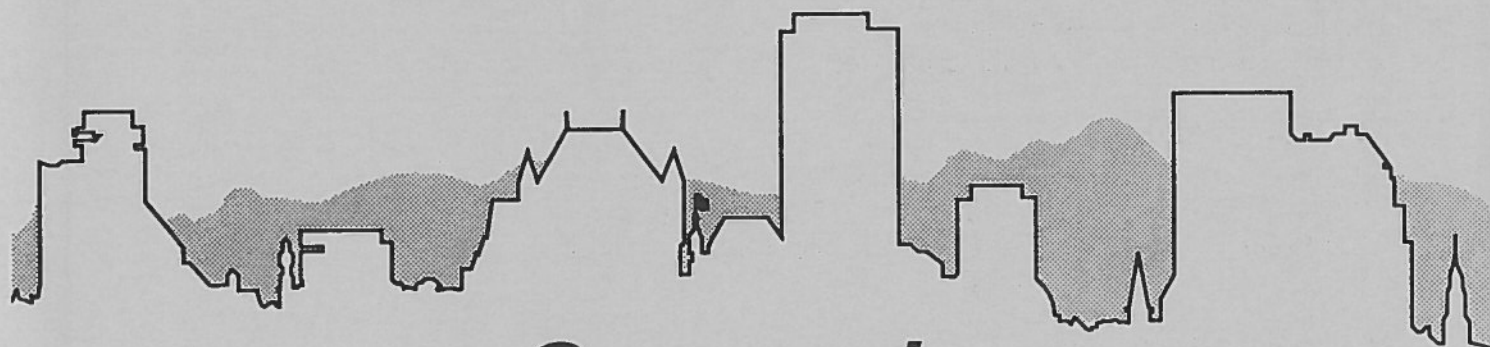
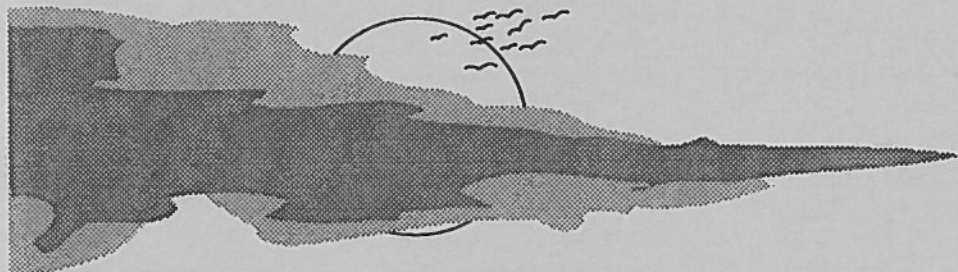
at least a year after non-payment of dues. Thus individuals given a free membership for the year they attended a PSNA annual meeting who don't renew their membership can become costly to the society. It seems appropriate this year to provide free membership to non-members paying the higher registration fee only to those individuals requesting membership and only for the remainder of the year. Those not renewing their membership in 1991 will be removed from the mailing list after the winter issue of the newsletter is mailed.

JOINT MEETING

INTERNATIONAL SOCIETY OF CHEMICAL ECOLOGY
INTERNATIONAL SOCIETY OF CHEMICAL ECOLOGY
and PHYTOCHEMICAL SOCIETY OF NORTH AMERICA
and PHYTOCHEMICAL SOCIETY OF NORTH AMERICA

LAVAL UNIVERSITY
QUEBEC CITY, P.Q.
CANADA

11 - 15 August, 1990



Symposia

Modern Phytochemical Methods

The Ecological Milieu of Chemical Defense and Communication

In 1990, the PSNA again has a most unique and attractive Canadian location for our annual meeting. The PSNA and ISCE Symposium sessions will be scheduled so that every participant will be able to hear all speakers. The price of registration includes both the opening reception and banquet at the Chateau Frontenac. Because the meeting begins on a Saturday, those traveling by air will have the advantage of lower fares, based on staying over a Saturday night. Those flying via Air Canada will be eligible for reduced fares. The colored brochure enclosed is intended to lure all PSNA members to one of the most fascinating cities in the world. Also enclosed are two copies of a poster which we hope you will place in locations where all interested students and colleagues will see them. Urge your students and postdocs to apply for travel grants and/or best student paper awards. Now is a good time to encourage students to join the PSNA. An application form is on the inside back cover of every newsletter and additional copies of the membership brochure are still available. Extra copies of the meeting poster are also available and you may request that copies be sent to any potentially interested individual or department (call the secretary or forward the request by mail or Email: HHABERMA@UMAB).

ISCE/PSNA JOINT MEETING, QUEBEC CITY, 11-15 AUGUST, 1990

TENTATIVE PROGRAMME

Saturday, 11 August

13:00 - 19:00 Registration
13:00 - 19:00 ISCE/PSNA Council Meetings
18:30 Opening Reception

Sunday 12 August

8:30 - 15:00 Registration
8:45 - 9:00 Opening Ceremonies
9:00 - 12:00 Symposium
13:30 - 16:30 Symposium
16:00 - 18:00 Poster session

Monday 13 August

8:30 - 12:00 Symposium
13:30 - 16:00 Symposium
16:00 - 18:00 Submitted papers

Tuesday 14 August

8:30 - 12:00 Submitted papers/Poster session
13:30 - 16:00 Submitted papers/Poster session
16:00 - 17:30 Annual Business Meetings
19:00 Banquet

Wednesday 15 August

8:30 - 11:00 Submitted papers
11:00 - 12:00 Closing Ceremonies

ALTERNATIVE ACCOMMODATIONS (Please make your own reservations.)

Within 20 minutes walk of Campus

Motel Universel
2300, chemin Sainte-Foy, Sainte-Foy, Qué. Tél. 653-5250

Hôtel des Gouverneurs
3030, boul. Laurier, Sainte-Foy, Qué. Tél. 651-3030

Plaza Universel
3031 boul. Laurier, Sainte-Foy, Qué. Tél. 657-2727

Downtown (30 min. by bus)

Château Frontenac
1 rue des Carrières, Québec Tél. 692-3861

Loews Le Concorde
1225, Place Montcalm, Québec Tél. 647-2222

Québec Hilton International
3 Place Québec, Québec Tél. 647-2411

ISCE/PSNA SYMPOSIA

MODERN PHYTOCHEMICAL METHODS

N. H. Fischer
Louisiana State University

New NMR methods in phytochemical studies

J.P. Foley
Louisiana State University

Supercritical fluid chromatography in natural products analysis

J. Gershenzon
Washington State University

Ecological function of trichome constituents in higher plants

K. Hostettmann
University of Lausanne

New developments in the separation of natural products

C. Pidgeon
Purdue University

Immobilized artificial membrane chromatography

J. St. Pyrek
University of Kentucky

New mass spectral methods in natural products structure elucidations

D. L. Smith
Purdue University

Methods of mass spectrometry for the structure elucidation of natural products

O. Spring
University of Tubingen

Trichome microsampling of sesquiterpene lactones for the use of systematic studies

ECOLOGICAL MILIEU OF CHEMICAL DEFENSE AND COMMUNICATION

I. Baldwin
SUNY, Buffalo

Ecological constraints on plant chemical defenses: The case of nitrogen and nicotine in Nicotiana

(R. Colwell

To be announced)

D. Gosling
Coypu Research Laboratory

The significance of scent marking in the assessment of opponents by male mammals

J. Himmelman
Université Laval

Coupling marine invertebrate spawning with larval food abundance using chemical cues

V. Krischik
University of Maryland

Generalised plant defenses: Effects on multiple taxa

D. Marshall
University of New Mexico

The potential for chemical mediation of non-random mating in plants

N. Negus
University of Utah

Plant chemical cues, phenotypic plasticity and population dynamics

M. Rowell-Rahier
University of Basel

Chemical specialisation on toxic plants as a defensive tool: ecological reality or fantasy?

ISCE/PSNA JOINT MEETING, QUEBEC CITY, 11-15 AUGUST, 1990

CALL FOR PAPERS

Members and non-members are invited to present a contributed paper or poster on any topic in chemical ecology or phytochemistry.

GENERAL INFORMATION

Oral presentations will be 12 minutes, followed by a 3 minutes question period. A slide projector (5cm x 5cm), an overhead projector and a chalkboard will be available in each lecture hall. Each poster presentation will be allotted a 180cm x 120cm space.

Please note that it may be necessary to limit the number of oral presentations. If this is the case some applicants may be assigned to a poster session and will be informed of this at least 4 weeks before the meeting.

PREPARATION OF ABSTRACTS

Abstracts, not exceeding 200 words, should be typed in the space provided, using the format shown below. PLEASE BE SURE TO UNDERLINE THE NAME OF THE AUTHOR PRESENTING THE PAPER.

If you require any further information concerning paper submissions, call:

ISCE: Dr. Jeremy N. McNeil Tél.:(418) 656-2999 Fax: (418) 656-5902
PSNA: Dr. Murray B. Isman Tél.:(604) 228-2329 Fax: (604) 228-6394

EXAMPLE

HOW DID WE GET OURSELVES IN THIS ECO-, PHYTO-CHEMICAL MESS?

Murray B. Isman, Dept. of Plant Science, University of British Columbia, Vancouver, B.C., Canada, V6T 2A2 and Jeremy N. McNeil, Dept. de biologie, Université Laval, Ste-Foy, P.Q. Canada G1K 7P4

It has been postulated that short term behavioural changes resulting from the ingestion of certain chemicals may have far-reaching consequences. Results will be presented showing how the consumption of an ethanolic grape preparation rendered several sane individuals* sufficiently feeble-minded to accept the responsibility of organizing a scientific meeting. This induced change is quite remarkable as all subjects had, as the result of previous experience, been heard to adamantly state "never, never again". The potentially debilitating long-term effects of this chemically-induced behavioral aberration on the other organisms within the habitat (secretaries, graduate students, technicians, colleagues, spouses, etc.) will be discussed.

* If you believe that you will probably come to the meeting with the sincere intention of attending this paper!

DEADLINE 1 JUNE, 1990

**ISCE/PSNA JOINT MEETING, QUEBEC CITY,
11-15 AUGUST, 1990**

PSNA SUBMITTED PAPERS

NAME: _____ PHONE NUMBER: _____

Oral presentation

Poster presentation

Consideration for travel assistance award.....

Consideration for best oral paper award.....

Additional requirements for presentation:

ABSTRACT - Please follow attached instructions.

To be received by 1 June 1990. Send to:

Dr. Murray B. Isman
Department of Plant Science
University of British Columbia
Vancouver, B.C.
Canada
V6T 2A2

FAX (604) 228-6394

ISCE/PSNA JOINT MEETING, QUEBEC CITY, 11-15 AUGUST 1990

HOUSING REGISTRATION

350 single rooms (sorry there are no doubles) have been reserved in the student residences from Saturday 11 August through Tuesday 14 August, (and a limited number for Wednesday, 15 August) that are available on a "first-come, first-serve" basis. Rooms are \$27.U.S./night, which includes breakfast and on-campus parking.

Please complete this reservation form and send it, together with full payment, to:

ISCE/PNSA 1990 JOINT MEETING
Department of Biology
Laval University
Ste.Foy, Que.
Canada
G1K 7P4

The cheque or money order should be made out to (Université Laval, ISCE/PSNA 1990)

NAME: _____

ADDRESS: _____

PHONE: _____

ARRIVAL DATE: _____ Estimated hour _____ AM _____ PM

DEPARTURE DATE: _____ Estimated hour _____ AM _____ PM

AUGUST

CIRCLE NIGHTS REQUIRED	11	12	13	14	15
	SAT	SUN	MON	TUE	WED

NUMBER OF NIGHTS: _____ @ \$27. U.S. \$ _____

DEADLINE: 1 JUNE, 1990

TRAVEL ASSISTANCE AND BEST STUDENT PAPER AWARDS

PSNA has allocated funds which will allow partial travel assistance for graduate student members presenting oral (but not poster) presentations at the 1990 meeting. Depending on the response, this might cover up to 50% of an economy airline fare. To be considered for an award, candidates should complete the abstract form and submit it by June 1, 1990 with a proposed travel budget, curriculum vitae, abstract and a letter of support from the supervising professor verifying need for

assistance to Dr. Murray B. Isman, Dept. of Plant Science, Univ. of British Columbia, Vancouver, B.C. V6T2A2, Canada.

Student membership in PSNA may be obtained by sending \$8.00 and an application for membership (see inside back cover of newsletter; form may be xeroxed) to Kelsey R. Downum, treasurer, by May 15, 1990. Recipients of travel assistance awards will be notified by July 1.

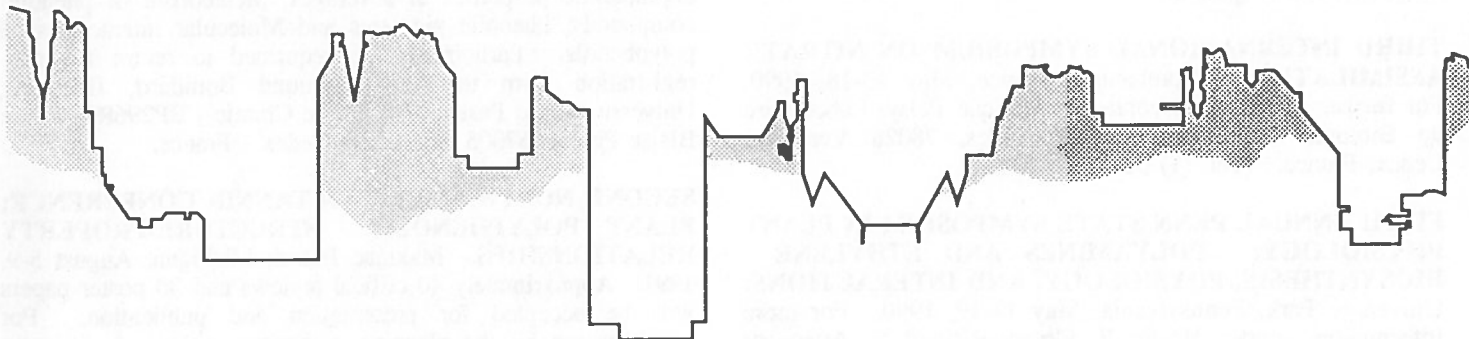
AIR CANADA WILL PROVIDE REDUCED FARES

Air Canada will provide reduced fares for those attending this summer's ISCE/PSNA joint meeting in Quebec City. Information about fares for those traveling in North America may be obtained by calling 1-800-361-7585. When requesting information about discounted fares, be sure to refer to Event File No. 90-637. The toll free number is operational from 8:30 AM to 8:00 PM Eastern time.

Those who are traveling from abroad can call any of the appropriate numbers listed for information about the availability of flights on Air Canada or associate airlines. Please remember to refer to Event File No. 90-637 when inquiring about discounted fares.

OVERSEAS NUMBERS:

Auckland 793-708	Amsterdam 604-14.89, 601-53.63	Athens 32-35143
Bangkok 233-5900	Bombay 202-1111	Brussels 751-9116
Copenhagen 0430-00-44	Denmark 80.01.0044	Dublin 771488
Dusseldorf 80451	Frankfurt 25 01 31	Geneva 73114980
Hanover 18441-18442	Hong Kong (5) 221-011/3	Lisbon 735529
London (01) 7592636	Madrid 5429144	Manchester 0800181313
Melbourne 008221015	Munich (089) 288451	Nice/Paris (1) 43201200
United Kingdom 0800181313	Singapore 732-8555	Stockholm 081240350
Sydney (02) 232-5222	Sweden 08240350	Tokyo 586-3891
Vienna 567474	Zagreb 421555	Zurich 2110777



POSITIONS AVAILABLE

UNIVERSITY OF KENTUCKY, LEXINGTON. POSTDOCTORAL POSITION IN PLANT BIOCHEMISTRY/MOLECULAR BIOLOGY. Research position to utilize proteins unique to trichome secretory cells to identify and study trichome-specific genes and to attempt alteration of secretion processes. Send *vitae*, names of three references and reprints/preprints to Dr. George Wagner, Plant Physiology / Biochemistry / Molecular Biology Program, Department of Agronomy, University of Kentucky, Lexington, KY 40546-0091. Phone (606) 257-5974.

UNIVERSITY OF IOWA, IOWA CITY. POSTDOCTORAL POSITION. Available February 1, 1990. Investigation of molecular aspects of cyanogenesis (HCN production) during maturation of rosaceous stone fruits,

principally *Prunus serotina*. The research will follow up that described in *Arch. Biochem. Biophys.* (1986) 247: 433-445 and (1987) 255: 19-26. Advanced training in plant biochemistry/plant physiology and molecular biology is required. Training in protein isolation and purification, preparation of cDNA libraries, the use of radioisotopes, gel electrophoresis, and immunological techniques is desired. Annual stipend will be \$22,000 plus benefits with an opportunity for reappointment for a further two years. Applicants should send *curriculum vitae*, three letters of recommendation, relevant reprints, and a statement of research experience and interests to: Dr. Jonathan E. Poulton, Department of Botany, University of Iowa, Iowa City, IA 52242. Phone (319) 335-1322. FAX (319) 335-2951. The position will remain open until a suitable candidate is identified.

MEETINGS AND PROGRAMS OF INTEREST

NINTH ANNUAL SYMPOSIUM ON CURRENT TOPICS IN PLANT BIOCHEMISTRY AND PHYSIOLOGY: Columbia, Missouri, April 4-6, 1990. Topics: Phosphorylation/Dephosphorylation of Plant Proteins; Plant Protein Kinases and Phosphatases, Calcium, Calmodulin and Boron. For further information, contact Dr. Doug Randall, 117 Schweitzer Hall, Univ. of Missouri, Columbia, MO 65211. (Tel. 314-882-7796).

UCLA SYMPOSIUM ON MOLECULAR STRATEGIES FOR CROP IMPROVEMENT: Keystone, Colorado, April 16-23, 1990. For further information, contact UCLA Symposia, 2032 Armacost Ave., Los Angeles, CA 90025. (Tel. 213-207-5042).

THIRD ARGENTINE AND SIXTH LATINAMERICAN SYMPOSIUM ON PHARMACOBOTANY: Corrientes, Argentina, May 6-12, 1990. The symposium will be open to research workers involved in studies of herbs, spices and medicinal plants. Oral papers (approximately 10 minutes) and posters will be accepted. The official language will be Spanish. Topics will be: I. Botany and Ethnobotany; II. Pharmacognosy and Pharmacology; III. Natural Resources and Biotechnology; IV. Toxicology and Pharmacovigilance; V. Quality Control and Legislation. For further information, please contact Ing. Armando I. Ricciardi, Colegio O. de Farmaceuticos Y Bioquimicos de la Capital Federal, Rocamora 4045/47, 1184 Buenos Aires, Argentina.

THIRD INTERNATIONAL SYMPOSIUM ON NITRATE ASSIMILATION: Bombannes, France, May 13-18, 1990. For further information, contact Frederique Pelsy, Laboratoire de Biologie Cellulaire, INRA-Versailles, 78026 Versailles Cedex, France. (Tel. (1) 30 83 30 69)

FIFTH ANNUAL PENN STATE SYMPOSIUM IN PLANT PHYSIOLOGY: POLYAMINES AND ETHYLENE - BIOSYNTHESIS, PHYSIOLOGY, AND INTERACTIONS: University Park, Pennsylvania, May 17-19, 1990. For more information, contact Hector E. Flores, Richard N. Arteca or Jack C. Shannon, Plant Physiology Program, 102 Tyson Building, University Park, PA 16801. (Tel. 814-863-2192).

EIGHTH INTERNATIONAL CONGRESS ON NITROGEN FIXATION: Knoxville, Tennessee, May 20-26, 1990. Developments over the past two years will be summarized with focus on relevance to future research. Cross-disciplinary symposium sessions will be featured. For further information, contact Peter M. Gresshof, Plant Molecular Genetics, UTK, Knoxville, TN 37901-1071 (Tel. 615-974-8841) or Gary Stacey, Microbiology, UTK, Knoxville, TN 37996-0845 (Tel. 615-974-4041).

FIRST INTERNATIONAL CONGRESS ON ETHNOPHARMACOLOGY: Strasbourg, France, June 5-9, 1990. During this congress, which will stress the scientific basis for evaluation and rational use of traditional medicines, the International Society of Ethnopharmacology will be created. For further information, contact Prof. Robert Anton, Faculte de Pharmacie, Laboratoire de Pharmacognosie, B.P. 24, 67401 Illkirch Cedex, France.

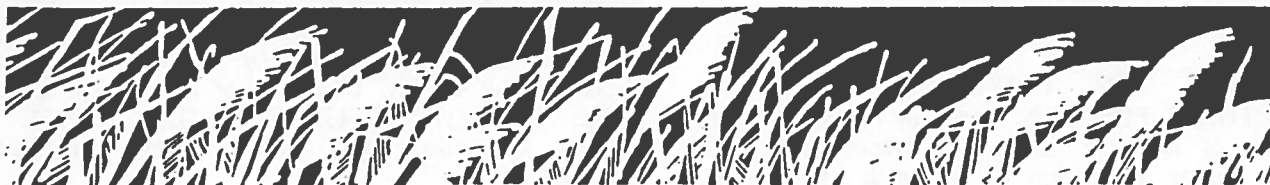
SECOND INTERNATIONAL SYMPOSIUM ON PLANT-SOIL INTERACTIONS AT LOW pH: Beckley, West Virginia, June 24-29, 1990. For further information, contact Dr. R. Paul Murrmann, USDA/ARS, Appalachian Soil and Water Conservation Research laboratory, P.O. Box 1061, Beckley, WV 25802-1061 (Tel. 304-252-6426).

VII INTERNATIONAL CONGRESS ON PLANT TISSUE AND CELL CULTURE: Amsterdam, The Netherlands, June 24-29, 1990. For further information, contact RAI Organisatie Bureau Amsterdam bv, Europaplein 12, 1078 GZ Amsterdam, The Netherlands (Tel. 31-20-5491212).

XVTH INTERNATIONAL CONFERENCE OF THE GROUP POLYPHENOLS (JIEP 90): Strasbourg, France, July 9 to 11, 1990. Topics of the conference are: Biological and therapeutic activities of polyphenols; Recent developments in the analysis of polyphenols; Polyphenols and their organoleptic properties in beverages; Metabolism of phenolic compounds; Phenolic pigments and Molecular interactions of polyphenols. Participants are requested to return the pre-registration form to Prof. Raymond Bouillard, JIEP 90, Universite Louis Pasteur, Institut de Chimie - BP296R8, 1 Rue Blaise Pascal, 67008 Strasbourg Cedex - France.

SECOND NORTH AMERICAN TANNIN CONFERENCE; PLANT POLYPHENOLS: STRUCTURE-PROPERTY RELATIONSHIPS. Makinac Island, Michigan, August 5-9, 1991. Approximately 40 critical reviews and 30 poster papers will be accepted for presentation and publication. For consideration by the planning committee, title and one page extended abstract should be sent to Peter E. Laks, Institute of Wood Research, Michigan Technical Univ., Houghton, MI 49931 or Richard W. Hemingway, Southern Forest Experiment Station, 2500 Shreveport Highway, Pineville, LA 71360.

FIFTH INTERNATIONAL SYMPOSIUM ON THE MOLECULAR GENETICS OF PLANT-MICROBE INTERACTIONS: Interlaken, Switzerland, September 9-14, 1990. For further information, contact Dr. Hauke Hennecke, Mikrobiologisches Institut, Eidgenossische Technische Hochschule, ETH-Zentrum, CH-8092, Zurich, Switzerland.





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PHYTOCHEMICAL SOCIETY OF NORTH AMERICA

Newsletter

Volume 30
Number 1

August 1990

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Dr. David S. Seigler
Past-President, PSNA
Department of Plant Biology
289 Morrill Hall
University of Illinois
Urbana, IL 61801
(217)333-7577

Dr. Jonathan Poulton
President, PSNA
Department of Botany
University of Iowa
Iowa City, IA 52242
(319) 335-1322

Dr. Brian E. Ellis
President-Elect, PSNA
Department of Plant Science
University of British Columbia
Vancouver, B.C., Canada V6T2A2
(604)228-3451

Dr. Helen M. Habermann
Secretary, PSNA
Department of Biological Sciences
Goucher College
Baltimore, MD 21204
(301) 337-6303

Dr. Kelsey R. Downum
Treasurer, PSNA
Department of Biology
Florida International University
University Park
Miami, FL 33199
(305)348-3419

Dr. Helen A. Stafford
Editor-in-Chief, PSNA
Biology Department
Reed College
Portland, OR 97202
(503)771-1112

The Phytochemical Society of North America is a non-profit scientific organization whose membership (currently over 400) is open to anyone with an interest in phytochemistry, the role of plant substances, and in related fields. Annual membership dues are \$15.00 for regular members and \$8.00 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. A newsletter is circulated to members several times a year to keep them informed of upcoming meetings and developments within the Society.

If you would like additional information about the PSNA or if you have material to be included in the newsletter, please contact the Society Secretary. Annual dues and changes in addresses should be sent to the Society Treasurer.

PHYTOCHEMICAL SOCIETY OF NORTH AMERICA NEWSLETTER

AUGUST, 1990

VOLUME 30, NUMBER 1

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THE PERGAMON PHYTOCHEMISTRY MEDAL AND PRIZE

This new international medal and prize of \$5000 will be awarded annually by Pergamon Press in recognition of sustained, outstanding contributions to the subject of phytochemistry. It is open to candidates of any nationality, subject to nomination. It is expected that those winning the award will have published a significant proportion of their research findings in the journal *Phytochemistry*.

Nominations for the award should be sent, for onward transmission, *either* to the secretary of one of the established Phytochemical Societies (i.e. PSE, PSNA, PSJ, PSSA, PSLA) *or* to a member of the Editorial Board of *Phytochemistry* (the editor-in-chief is Prof. J.B. Harborne, Plant Science Laboratories, The University, White Knights, P.O. Box 221, Reading RG2 2AS, England). Accompanying documentation should consist of a one or two page letter making out the case for the candidate, a list of appointments (one page) and a list of major publications (no more than three pages). The award will be decided by the editorial board, which reserves the right not to make a recommendation in any given year, at its annual meeting in July. The result will be announced in the October issue. The deadline for nominations for the next award will be 30 April 1991.

TENTATIVE PROGRAMME

Saturday:	13:30-17:00 16:00 18:00-19:30	Registration (Pavillon Lacerte) PSNA Executive Committee meeting Opening Reception
Sunday:	09:00-12:00 14:00-17:00 17:30-19:30	ISCE Symposium (part 1) PSNA Symposium (part 1) PSNA Student Paper Competition
Monday	09:00-12:00 14:00-17:00 17:30-19:30	PSNA Symposium (part 2) ISCE Symposium (part 2) ISCE/PSNA General Meetings
Tuesday	08:30-12:00 14:00-17:00 18:30-22:30	Submitted papers and posters Submitted papers and posters Banquet at the Chateau Frontenac
Wednesday	08:30-12:00	Submitted papers and posters

PARKING ON CAMPUS

Parking is free if you are staying in residence. If you are staying elsewhere, you may acquire a permit at the time of registration. Parking is free on the weekend.

TRAVEL FROM THE AIRPORT

The only means of transport is by taxi, which costs about \$15. Ask for Pavillon Lacerte on the Laval University campus.

ALTERNATIVES TO RESIDENCE LIVING

The following are less than a 15 minute walk from campus. Mention that you are a participant at the ISCE/PSNA Congress when you make reservations. Do so as soon as possible; there are a lot of tourists in Quebec City at this time of year.

Hotel Classique	\$68 for single or double occupancy \$78 for two double beds (in adjoining rooms) Rooms have a kitchenette	Telephone: 1-800-463-1885 Fax: 418-658-6816
Hotel Germain des Pres	\$82 for single or double occupancy	Telephone: 1-800-463-5253 Fax: 418-658-1224
Auberge des Gouverners	\$88 single/\$108 double	Telephone: 1-800-463-2802

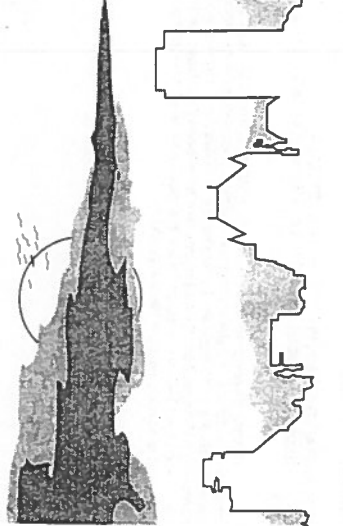
ACTIVITIES IN QUEBEC CITY

Bus tours of the old city and the surrounding area. These trips vary in length from 1.5 to 7 hours (\$15-34 for adults, \$7.50-17.00 for children under 13).

Boat ride on the St. Lawrence. A 1.5 hour trip: \$16 for adults, \$8 for children under 13 and free if under 5. With lunch \$30 and \$23.

These trips run daily. Reservations may be made when you register.

SYMPOSIUM ABSTRACTS



Sunday 09:00

THE POTENTIAL FOR CHEMICAL MEDIATION OF NON-RANDOM MATING IN PLANTS
Diana L. Marshall, Dept of Biol., Univ. of New Mexico, Albuquerque, NM, USA.

Plant mating is non-random whenever the actual paternity of seeds is different from that which would be achieved by a random assortment of the pollen available. Non-random mating can alter the fitness of pollen donors, seed parents, and progeny. While it may occur either before or after pollen arrives on stigmas, I will concentrate on post-pollination mechanisms of non-random mating. These include differential pollen germination, pollen tube growth and fertilization and differential seed and fruit filling. While the possibility is little studied, these mechanisms may be mediated by chemical signals from pollen grains, pollen tubes, maternal plants, and embryos, just as animal mating behavior can be affected by pheromonal signals. The chemical signals may mediate competition among pollen donors and/or mate choice by the maternal plants. Recent data from wild radish suggest that all of the mechanisms of post-pollination non-random mating operate. Further, studies of pollen germination suggest direct interference among pollen from different donors. These data will be discussed in terms of data from the literature that suggest chemical mediation of these interactions.

Symposium Paper 1

Sunday 09:45

ECOLOGICAL CONSTRAINTS ON PLANT CHEMICAL DEFENSES: THE CASE OF NITROGEN AND NICOTINE IN NICOTIANA
Jan J. Baldwin, University at Buffalo, SUNY Buffalo, Buffalo, NY 14260, USA.

Ecologists interested in the patterns of secondary metabolites in plants have proposed a set of hypotheses that range from the largely ecological (Plant Apparancy Theory) to the largely physiological (Carbon-Nutrient Theory) which thoroughly treat the interspecific patterns. However, the intraspecific patterns of chemical defense have received less attention. The ecological/physiological constraints on the intraspecific patterns of chemical defense will be explored in the genus *Nicotiana*. Particular emphasis will be placed on the patterns of alkaloid concentration both before and after herbivory and how these patterns fit ecological and physiological predictions. The alkaloidal responses to leaf damage in plants grown over a range of nitrate supply rates suggest that these responses to damage are important in the transport of nitrogen from root to shoot after herbivory. A nitrogen-transport function for a damage-induced alkaloid response highlights the integration of defensive and physiological responses to herbivory in plants.

Symposium Paper 2

Sunday 11:00

CHEMICAL SPECIALIZATION ON TOXIC PLANTS AS A DEFENSIVE TOOL: ECOLOGICAL REALITY OR FANTASY?
Mardine Rowell-Rabier, Zoological Institute, Rheinsprung 9, Basel 4051, Switzerland and J.M. Pasteels, Faculté des Sciences, ULB, av. F. D. Roosevelt 50, Brussel 1050, Belgium.

The leaf beetles of the genus *Oreina* feed on herbaceous plants of the families Apiaceae and Asteraceae both of which are known to be rich in toxins, e.g. coumarins in the former and alkaloids (pyrrolizidin N-oxides) in the latter. However, only 2 of the 9 species studied so far are able to sequester plant toxins for their own defense. The others biosynthesize costly autogenous cardiac glycosides. We study the food plant preferences and genetic relationships of several species, as well as their mode of chemical defense and reproductive biology, to try to determine what favors the utilization of plant toxins for defense. The results show that sequestration of alkaloids in *O. cacalia* and *O. speciosissima* is associated with a host plant shift and is a derived condition. The process of sequestration is chemically specific. In *O. cacalia* it has completely replaced autogenous defense, whereas in *O. speciosissima* does not feed on plants rich in PA-N-oxides even when they are available. Thus this species is physiologically able to sequester toxins but does not utilize this possibility in the field.

Symposium Paper 3

Sunday 11:45

COUPLING OF MARINE INVERTEBRATE SPAWNING WITH LARVAL FOOD ABUNDANCE USING CHEMICAL CUES

John H. Himmelman and Michel Starr, Dép. biologie, Université Laval, Québec, G1K 7P4 and Jean-Claude Theriault, Ministère des Pêches et des Océans, Mont-Joli, Québec G5H 3Z4, Canada.

We examined the mechanisms coupling spawning (release of gametes or larvae) with the spring phytoplankton bloom in three phylogenetically separated invertebrates, urchins (*Strongylocentrotus droebachiensis*), mussels (*Mytilus edulis*) and barnacles (*Balanus balanoides*). Gamete release in urchins and mussels is triggered by a heat-stable metabolite released by various species of phytoplankton. Mussels require a higher phytoplankton density for a maximum response than urchins, probably because mussels are exposed to higher concentrations of phytoplankton as a result of their filtering activity. The spawning substance is readily extracted from phytoplankton cells using 1 N NaOH and is likely phenolic in nature. Its spectral properties resemble the 'yellow substances' previously described for natural sea water. Phytoplankton similarly stimulates the release of naupliar larvae in barnacles but, in contrast to spawning in urchins and mussels, contact with the plankton cells is required. In addition to being a source of food, phytoplankton as a spawning cue probably integrates numerous physical and biotic factors indicating favourable conditions for larval growth and survival. Similar direct coupling of the larval phase with phytoplankton blooms may be common among marine invertebrates.

Sunday 14:00

NEW DEVELOPMENTS IN THE SEPARATION OF NATURAL PRODUCTS

Kurt Hostettmann and A. Marston, Institute of Pharmacognosy and Phytochemistry, University of Lausanne, rue Vuillemin 2, CH-1005 Lausanne, Switzerland.

Obtention of pure constituents from a crude extract of biological origin remains a crucial step in any research on natural products. The past few years have seen an increasing interest in chromatography systems involving liquid-liquid partition. Droplet counter-current chromatography (DCCC) has found numerous applications but is limited by time considerations and by the choice of solvent systems. The newly emerging technique of centrifugal partition chromatography (CPC) has done much to overcome these limitations and provides a very useful addition to the methods available for the separation of different classes of compounds. CPC has been used for the separation of simple mixtures and complex plant extracts, containing both polar and non-polar constituents (saponins, flavonoids, coumarins, anthranoids and alkaloids).

Symposium Paper 5

Sunday 14:45

SUPERCritical FLUID CHROMATOGRAPHY AND CAPILLARY ZONE ELECTROPHORESIS FOR THE ANALYSIS OF NATURAL PRODUCTS

Joe P. Foley, Dept. of Chemistry, 232 Choppin Hall, Louisiana State University, Baton Rouge, Louisiana, USA.

Symposium Paper 6

Two emerging separation technologies, supercritical fluid chromatography (SFC) and capillary zone electrophoresis (CZE), are reviewed and assessed for their applicability to the analysis of natural products. SFC utilizes the unique properties of a supercritical fluid (a gas above its critical pressure compressed beyond its critical pressure) to achieve separations of certain compounds that are impractical or impossible to perform by modern gas or liquid chromatography. Such compounds include those that are thermally unstable and/or nonvolatile (high molecular weight) that do not have a UV chromophore. First reported in 1962, SFC did not come of age until the early 1980's due to advances in the supporting technology. CZE is an even newer separation methodology (late 1980's) that utilizes very high voltages (typically 15-30 kV) applied across long, very small diameter fused silica capillaries (e.g. 1 m long and 100 µm i.d.) to achieve separation of sample constituents via their differential electrophoretic flow velocities. CZE can provide information that is complementary to that provided by chromatographic separations. The differences between CZE and slab gel electrophoresis are, in many ways, analogous to the differences between HPLC and classical column chromatography.

Sunday 15:30

IMMOBILIZED ARTIFICIAL MEMBRANES

C. Fildes, W. Chae, C. Luo, C.R. Lombardo, P. Low, Department of Medicinal Chemistry and Pharmacognosy and Department of Chemistry, Purdue University, West Lafayette, IN 47907, USA.

Symposium Paper 7

Immobilized Artificial Membranes (IAM) are solid-phase-membrane-mimetics. Synthesis of IAM entails bonding cell membrane lipid molecules to solid surfaces at high molecular surface densities. IAM surfaces are intended to mimic the lipid environment of cell membranes and consequently the initial applications of IAM relate to endogenous solute-membrane interactions. Non-chromatographic applications of IAM are reconstitution of phospholipase D (unpublished observation), and the correlation of drug-binding to IAM with drug-transport through human skin. Chromatographic applications include the purification of cytochrome p450, and the purification of other membrane proteins. Although both non-chromatographic and chromatographic applications are evolving, the most useful application(s) of IAM will be for the purification of membrane proteins. Our current understanding of IAM chromatography for the purification of proteins will be presented.

Sunday 16:15 **Symposium Paper 8**
TRICHOME MICROSAMPLING OF SESQUITERPENE LACTONES FOR THE USE OF SYSTEMATIC STUDIES
Olmsted Spring, University of Tuebingen, Institute of Biology, Auf der Morgenstelle 1, D-7400 Tuebingen, F.R.G.

Chemical investigation of secondary plant metabolites, in the past, has been conducted by means of intensive extraction of large amounts of plant material and subsequent time consuming spectroscopic measurements. Meanwhile, modern techniques for separation and analysis of plant extracts have been developed and should be applied in order to reduce costs, to save time and to provide complete data on the biochemical constitution of plants for other scientific disciplines. Advantageously, sesquiterpene lactones - the characteristic compounds of Asteraceae - are often located in special compartments like glandular trichomes from which they can be sampled in almost pure form. HPLC analysis allows establishment of compound profiles of plants in only a few minutes with detection of even minor constituents of less than 1 ppm in tissues. Peak assignments, via reference compounds, provide information on the chemical constitution of a specimen. This enables previously unaffordable broad screening of plant material for investigation of intraspecific variation and chemotaxonomic relationship within complete systematic groups. The potential of this technique and its impact on taxonomy will be discussed with special focus on *Helianthus* and related genera.

Monday 09:00 **Symposium Paper 9**
THE ROLE OF MASS SPECTROMETRY IN STRUCTURE ELUCIDATION OF NATURAL PRODUCTS
Jan S.L. Fryxell, Division of Medicinal Chemistry and Life Science Mass Spectrometry Facility, College of Pharmacy, University of Kentucky, Lexington, Kentucky 40536, USA.

Mass Spectrometry (MS), since its first use for organic compounds, is intensely applied to structural and analytical problems facing natural product chemistry. These applications have made significant contribution to the mutual development of both fields. The simplicity of information provided, great sensitivity, precision, and selectivity of detection are the major virtues of MS methods. In addition, new ways of ion generation and the direct combination with chromatography, permit the extension of MS analysis to very polar and high molecular weight compounds. In this context a systematic review of major MS methods, the information they provide, and questions they could answer will be attempted.

Monday 09:45 **Symposium Paper 10**
METHODS OF MASS SPECTROMETRY FOR THE STRUCTURE ELUCIDATION OF NATURAL PRODUCTS
David L. Smith, Department of Medicinal Chemistry and Pharmacognosy, Purdue University, W. Lafayette, IN 47907, USA.

The traditional uses of mass spectrometry for structure elucidation of natural products include determination of molecular weight and elemental composition. Fragmentation patterns have also been used to provide important structural information. During the past decade, mass spectrometric methods have advanced in many areas, especially with respect to the types of compounds that can be analysed. Despite the excitement over these new capabilities (MW determination to 100,000), traditional methods of mass spectrometry continue to play an important role in the structure elucidation of natural products. This presentation will illustrate the use of traditional as well as new methods of mass spectrometry for determining the structures of acetalogenins.

Monday 11:00 **Symposium Paper 11**
NEW NMR METHODS IN PHYTOCHEMICAL STUDIES
Nikolaus H. Eischer, Department of Chemistry, Louisiana State University, Baton Rouge, Louisiana, 70803, USA.

Recent developments in high-field NMR spectroscopy have provided a powerful tool for structural and biosynthetic studies of natural products. Computer-controlled pulse sequences for one- and two-dimensional NMR experiments have dramatically increased the sensitivity and efficiency of NMR spectral data. In spite of the many confusing NMR spectroscopist's jargons that have been introduced for the various pulse sequences, emphasis will be on selected examples to illustrate the power of NMR spectroscopy in solving structural and biosynthetic problems of various types of natural products.

Monday 11:45

Symposium Paper 12

BIOSYNTHETIC METHODS FOR PLANT NATURAL PRODUCTS: NEW PROCEDURES FOR THE STUDY OF GLANDULAR TRICHOME CONSTITUENTS
Jonathan Garshbuzon, Institute of Biological Chemistry, Washington State University, Pullman, WA 99164-6340 USA

Many plant terpenoids, phenolics and other natural products are synthesized and accumulated in specialized epidermal structures known as glandular trichomes. Biosynthetic studies of these substances have been hindered by the low incorporation of precursors in *in vivo* experiments and by the difficulties in obtaining active *in vitro* preparations from typical plant extracts due to the instability and low concentrations of the relevant enzymes. I will outline several useful procedures for investigating the metabolism of glandular trichome constituents and describe their application to the study of monoterpene biosynthesis in mint. Techniques for isolating high yields of active enzymes from glandular trichomes will be presented, as well as a protocol for obtaining trichome cell clusters suitable for *in vivo* studies.

Monday 14:00 **Symposium Paper 13**
PLANT CHEMICAL CUES, PHENOTYPIC PLASTICITY AND POPULATION DYNAMICS
Norman C. Nagel, Dept. of Biology, University of Utah, Salt Lake City, Utah 84112, USA.

Some herbivorous mammals employ plant chemicals (6-methoxy-benzoxazolinone) in the diet as a cue for timing of reproduction. Since 6-MBOA occurs primarily in monocotyledons, this cueing mechanism is adaptive only for species that specialize on grasses and sedges. The use of such a temporally variable cue selects for phenotypically plastic growth and maturation responses, which in turn results in unstable age distributions. Species that employ plant chemical cues exhibit more profound population fluctuation than species employing other cues (i.e., photoperiod). The limitations and implications will be discussed.

Monday 14:45 **Symposium Paper 14**
THE ROLE OF SCENT MARKING IN THE ASSESSMENT OF OPPONENTS BY MALE MAMMALS
L. Morris Gosling, Mammal Ecology Group, ADAS Central Science Laboratory, MAFF, Jupiter Road, Norwich NR6 6SP, UK.

The scent matching hypothesis of competitor assessment suggests that male mammals may assess opponents by comparing their odour with that of nearby scent marks. Where these scents are the same the opponent is probably a resource holder (a male monopolizing a territory or mates). The receiver should then be reluctant to continue the encounter, since resource holders will generally escalate to defend their resources. Scent marks may thus be conditional threats which resource holders use to reduce defence costs. Predictions of this hypothesis were tested using house mice in experiments simulating interactions between territory owners and intruders. We compared how readily males fought with opponents that either matched or did not match the smell of a scent marked substrate. Scent marked substrates were also manipulated to separate the effect of an opponent's behaviour (as an owner or intruder) from whether or not its odour matched the substrate.

Monday 16:00 **Symposium Paper 15**
GENERALIZED PLANT DEFENSE: EFFECTS ON MULTIPLE SPECIES
Vera A. Kirschik, Dept. Entomol., University of Maryland, College Park, MD, USA, 20782.

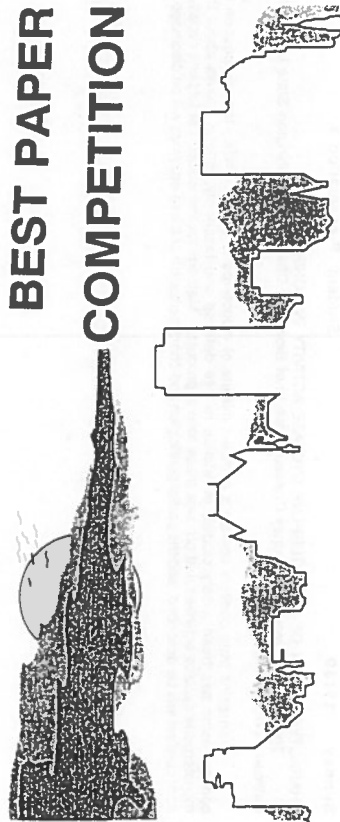
Since Fraenkel's 1959 paper on the purpose of secondary compounds in plants, a vast literature has accrued discussing the effects of plant chemicals on insects. He also speculated that other biota such as plant pathogenic bacteria and fungi are affected by allelochemicals. The general nature of plant compounds and effects on multiple species such as generalist and specialist herbivores and plant pathogens as well as insect pathogens are studied. Plant chemicals having high general toxicity, such as the alkaloids discussed here, offer plants broad spectrum defense. It seems parsimonious to argue that broad spectrum compounds are employed by plants. In some instances it may appear that specific plant compounds affect either herbivores or plant pathogens, when it actually is the sensitivity of the species to the chemical. In addition, both herbivores and plant pathogens have the ability to induce leaves and alter leaf quality. If a plant chemical has a generalized effect on multiple species, then pathogen or herbivore attack may affect the ability of either group to subsequently colonize a plant. The general nature of plant chemicals may be more ubiquitous than realized. The occurrence of alkaloids in numerous plant families may be a case in point.

Monday 16:45

Symposium Paper 16

RAPID DISCRIMINATION BETWEEN HOST PLANTS AND NON-HOSTS BY HUMMINGBIRD FLOWER MITES ON THE BASIS OF NECTAR CHEMISTRY
Robert K. Colwell, Dept. of Ecology & Evolutionary Biology, University of Connecticut, Storrs, CT 06269-3042; Amy J. Heyneman, 2019 Newton Street, Seattle, WA 98112; and Irene Baker (deceased).

Hummingbird flower mites feed on nectar and pollen and reproduce in the flowers of hummingbird-pollinated plants and ride the birds between plants. The mites are highly host-plant specific--many are monophagous. Although local mite species often share the same (polyphagous) hummingbird carrier, fewer than 1 in 200 mites makes a host error when disembarking, with only 1-3 seconds to decide. Every species in some plant families (e.g. Lobeliaceae) have mites, yet flowers of other plant families on the same bird route (e.g. Labatae) are never occupied. In tests, mites choose (virgin) nectar of their own host species over sugar water, nectar of another mite species' host, or nectar of a "miteless" species--some of which appear to repel mites. In a survey of 40 chemical constituents of host nectar (39 spp.) and miteless nectar (24 spp.), differences in phenolics and amino acids were the statistical discriminators between these two groups of plants.



BEST PAPER COMPETITION

Sunday 17:30

Student Presentation 1

ANTIOXIDANTS AND ANTIOXIDANT ENZYMES AS A DEFENSE AGAINST PHOTO-ACTIVATED PLANT SECONDARY COMPOUNDS IN HERBIVOROUS INSECTS
Richard B. Alicata, Bernard J.R. Philogène, and John T. Arason. Ottawa-Carleton Institute of Biology, University of Ottawa, Ottawa, Ont., Canada, K1N 6N5.

We have been examining antioxidant defenses in photolabile-tolerant and photolabile-sensitive lepidopteran larvae. *Arctia plagiata*, a specialist feeder on the phototoxic plant *Hypericum perforatum* which contains the extended quinone hypericin, has relatively high levels of the antioxidant enzymes superoxide dismutase, catalase, and glutathione reductase. These enzymes may be inducible defenses against the activated oxygen species which are generated by these phototoxins and are responsible for their toxicity. *Manoduca sexta* is particularly sensitive to phototoxins such as hypericin and the thiophene alpha-terthienyl and has relatively low constitutive levels of antioxidant enzyme activity. This sensitivity can be dramatically altered however, with the use of dietary antioxidants such as beta-carotene and vitamin E. The implications of antioxidant defenses for insect herbivory will be discussed.

Sunday 17:45

Student Presentation 2

PARTIAL PURIFICATION AND CHARACTERISATION OF A 2-OXOGLUTARATE DEPENDENT DIOXYGENASE FROM *CATHARANTHUS ROSEUS*
Emidio De Carolis and Vincenzo De Luca, Institut Botanique, Dept. de Biologie, Université de Montréal, Qué., Canada H1X 2B2.

Young leaves of *Catharantus roseus* contain the enzymes which convert the monoterpenoid indole alkaloid labersonine by 3 hydroxylations, 2 methylations and 1 acylation step to vindoline. A novel hydroxylase which catalyses the second to last step in vindoline biosynthesis will be described. Using a recently established enzymatic assay for the hydroxylase, the enzyme was partially purified by ammonium sulfate precipitation, successive chromatography on Sephadex G-100, Hydroxyapatite, Aiky Superose and Mono Q. The enzyme demonstrated an absolute requirement for 2-oxoglutarate and enzymatic activity was enhanced by ascorbate, establishing it as a 2-oxoglutarate dependent dioxygenase. The hydroxylase was characterised by its strict specificity for position 4 of various alkaloid substrates, K_m 's, and M_i .

6:00 pm

Sunday 18:00

Student Presentation 3

SALINITY, SOIL AERATION AND HERBIVORY EFFECTS ON AMINO ACID AND BETAINES CHEMISTRY OF *SPARTINA ALTERNIFLORA*
John D. Bacheller & John T. Romeo, Department of Biology, University of South Florida, Tampa, FL 33620, USA.

The salt marsh cordgrass, *Spartina alterniflora*, modulates proline and glycinebetaine levels in response to saline stress. The amplitude of this osmoregulation is correlated with plant ecophene, tall growth forms having higher levels than short. The factors responsible are sediment oxidation level, interstitial salinity, and available nitrogen. Our experiment, conducted under conditions of high nitrogen availability, examined single and interactive effects of sediment aeration, interstitial salinity, and herbivory by monophagous *Prokelisia* planthoppers on nitrogen chemistry. Plants were subjected to combinations of: 10 or 20 ppt salinity; daily or weekly flushes, and 0, 50, or 200 insect loads. Sampling was done at 0, 14, 28, 42, and 56 days, and chemicals quantified by HPLC. Data were statistically analyzed by means of multifactorial analyses utilizing Duncan's New Multiple Range test and Student-Newman-Keuls test. Significant findings include: a density-dependent increase in proline and 3 other amino acids in response to planthopper predation.

Sunday 18:15

Student Presentation 4

PARTIAL PURIFICATION AND CHARACTERIZATION OF LIMONENE CYCLASE FROM *MENTHA PIPERITA* L CV BLACK MITCHAM (PEPPERMINT)
Jead L.M. Balanaravody, Jonathan Gershenson and Rodney Croteau, Institute of Biological Chemistry, Washington State University, Pullman, WA 99164-6340 USA.

The cyclization of geranyl pyrophosphate (GPP) is a key step in the biosynthesis of most monoterpenes. The enzymes that catalyze this conversion are known as cyclases. In peppermint, GPP is converted to the monocyclic olefin limonene by the action of limonene cyclase. We partially purified this activity 45-fold from a preparation of epidermal glands. Limonene cyclase has an apparent molecular weight of 55,000, an isoelectric point of 4.35, shows a pH optimum near 6.7 and requires a divalent metal ion, either Mn^{++} or Mg^{++} , for catalysis, with Mn^{++} being preferred. The apparent Michaelis constant for GPP was determined to be 1.7 mM. Both histidine and cysteine residues appear to be essential for catalysis.

Sunday 18:30

Student Presentation 5

NEEM-BASED ANTIFEEDANTS AND THEIR EFFECT ON EUROPEAN CORN BORER (*OSTRINIA NUBILALIS* (LEPIDOPTERA: PYRALIDAE))
Diane C. Gagnon and J.T. Arason, Dept. of Biology, University of Ottawa, 30 George Glnski, Ottawa, Ont., Canada, K1N 6N5.

Neem oil extracted from the neem tree (*Azadirachta indica* A. Juss. (Meliaceae)) and azadirachtin, a irterpenoid purified from neem seeds, were evaluated in field trials for their antifeedant and insecticidal properties to the European corn borer in sweet corn. Corn plants artificially infested with egg masses of corn borer showed that cobs were significantly less damaged when treated with neem oil or azadirachtin, compared to an infested control. Antifeedant activities of azadirachtin and the formulation used in the field trials were tested in a leaf-disk bioassay; growth and development parameters of larvae placed on diet treated with various neem oil concentrations were monitored. The data suggest that neem may offer a safer alternative to the use of synthetic pesticides in controlling the corn borer in sweet corn.

Sunday 18:45

Student Presentation 6

TWO NEW TRIHYDROXYPIPECOLIC ACIDS FROM *INGA PATERNO* (MIMOSOIDAE)
Timothy C. Morfin and John T. Romeo, Department of Biology, University of South Florida, Tampa, FL 33620, USA.

The Mimosoid subfamily of the Leguminosae is known for its array of limino acids based on piperolic acid. All single trihydroxy piperolic acid is also known, but from a single species in the Papilionoideae. A phytochemical study of the Mimosoid genus *Inga* has revealed two additional naturally occurring trihydroxy piperolic acids. The new compounds were isolated from *Inga paterno*, native to Mexico and Central America. Alumina column chromatography, followed by high voltage paper electrophoresis and reverse-phase C-18 HPLC yielded small amounts of both compounds. They were characterized by proton and C-13 NMR spectroscopy and structures assigned. A distributional survey revealed that both compounds are restricted to a small number of species.

CONTRIBUTED PAPERS

Sunday 19:00

Student Presentation 7

BIOSYNTHETIC STUDIES OF THIOPHENES FROM HAIRY ROOT CULTURES OF *TAGETES PATULA* USING ^{13}C -LABELED SODIUM ACETATE

Mátias A. Mendeláqui, Nikolaus H. Fischer, Martin Hjortso*, Maryam Foroozesh and Tina Thibodeaux. Department of Chemistry and Chemical Engineering*, Louisiana State University, Baton Rouge, Louisiana, USA.

Biosynthetic studies of 5 (but-3-en-1-ynyl) 2,2' bithiophene and 5 (4-acetoxy-1-butynyl) 2,2' bithiophene were carried out using *Agrobacterium* rhizogenes-transformed hairy root cultures of *Tagetes patula*. Experiments with $[1-^{13}\text{C}]$ and $[2-^{13}\text{C}]$ sodium acetate as precursors verified that the two thiophenes followed the acetate pathway as previously proposed based on studies of structurally related compounds using ^{14}C labeled precursors. It was shown that the C-12 thiophenes are derived from C-14 precursors followed by two decarboxylations as previously proposed for the biogenesis of this class of compounds. The interpretation of the ^{13}C NMR spectra of the above thiophenes and the advantages of a combined use of hairy root cultures and ^{13}C labeled precursors for biosynthetic studies will be discussed.

Sunday 19:15

Student Presentation 8

CIS-MONOLIGNOLS AND THEIR GLUCOSIDES IN BEECH BARK TISSUE: ENZYMOLOGY AND THEIR INVOLVEMENT IN LIGNIFICATION

Ma. Estela J. Inciong, Eisuo Yamamoto, Laurence Davin and Norman G. Lewis, Departments of Wood Science and Biochemistry, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061-0232, USA.

American beech bark (*Fagus grandifolia* Ehrh) exclusively accumulates Z-monolignols and their corresponding glucosides, which are biosynthetically derived from E-hydroxycinnamyl alcohols, such as coniferyl alcohol. Although E \rightarrow Z isomerization can occur photochemically *in vitro*, the evidence suggests that a novel isomerase is involved *in vivo*. Beech bark glucosyltransferase exhibits a strong substrate preference for Z, and not E-, monolignols. Recent progress in the purification and characterization of this unusual enzyme will be discussed. Finally, the nature of the inter-monomeric bonding environments in beech bark lignins, together with a proposed role for Z-monolignols, is presented.

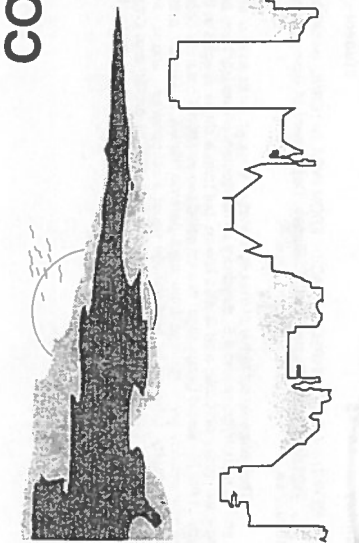
Sunday 19:30

Student Presentation 9

CHARACTERIZATION OF MONOTERPENE CYCLASE ACTIVITY IN CONIFERS

Thomas J. Savoca and Rodney Croteau, Institute of Biological Chemistry, Washington State University, Pullman, WA 99164-6340 USA.

Oleoresins from conifers contain a complex mixture of monoterpene olefins. While the composition of conifer resins has been widely studied in relation to tree defense and taxonomy, little is known about the monoterpene cyclase activities that produce these natural products. Methods for the isolation of terpene cyclases from conifers will be described, and the partial purification and characterization of these enzymes will be discussed.



Tuesday 08:30

Oral Presentation 1

HISTOLOGICAL LOCALIZATION OF PSORALENS IN SEEDS AND FRUITS

Alicia M. Zobel and Stewart A. Brown, Department of Chemistry, Trent University, Peterborough, Ont., Canada, K9J 7B8.

Three psoralens of umbelliferous plants were determined on the fruit surface, and in rufaceous and leguminous plants on the seed surface. Concentrations varied among and within the species, from traces to 40 micrograms/g fresh weight -- 0.28 to 43% of the total. On *Ruta graveolens* seeds the concentration was very low compared to that on the leaf surface. Dry fruits of the Umbelliferae contained higher concentrations within the tissue than on the surface, and still higher within the seed. Autofluorescent microscopy and isolation of fruit and seed parts revealed a fluorescent layer on the surface of umbelliferous fruits and seeds, and on the surface of the embryo. Crystals were visible in some longitudinal glands of dry fruits of *Heracleum*, *Angelica* and *Seseli*, and also on the seed covers of the Umbelliferae. *Psoralea* contained crystals on the surface of the embryo.

Tuesday 08:45

Oral Presentation 2

MECHANISMS OF ACTION OF PSORALEN AND XANTHOTOXIN ON MITOTICALLY ACTIVE CELLS

Alicia M. Zobel, Dept. of Chemistry, Sharon Louis and Koome Mwirira, Dept. of Biology, Trent University, Peterborough, Ont., Canada, K9J 7B8.

In darkness and under UV, two plant furanocoumarins affected mitoses and morphology of mitotically active cells. Embryonic meristem of *Allium cepa* root tips and animal cell cultures showed fewer mitoses, but more chromosomal aberrations and blockage of some phases of mitosis. Even after 1h in the presence of UV, psoralen and xanthotoxin caused abnormal chromosome separation leading to chromosomal aberrations in sister cells, and complete cessation of mitosis after 3h. In darkness mitotic spindle aberrations were visible after 3h, but the primary mechanism after 1h was on the endomembrane system. The first responses were in the cell membrane, nuclear envelope, and endoplasmic reticulum, changing their structure and causing fragmentation. We suggest that although the effect of UV is on DNA, as is well-known, the primary reaction, which occurs in darkness, is on the endomembrane system.

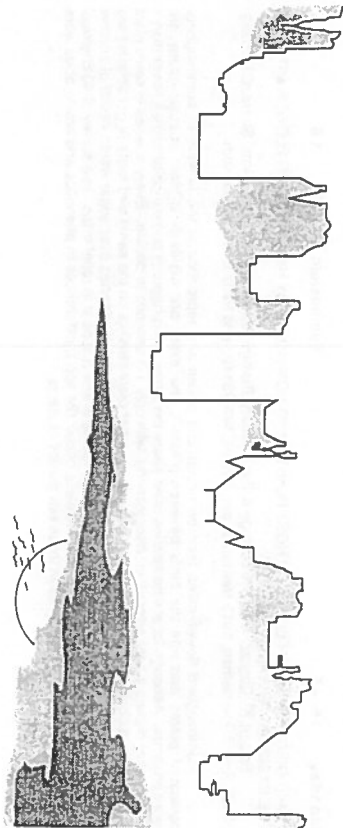
Tuesday 09:00

Oral Presentation 3

APPLYING QUANTITATIVE STRUCTURE-ACTIVITY RELATIONSHIP TECHNIQUES TO NATURAL PRODUCTS PHOTOTOXIC THIOPHENES

Robin J. Mardis and J. Thor Arnason, Biology Dept., University of Ottawa, Ottawa, Ont., Canada, K1N 6N5, and R. Lilia Compadre and César M. Compadre, Dept. of Biopharmaceutical Sci., College of Pharmacy, University of Arkansas for Medical Sciences, Little Rock, AR 72205, USA.

Reports on the relationship between chemical structure and biological activity of plant secondary metabolites generally describe structural features essential for activity and, in qualitative manner, how various modifications to the molecule enhance or detract from the level of activity. Such information, while useful, does not allow quantitative prediction of the level of activity or specificity of new natural or synthetic analogues of the lead compound. By preparing a large number of synthetic analogues of naturally occurring phototoxic thiophenes, determining their differences in selected biologically relevant physical parameters, and their phototoxicity against a variety of organisms, statistical models have been developed to reliably predict the phototoxicity and specificity of novel thiophene analogues.



Tuesday 09:15

Oral Presentation 4

EFFECT OF SALINITY STRESS ON SEEDLING CHLOROPHYLL OF *LAI TRIS PUNCTATA* HOOK
Alina Walther, Dept. of Biology, University of Regina, Regina SK, S4S 0A2, Canada.

L. punctata is a nonhalophytic herbaceous prairie perennial. It depends on seed for establishment on new sites, now increasingly subject to secondary soil salinization. Although seed germinated readily in high NaCl or Na₂SO₄ solutions, radicle development was inhibited. Viable seedlings from lower concentrations were raised in vermiculite irrigated with salt-enriched 1/2-strength nutrient solution under a 14 h 25/15° regime. Chl was extracted with 80% acetone. Salinity depressed the Chl content of mature cotyledons without affecting the *ab* ratios. The first foliage leaves were not significantly affected but older leaves showed a similar effect of mild-to-moderate salinity stress on Chl content. The near-constancy of the Chl *ab* ratios was also observed in another prairie species, *Glycyrrhiza lepidota* (Walther, 1989, Plant Physiol. vol. 89, No. 4, S1062) suggesting an equivalent effect on Chl formation under NaCl- or Na₂SO₄-induced salinity stress.

Tuesday 09:30

Oral Presentation 5

RELATIONSHIP OF EPICUTICULAR WAX FATTY ALDEHYDES TO CHILLING INJURY IN STORED GRAPEFRUIT
Harold E. Nordby and Roy E. McDonald, U.S. Department of Agriculture, ARS, 2121 Camden Road, Orlando, FL, USA 32803.

Grapefruit is quite susceptible to chilling injury (CI), e.g., rind pitting or brown staining, when stored 3 or more weeks at 1-5°C. Squalene and other terpenoids have been shown to be natural protectants against CI, being synthesized when grapefruit are held 7 days at 15°C prior to storage. Under storage conditions conducive to CI, the level of epicuticular wax C₂₆-C₃₄ linear aldehydes decreased dramatically. This weakening of the "outer coat" is postulated to make the membranes more susceptible to CI. Conditioning grapefruit 7 or more days at 15°C stimulated synthesis of C₂₄-C₂₆ aldehydes. This replacement of longer chain with shorter chain aldehydes is believed to be a complement to the protective action of squalene against CI.

Tuesday 09:45

Oral Presentation 6

THE USE OF GC AND GC/MS TO CHARACTERIZE THE SUCROSE ESTERS OF *MICOTYANA* SPECIES
Q.T. Chubb and R.F. Severson, Tobacco Quality & Safety Research Unit, USDA, ARS, P.O. Box 5677, Athens, Georgia, 30613, USA.

The glandular trichomes on the surface of green leaves of most *Nicotiana* plants produce a gummy exudate. We have identified the major constituents of this cuticular material to be terpenes and sucrose esters. Sucrose esters (SE) of some *Nicotiana tabacum* varieties have demonstrated both antibiotic and plant growth regulating activities. However, their most important function is the liberation, on smoking, of the potent Turkish tobacco flavor and aroma compounds, methylvaleric and methylbutyric acids. Accordingly, we are investigating the SE of the *Nicotiana* species, with the objective of finding promising species to cross with and enhance the aromas of commercial tobacco varieties. GC and GC/MS methodology used in the characterization of these SE will be described. Details will be given for the analyses and differentiation of five different SE structural types.

Tuesday 10:30

Oral Presentation 7

FLAVANONE-SPECIFIC 7-GLUCOSYLTRANSFERASE ACTIVITY IN *CITRUS PARADISI* SEEDLINGS: PURIFICATION AND CHARACTERIZATION
Cecilia A. McIntosh, Lilian Latchinian, and Richard L. Mansell, Dept. Biology, University of South Florida, Tampa, FL, USA 33620. ** Dept. Biology, Concordia University, Montreal, Quebec, Canada, H3G 1M8.

The isolation and characterization of a flavanone-specific 7-O-glucosyl-transferase (GT) and its resolution from other GTs in grapefruit seedlings will be described. This new enzyme in the subclass 2.4.1 catalyzes the glucosylation of the 7-OH group of naringenin to form prunin and has been purified (943 fold) by fractional precipitation with ammonium sulfate and successive chromatography on Sephadex G-100, hydroxyapatite, UDP-glucuronic acid agarose, Mono Q, and Mono P columns. It has a pH optimum of 7.5-8.0, an apparent *K_m* of 4.3, and an apparent *M_r* of 54.9 kd. This GT has an expressed specificity for the 7-position of the flavanones naringenin (Kmapp 62 µM; Kmapp UDPG 51 µM) and hesperetin (Kmapp 124 µM; Kmapp UDPG 243 µM) and did not accept other flavone, flavonol, or chalcone aglycones.

Tuesday 10:45

Oral Presentation 8

PROTEIN ENGINEERING OF PAPAINE: DESIGNING NEW PROPERTIES INTO AN OLD ENZYME!
Hedy E. Khoufi, Protein Engineering Section, Biotechnology Research Institute, National Research Council Canada, 6100 Royalmount Avenue, Montréal, Québec, Canada H4P 2R2.

Papain from the latex of the papaya tree (*Carica papaya* L.) has been the most intensively studied of all cysteine proteases. Its amino acid sequence is known and its structure has been determined to 1.65 Å resolution by X-ray crystallography. This makes the enzyme an ideal candidate for protein engineering. A synthetic gene coding for papain was expressed in a Baculovirus-insect cell system. Through site directed mutagenesis several papain mutants designed to investigate the mechanism of papain were produced in this system. Based on amino acid alignment with other known cysteine proteases, selected modifications into papains S2 subsite were designed with the aim of altering papains substrate specificity. Characterization of the mutants thus produced and their implication with respect to industrial application will be discussed.

Tuesday 11:00

Oral Presentation 9

PHOTOCHEMISTRY OF HYDROXYCINNAMATE ESTERS IN GRASS CELL WALLS
J.A. McCallum¹, G.H.N. Towers¹, S. Tachibana¹, I.E.P. Taylor¹ and T. Arason², ¹Botany Dept. University of British Columbia, Vancouver, B.C. V6T 2B1, ²Dept. Biology, University of Ottawa, Ottawa, Ont., K1N 6N5, Canada

Although earlier work has shown that UV-irradiation can bring about isomerization and dimerization of hydroxycinnamate esters in grass cell walls in vivo the influence of such reactions on the structure, development and degradation of the walls is uncertain. Our present studies have examined the effects of UV-irradiation on cell walls of Barley (*Hordeum vulgare*) and hydroxycinnamate esters in relation to degradation of walls and esters by crude and purified enzymes from *Aspergillus niger*. Our findings indicate that hydrolysis of cell walls and esters by xylanases and aromatic esterases respectively is significantly reduced by UV-irradiation. These results support earlier suggestions that in vivo E-Z isomerization of hydroxycinnamate esters may have significant effects on the conformation of hemicellulosic polymers in the monocot cell wall and thus their susceptibility to enzymatic modification.

Tuesday 11:15

Oral Presentation 10

SINAPINE METABOLISM WITHIN THE BRASSICACEAE
Thomas Vogl¹, Dieter Sirack² and Brian Ellis¹, ¹University of British Columbia, Dept. of Plant Science, Vancouver V6T 2A2, Canada, ²Institut für Pharm. Biologie der TH Braunschweig, 3300 Braunschweig, FRG.

Sinapychoiline (sinapine) is the main phenolic compound in the seeds of many members within the Brassicaceae. Its metabolic pathway during maturation and germination of seeds has been demonstrated in *Rapistrum sativus* (red radish) to involve high energy UDP-glucose esters instead of CoA-esters as intermediates. Members of the Brassicaceae like *Brassica napus* (rape-seed, canola) are important crops, the seed of which, after extraction of the oil, is used as protein rich animal food. This meal still contains high amounts of phenolics, especially sinapine, which are undesirable and therefore restrict its use. A new approach to reduce the sinapine content in the seeds may be achieved by genetically engineering a reduction in the amount or activity of the key biosynthetic enzyme 1-sinapoylglucose: choline sinapoyl transferase (SCT), which is responsible for the high accumulation of sinapine during seed maturation. The metabolic pathway of sinapine in *B. napus* is thought to likely resemble that demonstrated earlier in *R. sativus*. In this report the strategy for the purification of SCT from *B. napus* is outlined as a first step towards cloning the corresponding structural gene and development of an antisense RNA construct.

Tuesday 11:30

Oral Presentation 11

LIGNAN BIOSYNTHESIS IN FORSYTHIA SPECIES
Laurance Daudt, Toshiaki Umezawa, Norman G. Lewis, Departments of Wood Science and Forest Products and Biochemistry, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061-0323, USA.

Lignan biosynthesis has long been proposed to occur via oxidative coupling of two phenylpropanoid monomers in a manner analogous to that of lignins (i.e. via an H₂O₂-requiring peroxidase). However, lignans are normally enantiomerically pure, whereas lignins have no measurable optical activity. No explanation has been proffered to account for the stereochemical control leading to optical activity of lignans, other than that the reaction is somehow enzymatically mediated. The biosynthetic routes to the forsythia lignans, (+) pinoresinol, (-) secoisolariciresinol and (-) matairesinol have been investigated. We have established that (+) pinoresinol formation does not occur via mediation of a typical H₂O₂-requiring peroxidase. In addition, evidence for the role of (-) secoisolariciresinol (or an oxidised equivalent) as a central photol intermediate in the biogenesis of butyrolactone lignans, such as (-) matairesinol, is discussed.

Tuesday 09:15 Oral Presentation 16
TRAIL-FOLLOWING RESPONSES OF TAPINOMA SIMIROTHI (FORMICIDAE: DOLICHODERINAE) TO PYGIDIAL GLAND EXTRACTS
 Izvıl Simón and Abraham Hefetz, Department of Zoology, Tel-Aviv University, Ramat-Aviv, 69978 Tel-Aviv, Israel

The pygidial (anal) gland was found to be the source of trail-pheromone in the ant *Tapinoma simirothi*. Bioassays conducted with fractionated pygidial gland secretion indicated that the fraction containing iridodiols and iridomyrmecin is responsible for the trail-pheromone activity. Thus workers of *T. simirothi* may utilize the same glandular exudate for alarm and trail following. At high emission rates from a point source, the ants responded in alarm, e.g., rushed to the source with open mandibles and raised abdomen. At low concentrations and when drawn as a line, the ants followed the secretion calmly. Trails of *T. simirothi* are long-lived, having a biological half life between 10 and 19 days. Quantitative studies of the evaporation rates of the iridodiols by gas chromatography resulted in a half life of 11 days, agreeing with the biological data. The implications of the use of the same glandular secretion for alarm and food recruitment will be discussed.

Tuesday 09:30 Oral Presentation 17
INTRASPECIFIC RECOGNITION IN KALOTERMES FLAVICOLLIS (ISOPTERA: KALOTERMITIDAE)
 C. Everaerts, A. Perrin and O. Bonnard, Laboratoire de Zoologie, URA CNRS 674, Université de Bourgogne, 21000 Dijon, France.

As a rule, criminality does not exist inside a termite society. Being an exception to this rule, the primitive termite *Kaloterme flavicollis* is characterized by a special form of intra-nest aggressivity. In this species, the society is strictly monogynic. When the pair of reproductives disappears, many of the remaining individuals transform into replacement sexuals. While all non-transformed individuals are non-aggressive, neotenic individuals are very aggressive to all other neotenic but not to other castes. Fights occur between neotenic until only one pair survives. This behavior involves the existence of special recognition cues between neotenic and other castes, and such differences may be correlated to the involved recognition cues.

Tuesday 09:45 Oral Presentation 18
IDENTIFICATION AND ATTRACTIVENESS OF A MAJOR PHEROMONE COMPONENT FOR NEARCTIC EUSCHISTUS SPP. STINK BUGS (HEMIPTERA: HETEROPTERA: PENTATOMIDAE)
 Jeffrey R. Aldrich, USDA-ARS, Insect Hormone Laboratory, Bldg. 467, Beltsville, Maryland 20705, USA.

Methyl (2E, 4Z)-deca-2,4-dienoate is the major male-specific volatile of *Euschistus conspersus*, *E. tristigmus*, *E. servus*, *E. politus*, and *E. ictericus*. In a sixth species, *E. obscurus*, this ester is a relatively minor male-specific component, with the major component being tentatively identified as methyl 2,6-dimethyltetradecanoate. Females, males, and nymphs of *E. conspersus*, *E. tristigmus*, *E. servus* and *E. politus* were significantly attracted to methyl (2E, 4Z)-deca-2,4-dienoate in field tests conducted in California and Maryland. Tests in Maryland also demonstrated that parasitic tachinid flies use the *Euschistus* unsaturated methyl-ester as a host-finding kairomone. It is not yet clear what role minor volatile components of *Euschistus* play in reproductive isolation.

Tuesday 10:30 Oral Presentation 19
VARIOUS ARANEID SPIDERS ATTRACT FLY AND/OR MOTH PREY
 Mark K. Stone, c/o J. Reiskind, Dept. of Zoology, Univ. of Florida, Gainesville, FL 32611, USA.

A variety of recent work supports the hypothesis that "bola spiders" (species in the araneid subfamily Mastophorinae) mimic female moth sex pheromone blends and attract their prey (male moths). I discuss new work which suggests that aggressive mimicry is employed by a variety of genera in the superfamily Araneoidea, that some of the spiders attract Dipteran as well as Lepidopteran prey, and that these spiders evolved aggressive mimicry independently of each other.

Tuesday 11:45 Oral Presentation 12
PHENYLPROPANOID PHOTOCHEMISTRY OF GRASS CELL WALLS
 G.H.N. Towers, Felipe Balza, Roy Hartley, Michael Rodgers, Sanro Tachibana, John McCallum, Ed Neeland, Vic Rathore and Thor Arason. Botany Department, University of British Columbia, Vancouver, B.C. 6V1 2B1, USA, Athens, GA, USA. * Biology, University of Ottawa, Ottawa, Ont., K1N 6N5, Canada.

In addition to photoisomerization, the hydroxycinnamic acids, esterified to cell wall hemicelluloses in barley, corn and other grasses, undergo photodimerization to produce phenolic toxilic and truxinic esters on transfer of plants from dark to light. The significance of these photochemical events in relation to wall structure and to utilization by herbivores will be discussed.

Tuesday 12:00 Oral Presentation 13
TRITERPENES FROM TWO BETULA SPECIES
 Yun-Hua, Michael D. Bentley, and Barbara J.W. Cole, Department of Chemistry, University of Maine, Orono, Maine, 04469, USA.

Triterpenes from the outer bark of yellow birch, *Betula alleghaniensis*, and black birch, *Betula lenta*, have been isolated and identified. From *B. alleghaniensis*, we have isolated 17 lupane triterpenes, including 29-nor-20-oxolupan-3-one-28-ol, lupan-3-one-28-diol, 29-nor-20-oxolupan-3-one, and lup-20 (29)-ene-28-ol-30-ol-3-one as new natural products. From *B. lenta*, we have isolated 10 lupane triterpenes, including lup-20 (29)-ene-30-ol-3-one-28-diol as a new natural product.

Tuesday 8:45 Oral Presentation 14
VOLATILE COMPOUNDS FROM MALE BUTTERFLIES
 Stefan Schulz, Institut für Organische Chemie, Universität Hamburg, Martin-Luther-King-Platz 6, D-2000 Hamburg 13, FRG.

(1S,3R,6R,9S,10S)-9,10-Epoxytetrahydroedulan is the main compound in the volatile secretions of male scent organs of several species of *Euploea* (Danainae) butterflies. (1R,3S,6R)-8-Oxodihydroedulan was identified in *Danaus plexippus*. The new monoterpene, 8-hydroxy-6,7-dihydro-isogeraniol and -isomerol, could be identified as the minor components of the hairpenic bouquet of *Danaus chryseippus*. In males of the related Heliconidae acyclic esters, lactones and terpenes dominate the scent bouquets. In *Heliconius erato*, penyl- and hexyl esters of 2,3-dihydrofarnesic acid were identified as the major components of the extracts of scent organs. In *Heliconius heurippa* scent organs contain at least 32 different lactones. The major component of the abdominal secretion of males of the satyrid *Elymnias thyralis* proved to be the new monoterpene, 2-(2-hydroxy-2-methyl-3-butenyl)-4-methylfuran. Straight chain cis- and trans-2,5-dialkyltetrahydrofurans containing 27-35 carbon atoms could be identified from several butterfly families. They occurred in species specific mixtures in different concentrations in the scent organs of males of heliconids, danains, ithomiids and nymphalids. A new class of surfactants could be identified from the body extracts of *Cretonotos transiens* and from the scent organs of *Mechanitis lysimnia*: esters of long chain fatty acids with N,N-dimethylaminoethanol. Identification procedures and syntheses of the compounds will be presented, biological functions of some compounds will be discussed.

Tuesday 09:00 Oral Presentation 15
DETECTION AND IDENTIFICATION OF A CRYPTIC PHEROMONE FROM IPS PINI (COLEOPTERA: SCOLYTIDAE)
 Stephen A. Teale, Aijun Zhang, Gerald N. Lanier and Francis X. Webster, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210, USA.

A major new pheromone was isolated from *Ips pini* through a sequential fractionation and bioassay procedure. The interaction of several peculiarities of the system made detection of the new pheromone elusive: it co-eluted with a major capillary GC peak in Porapak Q collections of volatiles, it is present and active in minute relative quantities, and its activity varies seasonally. The structure of the isolated active compound was elucidated through MS, IR, and NMR spectrometry. It is active as a synergist with ipsdienol.

Tuesday 10:45

Oral Presentation 2 0

COMPARISON OF CALLING BEHAVIOUR IN TWO GEOGRAPHICALLY ISOLATED POPULATIONS OF THE TRUE ARMYWORM

Jaromír N. McNeill, Département de biologie, Université Laval, Ste-Foy, P.O., Canada, G1K 7P4.

In both Europe and North America the true armyworm, *Pseudaletia unipuncta* extends its summer range northward into areas far beyond their overwintering sites. It has been hypothesized (McNeill, 1987, Insect Sci. and its Appl. 8:591) that the delay in female calling behaviour, as well as male receptivity to the female sex pheromone, observed under short day, cool temperature conditions permits both northward (spring) and southward (fall) migratory flights. A existence of a permanent population in the Azores provides an opportunity to test the hypothesis that, in non-migrant populations, the pre-reproductive period will be shorter than that of migrant populations. Data in support of this hypothesis will be presented and the ecological implications discussed.

Tuesday 11:00

Oral Presentation 2 1

STRUCTURE-FUNCTION STUDIES OF CRAB PHEROMONE MIMICS

D. Billischol, A. Oliver, R.B. Forward Jr., and B.W. Erickson. Duke Univ. Marine Laboratory, Beaufort NC 28516. UNC, Chapel Hill, NC 27514, USA.

Synchrony of larval release in brachyuran crabs is orchestrated by pheromones released from hatching eggs. Here we examine the potency of pheromone mimics - arginine carboxyl tripeptides and of individual L-amino acids. Thresholds for responses ranged from attomolar for the most potent tripeptides and nanomolar for the most potent individual amino acids. Tests altering the position of glycine and either isoleucine or leucine showed the position and nature of the hydrophobic side chain were important. Thresholds increased 6 orders of magnitude through the test series GIR, IGR, GLR and LGR. Amino acids with charged R groups increased 6 orders of magnitude through the test series GIR, IGR, GLR and LGR. Amino acids with charged R groups were ineffective. Those with polar R groups had millimolar to micromolar thresholds. Those with large hydrophobic side chains were most potent. The untested tripeptide GMF should be the most potent peptide mimic. The dynamic range of the chemically mediated response will be discussed with respect to the hypothetical structure of the receptor.

Tuesday 11:15

Oral Presentation 2 2

THE SEX ATTRACTIVENESS PHEROMONE OF THE GUAM BROWN TREE SNAKE, *BOIGA IRREGULARIS*, IDENTIFIED?

Robert J. Masood and Tappay H. Jones, Laboratory of Biophysical Chemistry, National Health, Lung, and Blood Institute, NIH, Bethesda, MD 20892 USA.

The brown tree snake of Guam is an introduced pest species responsible for catastrophic ecological, environmental, and public health problems on the island. This colubrid snake is known to have extirpated at least three species of birds and the remaining species are considered threatened. We have previously identified a series of saturated and monounsaturated methyl ketones as the sex attractiveness pheromones of a related colubrid, the red-sided garter snake. Utilizing this paradigm and methodology, a similar mixture of methyl ketones was identified in *Boiga irregularis*. The predominant components of this mixture were identified as six new long chain ketodienes, Z,Z-6,26-pentatriacontadien-2-one, Z,Z-8,26-pentatriacontadien-2-one, Z,Z-6,27-hexatriacontadien-2-one, Z,Z-8,27-hexatriacontadien-2-one, Z,Z-6,28-heptatriacontadien-2-one, and Z,Z-8,28-heptatriacontadien-2-one. Their structures were determined from chemical and spectral means.

Tuesday 11:30

Oral Presentation 2 3

PHEROMONAL ACTIVITY OF PHENOLS AND KETONES IN BEAVER CASTOREUM

D. Müller-Schwazza and Peter W. Houlihan, College of Environmental Science and Forestry, State University of New York, Syracuse, NY 13210, USA.

Twenty-four single castoreum components and their mixtures were bioassayed with free-living beaver of three different populations in New York during four seasons. An artificial scent mark was placed in a family territory and the residents responded to this "mark of the intruder" with approach, sniffing, pawing, and scent marking in turn. Five compounds were active. These were 4-ethylphenol, 1,2-dihydroxybenzene, 4-methoxyphenol, acetophenone, and 3-hydroxyacetophenone. Mixtures of 6 or 24 compounds were as active as whole castoreum. The active compounds appear to be diet-derived and interact in additive as well as redundant fashion.

Tuesday 11:45

Oral Presentation 2 4

ALARM CHEMOSIGNALS AND IMMUNE PROCESSES

Robbelle Coëte, Department of Psychiatry, University of Rochester, Rochester, N.Y. 14642, USA.

Exposure to alarm chemosignals from stressed conspecifics results in physiological reactions that alter the immune response in laboratory mice. Lymphocyte proliferation following mitogen stimulation is altered in tissue samples from mice exposed to stress odors. Exposure for 24 hours results in suppression of T cell proliferation and suppression of B cell proliferation is seen following 48 hours exposure. Evidence suggesting that these immune system reactions to alarm chemosignals may play a role in disease resistance will be discussed.

Tuesday 14:00

Oral Presentation 2 5

INHIBITION OF GROWTH AND PHOTOSYNTHESIS BY SORGOLEONE

Frank A. Einballig, Itamar F. Souza, and Milton J. Haar, Dept. of Biology, University of South Dakota, Vermillion, South Dakota 57069, USA.

Root exudates of *Sorghum bicolor* contain an abundance of hydrophobic p-benzoquinones named sorgoleone. The objective of this study was to determine possible toxicity and physiological effects of sorgoleones on plants in order to evaluate their action in allelopathy. Root exudates containing sorgoleone were collected from *S. bicolor* seedlings five days after germination. Sorgoleone concentrations as low as 10 µM inhibited plant growth in brassicas using *Lemna minor*, *Eragrostis tef*, *Abutilon theophrasti*, and *Setaria viridis*. Photosynthesis was significantly reduced in *Glycine max* leaf disks vacuum infiltrated with 10 µM sorgoleone. These data indicate sorgoleones contribute to the allelopathic effects of *S. bicolor*.

Tuesday 14:15

Oral Presentation 2 6

PHENOLIC ACID CONTENT OF SOILS FROM SOYBEAN CROPPING SYSTEMS

Ludo Blum, Kristofer Klein, Lynn D. Holappa, Seung-Won Lyu, Thomas R. Wentworth, Dept. of Botany, Doug A. Worsham, Dept. of Crop Science, and Larry D. King, Dept. of Soil Science, North Carolina State University, Raleigh, NC 27695, USA.

Soil samples were obtained from wheat/no-till, wheat/conventional tillage, and fallow/conventional tillage at 30 day intervals during July and October of 1989. Soil extracts were obtained by autoclaving flasks containing 50 g of soil and 100 ml water for 45 min. Centrifuged and filtered supernatants were adjusted to pH 5 or adjusted to pH 2, centrifuged, and then adjusted to pH 7. HPLC analysis was used to isolate and quantify 7 common phenolic acids. Folin & Ciocalteu's reagent was used to determine total phenolic acid content. Individual phenolic acids and total phenolic acid content of soils were highly correlated. Phenolic acid content of 2.5 cm core samples from the wheat/no-till system were significantly higher than the samples from other cropping systems. Phenolic acid content and water potential of extracts was related to the observed inhibition of crimson clover germination.

Tuesday 14:30

Oral Presentation 2 7

CHEMICAL COMMUNICATION AND DEFENCE IN BARLEY

John V. Loxton and Dett Liu, Dept. of Agronomy and Soil Science, University of New England, Armidale, N.S.W., Australia, 2351.

Allelopathic potential has been demonstrated in the major temperate cereal crops, barley, oats, rye, and wheat. Allelochemicals may be liberated during life or from the residues of these, and other, crops after death. These compounds play a wider role in chemical communication with a range of organisms than their association with allelopathy, only, would imply. Techniques developed for the study of allelopathy and other chemical communication by barley will be described. Data will be presented on examples of chemical communication in barley which have deleterious consequences. These data are part of a programme which aims to define new selection criteria for this important crop.

Tuesday 16:15 Oral Presentation 3 2

INVESTIGATIONS ON SOME ASPECTS OF CHEMICAL ECOLOGY OF COGONGRASS (*IMPERATA CYLINDRICA* (L.) BEAUV.)
Jaddaji and K.M.M. Dakshini, Department of Botany, University of Delhi, Delhi - 11007, India.

To understand the mode of competitive mechanism of the weed, cogongrass (*Imperata cylindrica* (L.) Beauv.), its effect on nutrient availability and the components of mycolora of its rhizosphere soils, as well as nodulation characteristics of *Melilotus parviflora* Desf. were investigated. Additionally, the effect of the leachate of the leaves and the roots of the cogongrass on percent germination and seedling characteristics of radish, mustard, tomato and fenugreek were examined. Further to assess the qualitative and quantitative differences in the phytochemical components, the leachates were analysed through High Performance Liquid Chromatography (HPLC). It was observed that out of Cu^{++} , Ca^{++} , Mg^{++} , Na^{+} , K^{+} , Zn^{++} , Cl and PO_3^{-4} P analysed, the weed appeared to control the availability of PO_3^{-4} , Cl and Cu^{++} . Furthermore, of the 21 fungi recorded in the soils from the rhizosphere of the weed, decrease in the number of colonies (per gm of soil) of *Aspergillus niger*, *A. fumigatus*, *A. terreus* and *Penicillium chrysogenum* and increase in *A. flavus* and *Trichoderma viridis* was examined. The inhibition in nodule number and weight, acetylene reduction activity, root length and root/shoot ratio of *M. parviflora* seeds were affected by the leachate of root and leaves. It was found that root leachate was more inhibitory than leaf leachate. However, the inhibition was higher in soil-leaves than soil-root leachate. HPLC analysis established that four compounds were contributed by the weed to the soil system even though their concentration varied in various leachate. It is surmised that these compounds cause allelopathic inhibition of growth characteristics of the seeds tested. Significance of the data vis-à-vis the competitive potential of the grass will be discussed.

Tuesday 16:30 Oral Presentation 3 3

BIOSYNTHESIS OF SESQUITERPENOID PHYTOALEXINS IN COTTON FOLIAR TISSUE
Margareta L. Esslenbaag, Gordon D. Davis, and Guadelupe Davila-Huerta, Dept. of Biochemistry, Oklahoma State University, Stillwater, OK 74075-0454, USA.

During the hypersensitive resistant response of leaves and cotyledons of cotton (*Gossypium hirsutum*) to incompatible races of the bacterial pathogen *Xanthomonas campestris* pv. *malvacearum*, phytoalexins accumulate in the fluorescent, necrotic host cells closest to intercellular colonies of the pathogen. The most potent of these structurally related, photooxidizable phytoalexins is 2,7-dihydroxycadalenone (DHC). Putative biosynthetic precursors to DHC include *trans*-7-hydroxycalamenone, reported last year, and related compounds of molecular weights 216 and 222, which have been purified by normal phase HPLC on silica. A bacterial biight-resistant cotton line lacking lysigenous biands, WbMg1, possesses very low constitutive levels of sesquiterpenoids, but produced high levels of the phytoalexins after infection. Cell-free preparations from isolated and $CaCO_3$ -infiltrated control cotyledons of WbMg1, supplemented with cofactors, converted 1,3- H -labeled pyrophosphate to several hexane/chloroform-extractable, radioactive products. The predominant labeled product from the control extract cochromatographed with farnesol, whereas other products predominated from the extract of inoculated cotyledons. The FPP-converting enzyme from the latter extract has been partially purified. (Supported in part by the Oklahoma Agricultural Experiment Station and NSF Grant DMB 86-16650).

Tuesday 16:45 Oral Presentation 3 4

IDENTIFICATION OF PICETANNOL AS A PHYTOALEXIN OF SUGARCANE
Anita M. Brinkner and David S. Seigler, Dept. of Plant Biology, University of Illinois, Urbana, Illinois 61801, USA.

Sugarcane (*Saccharum* spp.) responds to infection by the fungus *Colletotrichum falcatum*, the causal agent of the disease red rot, by producing a red substance. Previous workers isolated the anthocyanidin leucocyanidin from this red substance and suggested that the compound might play a role in disease resistance, but evidence that this was the case was not conclusive. In our studies, the most active component of extracts of infected sugarcane was identified as picetannol (3',4,5'-trihydroxy-sibene). This compound is produced by sugarcane in response to infection but apparently not in response to wounding alone.

Tuesday 14:00 Oral Presentation 3 5

MODIFICATION OF CUTICULAR HYDROCARBONS IN DIAPAUSING INSECTS
Julien B. and F. Perez, Laboratoire de Chimie Structurale Organique, Université de Paris-Sud, Bâiment 410-415, 91405 Orsay, and J.-C. Blemont, A. Ouedrago, A. and J. Poulzat, Institut de Biocéologie Expérimentale des Agrosystèmes, Université François Rabelais, 37200 Tours, France.

It is now generally accepted that insect cuticular hydrocarbons are able to furnish valuable taxonomic information. Effectively the results of the comparison of cuticular hydrocarbons from *Acanthoscelides obiectus*, *A. obvelatus* and *Callosobruchus maculatus*, agree with the classification of these three species which are in the same subfamily of the Bruchidae. However, some differences between *A. obvelatus* (using exclusively diapausing insects) and its twin species *A. obiectus* stimulated us to study whether diapause has an effect on cuticular hydrocarbon repartition. The first results presented here concern the species *Callosobruchus maculatus* for which it is relatively easy to simultaneously obtain flying (sexually diapausing) or flightless (sexually active) insects

Tuesday 14:45 Oral Presentation 2 8

ALLELOPATHIC ACTIVITY OF *CHEMOPODIUM AMBROSIOIDES* ESSENTIAL OIL
Juan Jiménez-Osorio, Junji Kumamoto, Dept. of Botany and Plant Sciences, University of California, Riverside, Riverside CA 92521, and Christian Wasser, Phytochemistry Laboratory, Dept. of Ecology and Evolutionary Biology, University of California, Irvine, Irvine CA 92717, USA.

The activity of extracts of *Chenopodium ambrosioides* was examined and it was found that the active compound was volatile. Two ml per Petri dish (9 cm diameter) of *C. ambrosioides* essential oil inhibited totally germination and hypocotyl growth of *Amaranthus hypochondriacus*. At lower concentrations germination is only retarded though hypocotyl growth is inhibited 60% in comparison to the control. Steps to separate and identify the allelopathic compound(s) are described along with the possible effects of these allelochemicals in nature.

Tuesday 15:00 Oral Presentation 2 9

EFFECTS OF FERULIC ACID, A POTENTIAL ALLELOPATHIC AGENT, ON THE ENDOGENOUS LEVELS OF ABSICISIC ACID IN TOMATO
Lynn D. Holaday and Udo Blum, Dept. of Botany, North Carolina State University, Raleigh, NC. 27695-7612, USA.

Wild type and *flacca* (mutants deficient in abscisic acid) tomato plants of the isogenic parent line, *Lycopersicon esculentum* Mill., cv. Alisa Craig were treated with multiple treatments (at 2-day intervals) of ferulic acid concentrations (0.0, 0.2, 0.4, and 0.8 mM) in nutrient solution. Regression analysis indicated that ferulic acid was inhibitory to leaf elongation rates and plant water utilization of both taxa. As ferulic acid concentrations were increased concurrent decreases in leaf elongation and water utilization were observed. In addition, both wild type and *flacca* plants exhibited increases in endogenous levels of abscisic acid as measured by indirect immunoassay.

Tuesday 13:15 Oral Presentation 3 0

CROTALARIA JUNCEA SEEDS CONTAIN A POTENT PHYTOXIN
Serald R. Lealiter and Leonard E. Forrence, USDA-ARS, Forth Detrick, Bldg. 1301, Frederick, MD USA 21701

Crotalaria juncea (sunn hemp) is a legume with allelopathic potential. In our search for natural phytoalexins, we found that a water-soluble compound(s) extracted from the seeds of sunn hemp was toxic to *Lemna* sp. in bioassay. Fifty parts per million of a semi-purified extract inhibited *L. obscura* frond production 50%. Leafy spurge (*Euphorbia esula*), an invading noxious weed of rangelands in the USA and Canada is the target of alternative control techniques. Leafy spurge in sand culture produced only 25% of normal growth when two seeds of sunn hemp were planted in the same pot. Eight sunn hemp seeds inhibited the leafy spurge growth 88%. We are exploring the use of sunn hemp as an allelopathic crop plant for reducing leafy spurge infestations. With further development, the phytoalexin may be suitable as a natural herbicide.

Tuesday 16:00 Oral Presentation 3 1

IDENTIFICATION OF GROWTH INHIBITOR FROM *ARTEMISIA PRINCEPS* VAR. *ORIENTALIS*
Kyeong Won Yun, Bodo-Seob-Kil, Dept. of Biology, Wonkwang University, Iri, Chonbuk, 570-749 and Jong-Sei Park, Doping Control Center, KAI/ST, Seoul, 135-050, Republic of Korea

To find out growth inhibitor of the wormwood, *Artemisia princeps* var. *orientalis*, aqueous extract and volatile substances from the donor were treated to several selected receptor species included some bacteria and fungi. The results suggested that their inhibitory values of their growth were proportional to the concentration of the extract and the essential oil. It was, therefore, confirmed that the chemical substances of wormwood plant showed toxic activity biologically. The GC/MS method was employed to characterize the possible phytochemical substances from the donor. Twenty chemical compounds from the water soluble fraction and the volatile mass were identified. The bioassays have done with chemicals identical to the gas-chromatographically detected chemical compounds from the donor. The results obtained will be discussed.

Tuesday 14:20 Oral Presentation 36
 DOWN-REGULATION OF ECDYSTEROIDOGENESIS IN MOLTING GLANDS; A COMPARATIVE STUDY OF PROTHORACIC AND Y-GLANDS
 Mayumi Ohnishi, Midori Ikeda and Yuko Nava. Suntory Institute for Bioorganic Research, Shimamoto-cho, Mishima-gun, Osaka 618, Japan.

To understand molting regulation in arthropods, effects of ecdysteroidogenesis inhibitors were compared with two different molting hormone-producing glands: the prothoracic glands of silk worms, *Bombyx mori*, and the Y-organ of crayfish, *Procambarus clarkii*. The existence of a specific transportation mechanism for 3-hydroxy-L-kyurenine (3-OHK) of the Y-organ was evidenced. 3-OHK was an endogenous precursor of xanthurenic acid and revealed molting-inhibiting effects in the crayfish. Ecdysteroidogenesis in the prothoracic glands was reversibly inhibited by a high concentration of xanthurenic acid but not of 3-OHK. This inhibition effect was increased by use of the detergent Tween 80, and was independent of changes in intracellular Ca²⁺ levels caused by addition of the ionophore A 23187. The mode of action of molting-inhibitors will be discussed.

Tuesday 14:30 Oral Presentation 37
 ENZYMOLOGY OF CYANOGENESIS IN LARVAE OF ZYGAENA TRIFOLI/ (ZYGAENIDAE - LEPIDOPTERA)
 Adolf Nabstriedl, Sylvia Franzi and Elisabeth Möller. Institut für Pharmazeutische Biologie, University of Münster, FRG.

All developmental stages of the moth *Zygaena trifolii* liberate hydrocyanic acid (HCN) when violated. The glucosides linamarin and lotaustralin are the source of HCN by a two step degradation. The enzymes involved were investigated using the larvae of *Z. trifolii*. A specific β-glucosidase consisting of two subunits catalyses the hydrolysis of the substrates to form the corresponding cyanohydrins; a flavin containing hydroxynitrile lyase then catalyses the decomposition to HCN and acetone and methylglyoxal resp. The activity of both enzymes is evenly distributed in different tissues with more than 80% in the hemolymph. Thus the larvae dispose of an effective enzyme system to producing HCN from their endogenous substrates.

Tuesday 14:45 Oral Presentation 38
 GRASSHOPPER SPIT: WHAT IS THE NATURE OF ITS 'TOBACCO JUICE'?
 William S. Bowers & Felix Ortego, Dept. of Entomology, University of Arizona, Tucson, Arizona 85721, USA.

Grasshoppers possess numerous defensive artifices including coloration, autotomy, saltatorial mobility, flight and offensive chemical secretions. When disturbed the grasshopper *Schistocerca americana* regurgitates a vomitus highly repellant to insects especially ants. Chemical and biological relationships of the secretion will be discussed.

Tuesday 15:00 Oral Presentation 39
 SESQUITERPENIDS IN MASUTTERMES SOLDIER DEFENSIVE SECRETION
 C. Euraerts¹, J.L. Le Quere², Roisin, Y³ & J.M. Pasteels³ (1: Laboratoire de Zoologie, URA CNRS 674, Université de Bourgogne, 21000 Dijon, 2: Laboratoire de Recherche sur les Arènes, INRA, 21000 Dijon, France, 3 Laboratoire de Zoologie, Université Libre de Bruxelles, 1050 Bruxelles, Belgique).

In *Masuttermes*, the defensive secretion secreted by the soldier frontal gland is composed of a terpenic mixture which acts as an irritant and entangling weapon, and sometimes as alarm pheromone. Now there is plenty of information about the mono- and diterpenes contained in these resins, but only a few studies have mentioned the existence of sesquiterpenes in these secretions. In seven Neo Guinean *Masuttermes*, we have found no less than twelve sesquiterpene hydrocarbons, and in one species, *M. novanumhebridarum*, the sesquiterpene fraction is bigger than the monoterpene one. The possible roles and taxonomic implications of the sesquiterpene fraction in *Masuttermes* defensive secretion will be discussed.

Tuesday 15:15 Oral Presentation 40
 HIGH PERFORMANCE ION EXCHANGE CHROMATOGRAPHY IN THE ANALYSIS OF PLANT MATERIALS
 Joseph D. Olechno, James R. Thayer, Christopher A. Pohl, Rosanne W. Slingsby and John A. Stalter, Dionex Corp., 501 Mercury Dr., Sunnyvale, CA 94086, USA.

Many compounds of plant origin are extremely polar (or ionic) and tend to be non-volatile. These attributes tend to make these compounds difficult to analyze by either reversed phase HPLC or gas chromatography. Traditional ion exchange techniques (e.g., CM- or DEAE-cellulose) tend to yield poor resolution and low efficiency. New polymer microbead based columns coupled with improved detection techniques allow the analysis of many plant derived materials with speed, efficiency and resolution. Ion exchange separations of numerous plant derived analytes will be shown including: HPAE-PAD analyses of plant derived mono- and oligosaccharides; acid labile non-protein amino acids analyzed at elevated pH; cation exchange separations of alkaloids and anthocyanins; plant protein analyses. Pulsed amperometry, suppressed conductivity, absorbance, fluorescence and post-column derivatization will all be considered in detection schemes.

Tuesday 16:00 Oral Presentation 41
 USE OF HPLC IN PREFRACTIONATION AND PREPARATIVE ISOLATION OF NATURAL VOLATILE COMPOUNDS
 Denis Barrod, Pharmacognosy Laboratory, Faculty of Pharmacy, Joseph Fourier University-Grenoble I, 38706 La Tronche Cédex, France.

Capillary GC represents the method of choice for the analysis of aroma constituents, whereas HPLC is superior to GC in the preparative isolation of volatile constituents. In addition, HPLC is an efficient method for the prefractionation of complex extracts prior to GC analysis. The elution profiles of strawberry jam aroma constituents have been compared using two types of HPLC supports, silica gel, and diol-bonded silica. HPLC on diol allowed the recovery of all aroma constituents and resulted in the separation of two main fractions. The first fraction contained hydrocarbons and carbonyl compounds while alcohols and lactones were present in the second fraction. Further fractionation of the diol head fraction was achieved on silica gel. Combined HPLC on diol and silica gel columns has been applied to the semi-preparative isolation of some strawberry jam aroma constituents.

Tuesday 16:15 Oral Presentation 42
 CAPILLARY ELECTROPHORESIS: A NEW WEAPON IN THE PHYTOCHEMISTS' ARSENAL.
 Joseph D. Olechno, Jacqueline M.Y. Tso, Ann Wainright and James R. Thayer, Dionex Corp., 501 Mercury Dr., Sunnyvale, CA 94086, USA.

Most analytical scientists have mistakenly categorized capillary electrophoresis (CE) as a technique solely for the separation of proteins and nucleic acids. CE can also be used for a broad range of analytes regardless of size or charge. All liquid chromatographic techniques have corresponding CE equivalents, e.g., micellar electrokinetic capillary chromatography (MECC) separates small neutral molecules on the basis of their partition coefficients, capillary zone electrophoresis (CZE) separates on the basis of charge/mass ratios and ion exchange electrokinetic capillary chromatography (IEECC) separates on the basis of ion exchange. Only recently has CE been applied to plant samples. Examples of flavanoid, coumarin (with fluorescence detection) and alkaloid separations will be shown. A brief overview of the technique will be incorporated.

Tuesday 16:30 Oral Presentation 43
 USE OF AN IRGA (INFRA-RED GAS ANALYSER) TO EVALUATE THE EFFECTS OF VOLATILE ALLELOCHEMICALS ON THE GAS EXCHANGE OF LEAVES
 Anaya, A.L. Instituto de Fisiología Celular UNAM, Apdo. Postal 70-600, 04510 México, J.M. Ramos and J. Arevalo, UAM-Xochimilco, Calz. del Hueso 1100, 04960 México.

Volatile compounds from organic extracts of different fresh leaves were collected by flushing air through them, and then injected to an IRGA open system. The changes on CO₂ assimilation and H₂O transpiration exchange on attached leaves were recorded. The possible mode of action and their biological significance are discussed. The potential for the use of IRGA systems to study the effect of volatile substances on gas exchange of leaves in situ is analyzed.

Tuesday 16:45

Oral Presentation 4 4

SUPERCritical FLUID EXTRACTION (SFE) AND SUPERCritical FLUID CHROMATOGRAPHY (SFC) FOR THE ANALYSIS OF PLANT MATERIALS

Joseph D. Olechno, Douglas A. Weitz and Dale Felix, Dionex Corp., 501 Mercury Dr., Sunnyvale, CA, 94086.

While both SFE and SFC have become accepted techniques in analytical science, their applications for plant analyses have been few and far between. Non-volatile or heat labile compounds, unacceptable for analysis by gas chromatography, can often be chromatographed with SFC. Extraction with supercritical carbon dioxide eliminates the need for halogenated solvents and eliminates the need for solvent evaporation. Recent work illustrating the efficacy of the technique for a number of analytes in a wide variety of plant matrices will be shown. Included will be the analysis of capsaicin species for capsanthin, a comparison of expressed seed oils, analyses of Tagetes-derived acetylenics and comparisons of supercritical extractions versus those performed with traditional solvents. A brief review of the techniques and the analyses most benefited by their use will be included.

Wednesday 08:15

Oral Presentation 4 5

CHEMICAL DEFENSE IN GLYCINE MAX AGAINST POLYPHAGOUS VERSUS OLIGOPHAGOUS HERBIVORES
Dale M. Norris, 642 Russell Laboratories, University of Wisconsin, Madison, WI 53706, USA.

It was hypothesized that readily distinguishable chemistries in *Glycine max* provide defense against polyphagous versus oligophagous insects. Resistance in a "man-made" cultivar Davis to the oligophagous *Epilachna varivestis* is attributable to a mixture of flavonoids; however, resistance in a wild introduction PI 227687 to the very polyphagous *Trichopusa ni* requires additional volatile essential oils. In Davis, man unknowingly made an attractive "death trap" for *E. varivestis*. Some implications of our findings regarding evolution of plant-insect interactions will be discussed.

Wednesday 08:30

Oral Presentation 4 6

MAJOR ANTITERMITIC COMPOUNDS FROM THE HEARTWOOD OF NORTHERN WHITE CEDAR, *THUJA OCCIDENTALIS* L.

Clarence A. McDaniel, USDA, US Forest Service, Southern Forest Experiment Station, P.O. Box 2008, GMF, Gulfport, MS 39505, USA.

The heartwood of Northern White Cedar, *Thuja occidentalis* L., exhibits a natural resistance to attack by the eastern subterranean termite, *Reticulitermes flavipes* (Kollar). Solvent extracts of the heartwood were separated into acidic, phenol-ropolone, and neutral fractions; and the antitermitic activity was found to be in the neutral fraction. The major compounds in this fraction were identified by GC/MS as the sesquiterpene alcohols occidentalol, -eudesmol, occidolol (occidolol), and occidol. These compounds were isolated by semi-preparative scale reverse-phase HPLC. Laboratory tests for antitermitic activity included cellulose pad tests, and vacuum-impregnating the compounds at approximately 1 percent and 0.5 percent by mass into sapwood of sweetgum, *Liquidambar styraciflua* L. All of the compounds above exhibited some antitermitic activity.

Wednesday 08:45

Oral Presentation 4 7

IDENTIFICATION AND PREPARATION OF ANTI-INSECTAN DIENOLS FROM *DIPTEROCARPUS KERRII* TREE RESINS

David P. Richardson, Department of Chemistry, Williams College, Williamstown, MA, 01267, USA and Adam C. Masser, School of Food and Nutritional Science, University of Shizuoka, 395 Yada, Shizuoka, 422 Japan.

Two previously uncharacterized sesquiterpene dienols (1 and 2), originally isolated from *Dipterocarpus kerrii* resin, were prepared from a-gurjunene in order to extend earlier structural studies and to confirm termiticidal activity. Preparation of 2 involved a novel one step oxidation of a-gurjunene with m-chloroperoxybenzoic acid. Spectroscopic studies established that 2 is a nonconjugated diene and that the C-4 tertiary alcohol center has a configuration. Biosays with Indonesian termites (*Nasutitermes? dabbergiae*) demonstrated that 2 was more toxic than 1, resulting in a 50% mortality in 7 days. The sesquiterpene dienols appear to arise from biotransformation of a-gurjunene.



Wednesday 09:00

Oral Presentation 4 8

CELLULAR LOCALIZATION AND ECOLOGICAL ROLE OF A SECONDARY METABOLITE FROM THE SPONGE *HYMENIACIDON HELIOPHILA*

Susan H. Sandell, Amy E. Wright, Shirley A. Pomponi, J.E. Armstrong, and Robin Willoughby, Harbor Branch Oceanographic Institution, 5600 Old Dixie Highway, Ft. Pierce, FL, 34946, USA.

The sponge *Hymeniacidon heliophila* was selected to investigate cellular localization of secondary metabolites, production of metabolites by associated microbes, and feeding deterrence by secondary metabolites. Mature and larval forms of *H. heliophila* contain one major secondary metabolite which has been isolated and its structure elucidated. Density gradient fractionation yielded enriched cell fractions which were examined by light and electron microscopy to determine cell type. Analysis of fraction extracts suggests that the compound is localized in the archaeocytes. Production of the compound by microbial associates was also addressed. Extracellular bacterial associates separated from the sponge cells during the density fractionation did not contain the compound, nor was the compound detected in seven intracellular bacterial strains isolated from *H. heliophila*. Pinkish (*Lagodon rhomboides*) rejected pieces of whole sponge and sponge homogenate in preliminary feeding assays. Further assays are in progress to determine if the secondary metabolite has a role in this feeding deterrence.

Wednesday 09:15

Oral Presentation 4 9

ZOOHARMACOGNOSY: NON-NUTRITIONAL USE OF SECONDARY CHEMICALS BY VERTEBRATES

Eloy Rodriguez, Phytochemistry and Toxicology Lab, University of California, Irvine, and Richard Wrangham, Dept. of Anthropology, Harvard University, Cambridge, MA 02138, USA.

Phytochemical and chemical ecology studies have clearly established that animals and insects have evolved a variety of adaptations for avoiding plants that contain toxins or repellents. In some cases, insects are known to sequester the substances and use them for defensive purposes. In this presentation, we present our recent chemical and ecological findings on tropical animals that use plant chemicals for therapeutic or stimulatory purposes. Wild chimpanzees from Africa have been shown to consume plants that contain potent antihelmintics and antibiotics; a primitive herbivorous bird (hoatzin) from the Amazon consumes a mixture of very toxic and primitive plants from the Amazon and wild monkeys from Brazil swallow large quantities of tree resins for possible stimulatory and therapeutic purposes.

Wednesday 09:30

Oral Presentation 5 0

CHANGES IN LEAF CHEMISTRY RELATED TO FOREST DECLINE

J. Wyman, Y. Maurice, J. Martel, G.R.E.F., UOAM, Montréal H3C 3P8, and J.P. Renaud, C.R.A., MPAQ, Québec, G1P 3W8, P.Q., Canada.

North American forests have been subjected to forest decline and one of the main species affected by this perturbation is *Acacia saccharum*. Such stress will lead to changes in the leaf chemistry, which may have an impact on the phytophagous insects associated with these trees. This study was carried out in the south-west of Quebec (300 km east of Montréal) in an area hardest hit by forest decline. 72 trees found in 18 different stands were sampled throughout the growing seasons of 1987 and 1988. Leaf samples were analyzed for total nitrogen, sugars (glucose, sucrose, fructose, ribulose), polyphenols, and tannins. Statistical analyses indicated no significant difference in total nitrogen concentrations between leaves of healthy and declining trees. However, significantly higher amounts of both sugars and polyphenols were noted in declining trees. This can have a potential impact on the nutritional ecology of a single key species or the structure of the whole insect community.

Wednesday 09:45

Oral Presentation 5 1

DIFFERENTIAL FATE OF PLANT ALLELOCHEMICALS IN TWO POLYPHAGOUS INSECTS

Murray B. Isman and Michael J. Smilde, Department of Plant Science, University of British Columbia, Vancouver, B.C. Canada V6T 2A2.

Using radiolabelled allelochemicals, we examined the metabolism and fate of several putatively toxic plant natural products in two polyphagous insects, the migratory grasshopper *Melanoplus sanguinipes* (Orthoptera, Acrididae), and the variegated cutworm, *Pendroma saucia* (Lepidoptera, Noctuidae). We sought to test the hypothesis that the more evolutionarily advanced lepidopteran would depend primarily on metabolism to avoid toxicity, whereas the orthopteran would depend primarily on physical barriers to absorption from the gut (Berenbaum and Isman, *Experientia* 45, 229 [1989]). Both insects were fed the thiophene alpha-tertiary, the lanuocoumarin xanthotoxin, and the cardenolide digitoxin. Both insects metabolized xanthotoxin and digitoxin to a great extent, but the thiophene was metabolized to only a minor degree in the cutworm and excreted unmetabolized by the grasshopper. The fate of individual allelochemicals in polyphagous insects is best described as idiosyncratic.

Wednesday 10:30

Oral Presentation 5 2

PHYTOCHEMICAL BASIS FOR DIFFERENTIAL HOST USE BY WILD SILK MOTHS (*CALLOSAMIA SATURNIIDAE*) LARVAE
K.S. Johnson and J. Mark Scriber, Department of Entomology, Michigan State University, East Lansing, MI 48824, USA.

The genus *Callosamia* is composed of three species with varying host breadths, with the most polyphagous (*C. promethes*) feeding on plants from numerous plant families, an oligophagous species (*C. angulifera*) which uses both Lauraceous and Magnoliaceous hosts, and a monophagous species (*C. securifera*) which is restricted to a single Magnoliaceous host, sweetbay (*Magnolia virginiana*). Hostplant specialization may be advantageous in terms of predator free space, higher rates of ingestion, enhanced assimilation efficiencies, or improved detoxification of plant tissues. Although sweetbay occurs within the ranges of the two *Callosamia* species with broader feeding habits, they have not been reported to use it as a host. First instar survival and relative growth rate of *C. promethes* and *C. angulifera* on sweetbay is low, with 100% mortality occurring by the end of the third instar. Fresh foliage was extracted and bioassayed for activity against these two silkworm species. Preliminary results suggest a phytochemical component for differential host use within the genus. Identification of active compounds is underway.

Wednesday 10:45

Oral Presentation 5 3

COMBINED EFFECTS OF AMINO ACIDS AND GLUCOSINOLATES ON PREFERENCE AND PERFORMANCE OF THE GREEN PEACH APHID (*MYZUS PERSICAE* SULZ.)
Seward Z. Merritt, Dept. of Biology, University of Michigan, Ann Arbor, MI, 48109, USA.

Although nutrients and allelochemicals co-occur in plants, their combined effects on insect herbivores have rarely been examined. I used artificial diets to test for effects of amino acids and glucosinolates, separately and in combination, on the preference and performance of the green peach aphid (*Myzus persicae* Sulz.). In choice tests, first instar nymphs failed to discriminate among diets, even though nymph performance was highest on diets high in amino acids and low in glucosinolates. However, because adults preferred diets that gave high nymph performance, nymphs were born where high quality diets were located. Thus, adult choice may compensate for the inability of nymphs to choose high quality diets.

Wednesday 11:00

Oral Presentation 5 4

MARINE PLANT POLYPHENOLS: THEIR EFFECT ON ASSIMILATION EFFICIENCY IN THE TEMPERATE HERBIVOROUS MARINE FISH, *XIPHISTER MUCOSUS*
N.M. Targett, A.E. Boettcher and T.E. Targett, Graduate College of Marine Studies, University of Delaware, Lewes, Delaware, USA.

We have previously shown that polyphenolic compounds, found commonly in temperate phaeophytes, negatively affect assimilation efficiency of the temperate marine herbivorous fish, *Xiphister mucosus*. This study examines the effects of distinct phenolic size classes using the commercially available phenolics, phloroglucinol and tannic acid, and phenolic size fractions derived from the phaeophytes *Fucus distichus* and *Fucus vesiculosus* (<10,000, 10,000-100,000, and >100,000) on *X. mucosus*. Both commercially available and naturally occurring phenolics were assayed at concentrations of 1% plant wet weight, an average total phenolic level which occurs naturally for many temperate brown algal species. At this concentration, phloroglucinol exhibited no significant effect on assimilation efficiency. Tannic acid enhanced assimilation, perhaps due to a pH effect. Phenolic containing *Fucus* extracts showed a negative dose-dependent response. However, upon fractionation, the response at a given concentration was dependent upon phenolic size, thus demonstrating that phenolic chemical nature (size) as well as phenolic concentration is important in determining the effect of these compounds on fish digestive processes.

Wednesday 11:15

Oral Presentation 5 5

TOXICITY OF *MORINDA CITRIFOLIA* ON *D. MELANOGASTER* AND RELATED SPECIES
L.Legal, M. Katz, B. Chappe and J.M. Jallon, *BGE CNRS, 91198, Gif sur Yvette, ** Biologie des populations, Univ. Paris VI, VII, Place Jussieu, 75005, Paris, France. *** ICN, CNRS, 91198, Gif sur Yvette, France.

Morinda citrifolia is the host plant of *D. sechellia* while it is highly toxic for the other species of the subgroup (*D. melanogaster*, *D. simulans*, *D. mauritiana*). Only the ripe fruit is toxic for the three last species while the rotten fruit may serve as a host plant for all species. We have found significant differences in reactivity to the toxic fruit between species. Moreover, for *D. melanogaster* there is an intraspecific variability between strains. First investigations showed that a genetic factor controlling this reactivity is sex linked. The toxicity of the ripe fruit is poorly volatile and of a moderate polarity. The whole toxicity can be extracted by acetone.

Wednesday 11:30

Oral Presentation 5 6

COSTS, BENEFITS, AND EXAPTATIONS OF CARDENOLIDE UTILIZATION IN THE CHEMICAL DEFENSE OF THE MONARCH BUTTERFLY, *DANAUS PLEXIPPUS*
Lincoln P. Brower, Department of Zoology, University of Florida, Gainesville, Florida, U.S.A. 32611.

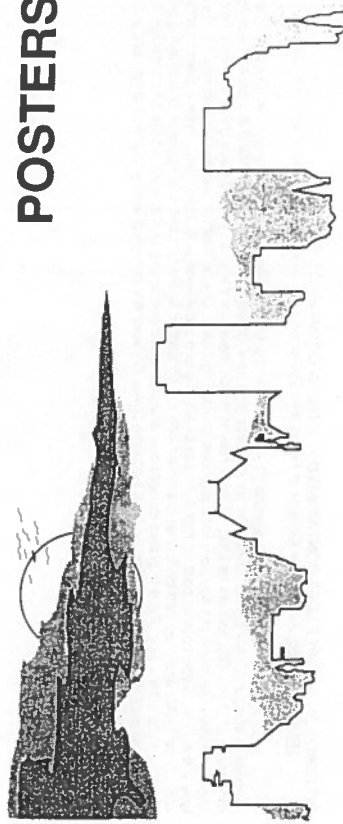
The selective bases for the evolutionary origin and individual utilization of *de novo* and plant derived chemical defenses in insects continues to be debated. My paper will review the nature of the evidence that bears on the hypothesis of metabolic costs and will provide new experimental data that cardenolides do in fact exact a cost when ingested by first instar larvae of the monarch butterfly feeding on milkweed (*Asclepias humistrata*).

Wednesday 11:45

Oral Presentation 5 7

THE ROLE OF NUTRIENTS IN HOST-PLANT SELECTION BY INSECTS
Donald E. Champagne and Elizabeth A. Barnays, Dept. of Entomology, University of Arizona, Tucson AZ 85721, USA.

Current research emphasizes deleterious or deterrent roles of plant secondary metabolites, and tends to assume plants are nutritionally adequate for most insects. However, nutritional deficiencies can also affect host-plant selection. The acceptability of spinach to the grasshopper *Schistocerca americana* rapidly declines with successive contacts in a classic aversion learning pattern. Grasshoppers cannot metabolize the D7 or D22 phytoosterols of spinach; when usable cholesterol or sitosterol is added aversion learning does not occur. After 24 h on spinach, grasshoppers prefer glass fibre discs with added cholesterol or sitosterol to those with the D22 sterol stigmasterol or sucrose controls. Detection of sterol quality occurs via gut feedback, not chemoreception. In this situation secondary metabolites likely provide a distinctive taste which is associated with the aversive stimulus ("bad steroids") to facilitate rapid learning.



POSTERS

Poster 1

CHANGES IN BIRCH LEAF CHEMISTRY ASSOCIATED WITH WATER STRESS AND GYPSY MOTH FEEDING
A. Tomazak, Department of Entomology, Warsaw Agricultural University, Warsaw, Poland and D.G. Nielsen, Department of Entomology, The Ohio State University-OARDC, Wooster, Ohio 44691, USA.

Two micropropagated clones of paper birch (*Betula papyrifera* Marsh.) were evaluated for response to water stress and partial defoliation by gypsy moth (*Lymantria dispar* (L.)) larvae, under greenhouse conditions. Two separate cohorts of 4th instars were placed on plants ca. 10 days apart to investigate influence of previous feeding on subsequent larval performance. Leaf samples were taken at specified intervals to measure the impact of water deficit and insect feeding on leaf sugars, amino acids, proteins and phenols. The clones responded differently, both in leaf chemistry and insect performance.

INTERSEXUAL PHEROMONAL COMMUNICATION OF THE EUROPEAN CORN BORER MODIFIED BY HUMIDITY CONDITIONS

Bayer-Lucia and Jeremy N. McNeil. Dept. de biologie, Université Laval, Ste-Foy, P.Q., Canada, G1K 7P4.

We examined the effect of relative humidity conditions on *O. nubilalis* mating success over time, the calling behaviour of virgin females from emergence through their sixth night of calling and the flight response of 3-day-old males to three pheromone concentrations in a flight tunnel. The incidence of mating was significantly less the first two days following emergence at low than at high humidity conditions. The mean age at which females first initiated calling was independent of relative humidity conditions. However on subsequent nights of calling, fewer virgin females called under low compared with high humidity conditions, and those that did began later in scotophase. Furthermore, they spent less time calling. The maximum male response to the sex pheromone occurred at lower and lower relative humidity conditions as the pheromone concentration increased. The evolutionary and ecological significance of these results will be discussed.

ANTIMICROBIAL AND NEMATOCIDAL COMPOUNDS FROM SOME NORTHERN ROSACEAE PLANTS

Yuko Yoshizawa, Satou Kawai and Junya Mizutani, Mizutani Plant Ecochemicals Project, Research Development Corporation of Japan, Eniwa RBP Center Building, Meguro Kita 3-1-1, Eniwa-shi, Hokkaido, 061-13, Japan.

Ethyl acetate extracts from more than 250 wild plants in Hokkaido, a northern island in Japan, were surveyed for their antimicrobial and nematocidal activities, for the purpose of understanding defence mechanisms of wild plants. Among the extracts, more than 90 samples exhibited one and/or both activities. Some typical northern Rosaceae plants such as *Sorbara sorbifolia* var. *stellata*, *Spiraea salicifolia* and *Malus baccata* var. *mandshurica* showed strong activities in both examinations. The active components are isolated. Their structure and characteristics will be described.

TWO DIMENSIONAL ANALYSIS OF INTRACELLULAR IONIZED CALCIUM IN THE NEMATODE, *CAENORHABDITIS ELEGANS*

Satoru Kawaji, Yuko Yoshizawa and Junya Mizutani, Mizutani Plant Ecochemicals Project, Research Development Corporation of Japan, Eniwa RBP Center Building, Meguro Kita 3-1-1, Eniwa-shi, Hokkaido, 061-13, Japan.

In order to monitor changes in the intracellular concentration of ionized calcium in the nematode *Caenorhabditis elegans*, an esterified fluorescent indicator (Fura 2-AM) which penetrates into the cells and binds specifically to Ca^{2+} , was used. The fluorescent image of the Fura 2 stained nematode obtained by illuminating with light at 340 nm or 380 nm is displayed on a video screen using an SIT (silicon intensifier tube) video camera. The video signal from the camera is then processed with an image analyzing system. The effects of some northern Japanese plants extracts on the changes in Ca^{2+} concentration are described.

THRYSIFLORIN, A NOVEL PHENALANONE PIGMENT FROM *WACHENDORFFIA THRYSIFLORA* BER. (HAEMODORACEAE)

Gamal, Dorzi and Michael Edwards, School of Pharmacy, University of Connecticut, Storrs, CT, USA, and William Campbell, Department of Chemistry, University of Cape Town, South Africa

From the yellow flowers of this plant we have isolated a phenalane pigment, mp 218-222°, ν_{max} 1624 cm^{-1} (H-bonded CO); MW 304.0735. Cal. for $C_{19}H_{12}O_4$, 304.0732; H-NMR 8.21 (1H; d 1Hz), 7.95(1H; d 0.8Hz), 7.53 (1H; s), 7.41 (1H; d 1Hz), 7.35 (1H; d 8.0Hz), 7.22 (2H; d 8Hz), 6.88 (2H; d 8Hz), to which the structure 2,6-dihydroxy-9-(4'-hydroxyphenyl) phenalane was initially assigned. Unequivocal synthesis of this from 6-methoxyphenalane has proved that this is not the correct structure for the natural product, and we now propose 2,4-dihydroxy-9-(4'-hydroxyphenyl) phenalane, as the structure for thrysiiflorin. This structure better fits the spectral data and agrees with the current biosynthetic hypothesis.

CHEMICAL BASIS OF CANNIBALISM IN AN HERBIVOROUS INSECT

Franz Bognar and Thomas Eisner, Neurobiology & Behavior, Cornell University, Ithaca, NY, USA.

Larvae of the moth *Ulethisa ornatrix* sequester pyrrolizidine alkaloids from their foodplants (Leguminosae; genus *Crotalaria*). They retain the chemicals through metamorphosis, and as adults transmit them in part to the eggs. All developmental stages are protected against predators as a result. Both males and females contribute to the alkaloid endowment of the eggs. The male's endowment is transferred to the eggs by the female via the sperm package. By use of a pheromone derived from the alkaloid, males announce to females during precopulatory interaction how much alkaloid they can donate by seminal infusion. *Ulethisa* larvae in nature compete for the seeds of the foodplant, where the alkaloids are primarily stored, and they are unequally successful in acquiring alkaloids. In laboratory experiments we have shown that larvae can make up for systemic shortfalls in alkaloid by resorting to cannibalism. They consume pupae and eggs, feeding preferentially on those that contain alkaloid. Alkaloid-free pupae and eggs can be rendered vulnerable to cannibalism if artificially supplemented with alkaloid. Moreover, the predisposition to cannibalism in larvae is specifically triggered by systemic alkaloid deficiency.

DISTRIBUTION OF DIPEPTIDES CONTAINING D-ALANINE IN GRAMINEAE CROPS

Hisashi Manabe, Aizu Junior College of Fukushima Prefecture, Aizuwakamatsu, Fukushima 965, Japan

In Japonica type rice plants, D-alanine (D-Ala) exists in the form of dipeptides, D-alanylglycine (D-Ala-Gly) and D-alanyl-D-alanine (D-Ala-D-Ala); D-Ala-Gly content was high (few μ mol/g fr. leaves) and D-Ala-D-Ala content was low (one tenth of D-Ala-Gly content or less). These results made me examine all *Oryza* species (rice) and other well-known Gramineae crops (11 species) for dipeptides containing D-Ala. *Oryza* species were classified into 3 groups, type I, II and III. Type I plants contain high levels of D-Ala-Gly and a low level of D-Ala-D-Ala. Type II plants contain only D-Ala-D-Ala and they can be further classified into Ila, Iib and Iic according to the amount of D-Ala-D-Ala they contained (Ila > Iib > Iic). Type III plants do not have any dipeptides containing D-Ala. Gramineae crops except rice were suggested to be classified into Iic or III because D-Ala-Gly was not detected in any of these crops and a low level of D-Ala-D-Ala was detected in only two species.

RELATIONSHIP OF FOLIAR GLUCOSINOLATE PROFILES IN CANOLA AND MUSTARDS TO GROWTH AND FEEDING OF THE BERTHA ARMYWORM, *MAMESTRA CONFIGURATA*

Calvin McCloskey and Murray B. Isman, Department of Plant Science, University of British Columbia Vancouver, B.C., Canada V6T 2A2.

The recent interest in developing new, chemically altered varieties of canola has prompted questions regarding the susceptibility of these new plants to insect attack. Five canola (*Brassica napus* and *B. campestris*) and three mustard (*B. juncea* and *Sinapis alba*) cultivars were evaluated for insect resistance against the bertha armyworm, *Mamestra configurata* Wlk. Foliar glucosinolate profiles were found to be related to larval growth and feeding on excised foliage of field-grown plants. The relative growth rate of this insect was negatively correlated with levels of isothiocyanate (ITC)-producing glucosinolates in the foliage. There was no correlation between consumption rate and levels of these substances. However, there appears to be a positive relationship between consumption rate and foliar levels of indolyl glucosinolates. Trends suggested by these results have been investigated further using pure compounds added to mericid diet.

BIOCHEMICAL INTERACTIONS BETWEEN CITRUS ROOTS AND THE SUGARCANE ROOTSTALK BORER, *DIAPREPES ABBREVIATUS*

Jeffrey E. Stubbins, U.S. Department of Agriculture, Agricultural Research Service, Horticultural Research Laboratory, Orlando, Florida 32803, and Kelsey R. Downum, Dept. of Biology, Florida International University, Miami, Florida 33199, USA.

Larvae of the root weevil *Diaprepes abbreviatus* feed on both small and large roots of citrus trees. Young larvae eat entire small roots, while older larvae strip the bark from large roots, girdling and killing them. Putative allelochemicals such as the pyranocoumarins exist in substantial concentration in roots but have no discernable effect on larvae. To determine the roles and significance of hemolymph in phytochemical detoxification or delivery, we are studying the involvement of larval hemolymph proteins in pyranocoumarin uptake, transport, and distribution

NEW ISOFLAVONOIDS IN THE ROOT BARK OF *PISCIDIA ERYTHRINA* (JAMAICAN DOGWOOD; LEGUMINOSAE)
S. Itabata*, M. Moriyama and J. Mizutani, Dept. of Agr. Chem., Hokkaido Univ., Sapporo 060, Japan, and
J.L. Ingham, Dept. of Food Sci., Univ. of Reading, Reading RG6 2AP, England. *Present address: Biol. Dept.,
Concordia Univ., Montréal, P.O., Canada, H3G 1M8.

Further investigation of constitutive isoflavonoids in the root bark of *P. erythrina* (Leguminosae; Papilionaceae-Lonchocarpeae) has revealed the presence of some complex compounds. One of these is a coumaranochromanone derivative (3,5,7,4'-tetrahydroxy-5'-methoxy-3'-prenylcoumaranochroman-4-one) which belongs to a new class of naturally occurring isoflavonoids. Another novel compound is an amino-substituted isoflavone (4'-amino-5,7,3'-trihydroxy-5'-methoxy-2',6'-diprenyl-isoflavone). The characterization of these new compounds, as well as the evidence for the occurrence of 5,7,3',4',5'-pentaoyxymethylated isoflavones in this arboreal legume will be presented.

THE PHYTOXICITY OF PHENOLIC COMPOUNDS IN SOIL SYSTEMS: USING DENSITY-DEPENDENT GROWTH AS A BIOASSAY
Abdi L. Shabab and Missy Watkins, Department of Biological Sciences, University of Cincinnati, Cincinnati, OH 45221-006, USA.

Allelopathic interactions are often difficult to separate from situations of resource competition. However, Wiedenhamer *et al.* (1989, J. Applied Ecol., 26:613) introduced the use of deviations from the density-dependent growth laws to partition out the inhibition associated with the presence of an allelochemical. In this study, we used that deviation from density-dependent growth as a bioassay to determine the phytotoxicity of soils treated with phenolic acids. One hundred grams of greenhouse soil (Taylor mix: peat, sand, river clay) were placed in 6X6 cm pots, planted with wheat (*Triticum aestivum* var. Calowell) and given 18 hour days. After germination, plants were thinned to densities of 1, 5, 10, 15, 20 and 30 plants per pot and then treated with concentrations of ferulic, caffeic, *p*-hydroxybenzoic, or vanillic acid. Plants and soils were harvested at 3 and 6 weeks. Dry and wet shoot weights were used as the growth parameters. Soils were subjected to water and alkali extractions that were then analyzed for phenolic acids by HPLC. Result will be presented.

ISOLATION OF A NEW VINDOLINE DIMER FROM *CATHARANTHUS ROSEUS* VAR. LITTLE BRIGHT EYE. ARE VINDOLINE DIMERS ARTEFACTS OF ISOLATION?
Abdi L. Shabab and Greg Bishop, Plant Biotechnology Institute, National Research Council of Canada, Saskatoon, Saskatchewan, S7N 0W9, Canada.

A new dimeric indole alkaloid, called supaine (1), was isolated from the aerial parts of *Catharantus roseus* var. little bright eye. The structure of the new alkaloid was elucidated by comparison of its spectral data with that of the established compounds, vindoline and secologanin. Corroboration for the assigned structure was obtained by analyses of products obtained from acidic hydrolyses of 1 as well as from its acetylation. Reaction of vindoline with various aldehydes under appropriate conditions afforded the corresponding vindoline dimers which were analogous to vindoline and 1 thus raising the question of whether these latter vindoline dimers were artefacts produced during the isolation sequence.

THE EFFECT OF DENSITY AND METHOD OF KILL IN WEED SUPPRESSION PROVIDED BY A RYE COVER CROP
Leslie A. Wasieki, Dept. of Horticulture, University of Kentucky, Lexington; John B. Masunas, Dept. of Horticulture, University of Illinois, Urbana; and Stephen C. Weller, Dept. of Horticulture, Purdue University, West Lafayette, USA.

Allelopathic rye cover crops may have potential to provide excellent weed control in tomato production systems. The effect of rye seeding density and method of kill on rye biomass persistence, weed control and tomato yield were determined in Kentucky, Illinois and Indiana locations in 1989 and 1990. Mowing alone did not adequately control the rye cover crop in any location and adversely affected tomato yields whereas greatest yields were obtained in plots treated with glyphosate. Rye density, method of kill and location interacted to determine weed pressure with greatest weed biomass occurring in mowed, low density rye plots in Kentucky. Although rye biomass did not substantially decrease during the growing season, weed control was only satisfactory for 4 to 8 weeks after rye kill, suggesting that other factors such as allelochemical concentration contributed to weed control.

AN EXAMINATION OF PHYTOALEXIN PRODUCTION IN THE HALOPHYTES *SPARTINA ALTERNIFLORA* AND *PHRAGMITES AUSTRALIS*
Susan L. Sennell, Harbor Branch Oceanographic Institution, 5600 Old Dixie Hwy., Ft. Pierce, FL, 34946 and Nancy M. Targett, College of Marine Studies, University of Delaware, 700 Plottown Rd., Lewes, DE, 19958, USA.

This study examined phytoalexin production in the response of the halophytes *Spartina alterniflora* and *Phragmites australis* to abiotic and biotic stress. Field studies indicated that natural populations of *Phragmites* and *Spartina* contained compounds which were active *in vitro* against two marine fungi. Laboratory studies were undertaken to determine if these naturally occurring antifungal metabolites could be induced in sterile plant and callus cultures using abiotic (mechanical wounding) and biotic (fungal inoculation) stresses. Abiotic stress was ineffective in inducing a phytoalexin response in any of the laboratory cultures. *Phragmites* plants and callus treated biotically contained an antifungal metabolite not present in controls; however, *Spartina* sterile plants did not respond to the biotic treatments. Results of these studies suggest that a biotic stress such as microbial invasion can induce the formation of antifungal metabolites in halophytic plants. Characteristics of the antifungal metabolite produced in the treated *Phragmites* cultures will be described.

OVIPOSITION STIMULANTS IN THE COCCOID CUTICULAR WAXES OF *APNYTTIS YANONENSIS*
Shozo Takahashi, Pesticide Research Institute, Faculty of Agriculture, Kyoto University, Kyoto 606, Japan.

Aphytis yanonensis, a parasitic wasp of the arrowhead scale, *Unaspis yanonensis* was introduced to Japan to control *U. yanonensis*. *A. yanonensis* recognizes a host insect by antennal contact and deposits eggs on the insect host underneath the scale. Ovipositional behavior is induced by perceiving the cuticular wax of the host insect, *U. yanonensis*, and other coccoids. Chemical composition of the cuticular wax was analyzed and oviposition stimulants were isolated following a bioassay using *A. yanonensis*. All cuticular wax that actively stimulated the ovipositional behavior of *A. yanonensis* were found to be a mixture of wax esters with a composition similar to the cuticular wax of *U. yanonensis*. The lantanin scale, *Hemiberlesia lantaniae* was found to be a good substitute host for successful rearing of *A. yanonensis* in the laboratory. The major component (52.5%) of the scale wax was a mixture of triglycerols of molecular weight from 668 to 890.

PUDDLING BEHAVIOR. MASSIVE FLUID THROUGHPUT LEADS TO SODIUM SEQUESTRATION IN A MOTH
Scott L. Smedley and Thomas Eisner, Section of Neurobiology and Behavior, Mudd Hall, Cornell University, Ithaca, New York, USA 14853.

Male butterflies and moths are commonly attracted to standing water sources to drink, a behavior known as "puddling". The noctuid moth *Gluphisia septentrionis* exhibits the behavior in extreme form. In the course of several hours of puddling, male *Gluphisia* forcibly pulse through their bodies a volume of water equivalent to over 600 times their mass (up to 38.4 ml). As indicated by cationic analyses of imbedded and ejected fluids, and of the body itself, the net result of puddling is a systemic gain in sodium. Male *Gluphisia* concentrate sodium in their reproductive system, presumably for eventual nuptial transfer to females (as documented for a butterfly by other researchers). Rapid fluid throughput and ionic absorption in male *Gluphisia* are enabled by oral and enteric structural specializations.

ROLE OF 2,4-DIHYDROXY-7-METHOXY-1,4-BENZOAZIN-3-ONE (DIMBOA) IN THE RESISTANCE OF A MAIZE TO WESTERN CORN ROOTWORM, *DIABROTICA VIRGIFERA VIRGIFERA* (LECONTE) (COLEOPTERA, CHRYSOMELIDAE)
Y.S. Xie, J.T. Arnason, B.J.R. Philogène, J.D.H. Lambert, J. Atkinson and P. Morand, Ottawa-Carleton Institutes of Biology and Chemistry, University of Ottawa, Ottawa, Ontario, Canada K1N 6N5.

2,4-Dihydroxy-7-methoxy-1,4-benzoxazin-3-one (DIMBOA), the major hydroxamic acid present in corn, was studied for its effects on western corn rootworm, *Diabrotica virgifera virgifera* (LeConte). Exogenously applied DIMBOA showed a strong effect on western corn rootworm larvae feeding on corn seedlings. The LC50 (lethal concentration for 50% mortality) value (fiducial limits) was 153.2 ppm (107.7-208.9). The deleterious effects of DIMBOA on western corn rootworm larvae are possibly due to feeding deterrence and toxicity. In replicated pot trials tests during two growing seasons, two corn lines from CIMMYT collections, ITR 3872 with high DIMBOA content in roots, and NTR-2 Ger. 4042 with low DIMBOA content in roots, were evaluated for resistance to western corn rootworm larvae. The results indicated that the high DIMBOA line stressed western corn rootworm larvae to produce inferior size and number of adults, and high DIMBOA line showed significantly less damage than low DIMBOA line NTR-2 Ger. 4042 in most plant growth parameters measured.

(Z)-10-HEPTADECEN-2-ONE BIOSYNTHESIS IN *DROSOPHILA BUZZATI*
Paul J. Skiba, Angela M. Schaner, and Larry L. Jackson, Biochemistry Group, Chemistry Department, Montana State University, Bozeman, MT 59715, USA.

(Z)-10-heptadecen-2-one, the major aggregation pheromone component of *Drosophila buzzatii*, is produced and stored in the ejaculatory bulb of males. The ketone first appears in the bulb at 2-3 days of age, increases most rapidly from 4-8 days, and plateaus at 7-8 days. We have proposed two alternative pathways for (Z)-10-heptadecen-2-one biosynthesis starting from various fatty acid precursors. Excised ejaculatory bulbs incubated for 18 hours in pH 6.5 buffer fortified with coenzymes produce (Z)-2-heptadecen-2-one comparable to live males. Fatty acids are being identified as possible pheromone precursors from changes in the fatty acid profiles of incubated ejaculatory bulbs. Preliminary experiments on incorporation of radiolabeled fatty acid precursors will be presented.

REEXAMINATION OF THE FEMALE-PRODUCED SEX PHEROMONE OF THE PEACH TWIG BORER, *ANARSA LINEATELLA* ZELLER (LEPIDOPTERA: GELECHIIDAE)
Jocelyn G. Millar, Thomas C. Baker, Dept. of Entomology, University of California, Riverside, CA 92521 and Richard E. Rice, Dept. of Entomology, University of California, Davis, CA 95616, USA.

The peach twig borer is a major pest of stone fruits and almonds in California. Developing resistance to pesticides and/or the possible loss of pesticide registrations has created a pressing need for alternative management strategies. Recent mating disruption trials using blends of E5-10:Ac and E5-10:OH, the components identified in pheromone gland extracts by Roelofs et al. (1975), were not completely successful. We have reexamined the sex pheromone of the peach twig borer and wish to report: a) the identification and field testing of minor components from the pheromone gland; b) determination of the pheromone blend produced by calling females; c) field testing of analogs and homologs of the pheromone components as synergists and behavioral antagonists.

SCREENING OF HOKKAIDO PLANTS FOR ANTIFEEDANT ACTIVITY, USING AN IMPROVED LEAF-DISK BIOASSAY
Pierre Escoubas, Junya Mizutani / Mizutani plant ecochemicals project. (Research Development Corporation of Japan) Eniwa RBP Center Building, 3-1-1 Megumino-kiita, Eniwa-shi, Hokkaido 061-13 Japan.

Chemical elucidation of plant allelochemicals and study of their physiological mode of action are two fundamental steps for understanding the complex relationships between plants and other organisms. In our search for new bioactive compounds, we have undertaken a survey of Hokkaido plants where we have used an improved leaf-disk antifeedant bioassay against *Spodoptera litura* (Tobacco cutworm). The principal improvement consists of a more accurate measurement of consumption rates, using numerisation of leaf-disk surfaces through a video-computer interface. Among the 250 samples assayed, 33 were found to present a significant feeding-deterrent activity. The method, as well as the results of the screening, are presented.

DEFENSIVE SUBSTANCES FROM TROPICAL PLANTS 1
Labunmi Lalida, Pierre Escoubas and Junya Mizutani, Mizutani Plant Ecochemicals Project, Research Development Corporation of Japan, Eniwa RBP Center Building, Megumino Kita 3-1-1, Eniwa-shi, Hokkaido 061-13, Japan.

Crude methanolic extracts of *Pavetta crassipes*, *Parkia clappertoniana* and *Aristolochia albidia* were examined for insect feeding deterrent activities against the armyworm larvae, *Spodoptera litura* using a choice leaf-disk bioassay technique. TLC bioautography was also used for activity against the fungus *Cladosporium herbarum*. Only *A. albidia* extracts exhibited strong activity against *S. litura* and *C. herbarum*. The results of the bio-assay using an improved technique in quantification and the compounds responsible for the activities in *A. albidia* will be discussed.

NITROGEN REGULATION OF ANTHOCYANIN COMPOSITION IN GRAPE (*VITIS VINIFERA* L.) CELL SUSPENSION
Francis Cormier and Chi Bao Do, Food Research and Development Centre, Agriculture Canada, 3600 Casavant Blvd. West, St-Hyacinthe (Québec) Canada J2S 8E3.

Recent restriction of the use of synthetic red dyes in food has activated research on plant pigments. We investigated the effects of nitrogen source on the formation of anthocyanins to develop methods for the production of red pigments by *Vitis vinifera* cell suspension culture. When cells were grown in B5 basal medium, anthocyanin accumulation was low. Decreasing nitrate concentration and increasing the ratio of the carbon source to nitrate ions in the culture medium enhanced significantly the level of anthocyanins, mainly peonidin 3-glucoside. The composition of anthocyanins was also influenced by the concentration of ammonium ions. The formation of acylated anthocyanin, namely peonidin 3-p-coumaroyl glucoside was promoted by the high concentration of ammonium ions. Nitrogen source can be one of the important culture factors and may be useful in controlling of anthocyanin composition and production.

¹H and ¹³C NMR ASSIGNMENTS OF THE MAJOR ANTHOCYANINS FROM A *VITIS VINIFERA* CELL SUSPENSION CULTURE
Matzle-Rosa Van Calsteren, François Cormier, Chi Bao Do and Richard R. Laing, Centre de recherche et de développement sur les aliments, Agriculture Canada, 3600 boul. Casavant ouest, Saint-Hyacinthe, Québec, Canada J2S 8E3.

A cell suspension culture of *Vitis vinifera* cv Gamay Fraiseux var leithurier was studied for its anthocyanins. The structure of the three major anthocyanins, which together account for approximately 85-90% of the total, was determined on small quantities of material using 1D and 2D NMR techniques in both normal and inverse modes of detection. ¹H and ¹³C NMR spectra were completely assigned for cyanidin 3-b-D-glycopyranoside, peonidin 3-β-D-glycopyranoside and peonidin 3-(6-p-coumaroyl)-β-D-glycopyranoside, as well as for the commercial product malvidin 3,5-di-β-D-glycopyranoside, which was used for comparison purposes.

FORMATION OF INSECT ALKALOIDS FROM PLANT DEHYDRO-PYRROLIZIDINES BY ARCTIID MOTHS (LEPIDOPTERA)

Th. Hartmann, A. Biller, L. Wille, L. Ernst* and M. Boppre*, Institut für Pharmazeutische Biologie der TH, Mendelssohnstr. 1, D-3300 Braunschweig; * NMR-Lab. der TH, Hagengring 30, D-3300 Braunschweig; ** Forstzoologisches Institut der Universität Freiburg i.Br., Fehrenbühl 27, D-7801 Stegen-Wittental, FRG.

Callimorphine plus two new pyrrolizidine alkaloids ("creatonoline", "isocreatonoline") were isolated from adults of *Cretonotos transiens* and shown to be synthesized in both sexes by esterification of retronecine (a) with larvae. Feeding ester alkaloids to *Cretonotos* larvae lead to degradation of plant PAs and reesterification of the resulting necine, i.e. also to the formation of creatonolines and callimorphine. However, there were quantitative differences and, in part, sex-bias in the rates of transformation due to different PAs. In any case, this is the first demonstration of hydrolysis of ester alkaloids and subsequent reesterification of the necine base with necic acids of insect origin by PA-adapted insects.

PURIFICATION AND PROPERTIES OF PHENYLALANINE AMMONIA-LYASE FROM ELICITOR-TREATED JACK PINE CELL CULTURE
M.M. Campbell¹ and B.E. Ellis², ¹Dept. Chemistry and Biochemistry, University of Guelph, Guelph, Ontario, Canada, N1G 2W1; and ²Dept. Plant Science, University of British Columbia, Vancouver, British Columbia, Canada, V6T 2A2.

Phenylalanine ammonia-lyase (PAL, E.C.4.3.1.5) appears to be involved in the accumulation of phenolic compounds in pine suspension cultures in response to ectomycorrhizal fungal elicitation. PAL has been purified to homogeneity from *Pinus banksiana* suspension cultures using anion-exchange and chromatocoussing FPLC. Physical and kinetic characterization of the enzyme has revealed that pine PAL is similar to PAL from other plant sources. Chromatographic analyses have been used to identify possible isoenzymic changes in pine PAL in response to elicitation by an ectomycorrhizal fungus.

FEEDING DETERRENCE OF *AUSTROEUPATORIUM INULAEFOLIUM* (COMPOSITAE) AGAINST *SITOPHILUS ORYZAE* (COLEOPTERA, CURCULIONIDAE) IN RELATION TO INSECT ADAPTATION
Miguel E. Alonso, Departamento de Química, Facultad de Ciencias, Universidad de Los Andes, Mérida 5101, VENEZUELA.

Methanol, dichloromethane-acetone, and hexane leaf extracts of the title plant were found to be strong feeding deterrents against tropical strains of the rice weevil *S. oryzae* (L.). This was determined by using short term (24 h) two choice bioassays on whole wheat kernels with concentrations as low as 0.5% w/w of extract. However, longer exposure of the test insects in the two choice testing arena (7 days) resulted in undifferentiated acceptance of treated/control kernels with all extracts. The possible implication of these observations in terms of inadequacy of established feeding deterrence bioassays of storage insects will be discussed.

TANNIN CHEMISTRY IN RELATION TO HERBIVORY
Ann E. Haereman and Clare McArthur, Dept. of Chemistry, Miami University, Oxford, OH, USA, 45056 and Charles T. Robbins, Natural Resource Sciences, Washington State University, Pullman, WA, USA, 99164.

The impact of tannins on herbivory has been difficult to assess in part because the tannins are such a diverse group of compounds. We have evaluated the chemical and biochemical properties of tannin *in vitro*, and have used that information to understand the nutritional effects of tannins. For example, nitrogen utilization in deer is adversely affected by the gallotannin found in fireweed flowers, but is unaffected by commercial gallotannin (lactic acid). The fireweed tannin is higher molecular weight than the commercial tannin, and is more likely to form insoluble tannin-protein complexes. The low molecular weight galloyl esters in tannic acid are presumably hydrolyzed in the rumen of the deer and thus do not affect nitrogen economy. In monogastric mammals such as rats even tannic acid diminishes apparent protein digestibility.

BIOACTIVE PHENOLIC CONSTITUENTS FROM THE LEAVES OF *MAGNOLIA VIRGINIANA*
James K. Nilsen, Muralaetharan Nair, and J. Mark Scriber, Departments of Entomology and Horticulture, Michigan State University, East Lansing, MI, USA.

We have identified plant compounds that prevent larvae of unadapted swallowtail butterfly species (Lepidoptera: Papilionidae) from feeding on *Magnolia virginiana* (Magnoliaceae). This tree is native to the southeastern United States and, although is a host for certain *Papilio* species, contains compounds that strongly deter feeding by *Papilio palamedes* caterpillars. Our bioassay-directed fractionation of *M. virginiana* leaf extracts identified high activity in a fraction comprised of two neolignan compounds. One of these compounds, magnolol, has been reported to occur in other members of the Magnoliaceae. The second compound, a biphenyl ether of magnolol, has to our knowledge not been previously identified in *Magnolia* species. In addition to having bioactivity against a lepidopteran species, preliminary studies indicate that both compounds are toxic to *Aedes aegypti* larvae and greatly inhibit bacterial growth.

LOCALIZATION OF PHENOLIC COMPOUNDS IN EPIDERMIS AS THE FIRST CELLULAR BARRIER BETWEEN THE PLANT BODY AND ITS ENVIRONMENT.
Alicja M. Zobel¹, Mieczyslaw Kuras² and Teresa Tykarska², Department of Chemistry, Trent University¹, Peterborough, Ont. K9J 7B8, Canada and Electron Microscope, Biology, Warsaw University², 00-927 Warsaw, Poland.

Epidermal vacuoles of many of the 50 species examined had phenolic compounds, as did trichomes, if present. Epidermis originates via protoderm from tunica initials, at the very top of the shoot apex. *Crataegus* and *Vitis* contained phenolics in the tunica; others only started to contain them in the vesicles and vacuoles of the protoderm. These vacuoles arise from the ER by: (1) separation of small vesicles from ER cisternae followed by their fusion, leading to vacuoles of increasing size, or (2) dilation of large areas of ER sheet, with the rapidly increased space of the cisternae leading directly to formation of large vacuoles. In the present case a connection of the still increasing ER with the large central vacuole was recognizable.

IDENTIFICATION OF HAIRPENCIL SECRETION FROM *MAMESTRA BRASSICAE* (L.) MALE (LEPIDOPTERA, NOCTUIDAE) AND ELECTROANTENNOGRAM STUDIES
Emmanuelle Jacquin, Patricia Nagnan and Brigitte Frerot, Laboratoire des Médiateurs chimiques INRA Magny les Hameaux, F-78114, France.

The male *Mamestra brassicae* hairpencils are everted during courtship in the vicinity of the female and this seems to increase female acceptance. Hairpencil extracts of 3-day-old males were analysed by capillary gas chromatography (GC) and by GC-mass spectrometry. The extracts were found to consist of 6 components. Benzaldehyde, 2-methyl propanoic acid, 2-methyl butanoic acid and phenol were present in the extracts as well as the previously identified benzyl alcohol and phenyl ethanol. Electroantennograms were recorded on male and female antennae in response to stimulation by hairpencil compounds. Male and female antennae responded to each chemical but the female responses were significantly higher than those of the males.

C-GLYCOSYLFLAVONES FROM *CENTAURIA PALLESCENS* L.
Mamdouh M. Abou-Zaid, Department of Biology, University of Ottawa, Ottawa, Ont., Canada K1N 6N5.

The flavonoids of the Compositae have been of ongoing interest as this family contains a number of medicinal plants. The present study deals with the separation and identification of the C-glycosylflavones of *Centaurea pallescens* L. (Compositae). Fresh plant material was collected in August 1988, from St. Catharines, Sinal, Egypt. The leaves and stems were extracted with 70% EtOH, followed by isolation on a series of polyamide, polyvinyl-pyrrolidone (PVPP) and Sephadex LH-20 columns. The C-glycoside mixture was isolated by HPLC using a prep. C-18 column and a MeOH:H₂O:HCOOH solvent system. Pure compounds were subjected to physical analysis (UV, ¹H-NMR, ¹³C-NMR and FAB-MS). Two (of a total of six) of the C-glycosylflavones have been identified as isovitexin (6-C-glucosylapigenin) and vitexin (8-C-glucosyl-apigenin). The remaining four are under further investigation.

FLAVONOIDS FROM THE LEAVES OF *ACER RUBRUM* L. AND *A.SACCHARUM* L.
Mamdouh M. Abou-Zaid and Constance Nozzolillo, Department of Biology, University of Ottawa, Ottawa, Ont. Canada K1N 6N5.

Leaves (1 Kg, Fr. wt.) of *Acer rubrum* L. (red maple) and *Acer saccharum* L. (sugar maple) family (Aceraceae) were collected in September 1989, from mature trees in the city of Ottawa and extracted with 70% MeOH. The methanolic extracts were fractionated on a polyvinylpyrrolidone (PVPP) column using water followed by increasing concentrations of methanol. PVPP fractions were further separated by paper chromatography. Final purification was achieved on Sephadex LH-20 column. Pure compounds were tested for purity by HPLC using a C-18 column and a MeOH:H₂O:HCOOH solvent system. The glycosidic flavonoids were subjected to chemical and physical investigations (UV, ¹H-NMR, ¹³C-NMR and FAB-MS). Kaempferol 3-O-glucoside, quercetin 3-O-glucoside, gallic acid and acylated glycosides of kaempferol and quercetin were isolated and identified.

THE CHEMICAL RELATIONSHIP BETWEEN COTTON AND BOLLWORM (*PECTIMOPHORA GOSSIPIELLA*)
Cao Bi Qiang and Yu Hui Min, Dept. of Biology, Nanjing University, Nanjing, Jiangsu, China.

We used a variety of chemical analyses combined with bollworm bioassays to determine the effects of different cotton plant extracts upon the feeding, growth and development of cotton bollworms. Alcohol extracts of cotton bolls stimulated feeding and increased growth rate, decreased mortality and increased pupation and emergence rates. These chemicals were crucial for emergence and thus, for further reproduction. The chemicals involved were isolated by a variety of techniques and were found to be sesquiterpenes and long chain fatty acids and esters. Both water extract of cotton bolls and alcohol extracts of cotton leaves were toxic to cotton bollworm larvae. These inhibited feeding, decreased growth rates and increased larval mortality. Various analytical techniques showed that there are at least 10 toxins in the leaves and 8 in the boll. These include carboxylic acids, alkaloids, aromatic carboxylic acid esters, flavonoids, and quinones. Future research will further investigate the nature and effects of these naturally occurring toxins and stimulants.

CALLING BEHAVIOR OF THE TOMATO LEAFMINER *SCROBIPALPULA ABSOLUTA* (LEPIDOPTERA: GELECHIIDAE)

Eduardo R. Hickel, Evaldo E. Vilela, José O. G. de Lima and Terezinha M. C. Della Lucia. Dept. of Animal Biology, University of Vçosa, MG., Brazil 36570.

The calling behavior of virgin females of 0 to 3-day-old *Scrobipalpula absoluta* was examined in the laboratory at 25±1°C and 60±20% RH under a 14L:10D photoperiod. The females began calling during their first crepuscular (dawn) period. Freshly-emerged, 1-, 2- and 3- day post-emergence moths were similar in respect of the total percentage of females calling, the time of initiation of calling, total time spent calling, and average duration of calling. The duration of calling periods varied considerably within the same age class. No calling activity was observed during the dark period.

TRANSFORMATION OF *ESCHSCHOLZIA CALIFORNICA*: ROOTS, EMBRYOS AND ALKALOIDS

B. Williams¹, B.E. Ellis², and J. Archambault¹. ¹Biotechnology Research Institute, National Research Council Canada, 6100 Royalmount Ave., Montreal, QC, Canada, H4P 2R2. ²Department of Plant Science, University of British Columbia, 2357 Main Mall, Vancouver, B.C. Canada, V6T 2A2.

Seedlings of *E. californica* were found to be susceptible to infection with a variety of *Agrobacterium rhizogenes* strains. Some strains induced adventitious root formation on greater than 60% of the test seedlings. In addition to roots many of the infected seedlings also showed the development of embryos at the wound site. Control seedlings showed a very low frequency of root formation but never showed embryo production. Root and embryo cultures, established from the infected seedlings were examined for growth and alkaloid accumulation. Benzophenanthridine alkaloids accumulated to relatively high levels in the roots (>0.3% dry weight), but embryos showed little accumulation until further tissue development. The effect of nitrogen and carbohydrate source on embryo development will also be discussed.

INSECTICIDAL MODE OF ACTION OF AN EXTRACT OF THE BARK OF THE PAW PAW, *ASIMINA TRILOBA*, CONTAINING THE LINEAR ACETOGENIN, ASIMICIN

Mark A. Lewis, J.T. Amason, B.J.R. Philogene, University of Ottawa, Ottawa, Ont. K1N 6N5 Canada.

A purified extract (F020) containing the linear acetogenin, asimicin, from the bark of *Asimina triloba* was investigated as a biologically active substance to the European cornborer, *Ostrinia nubilalis* and the tobacco hornworm, *Manduca sexta*. Significant aberrations in mortality, growth and fecundity were evident. Toxicity of the compound was apparent through a comparison of the nutritional indices determined for *O. nubilalis* between the consumption and topical application of F020. Consumption index, relative growth rate, efficiency of conversion of ingested food and efficiency of conversion of digested food decreased in all cases, suggesting a true toxin rather than an antifeedant. The approximate digestibility was not significantly different as the dose of F020 increased, indicating that the digestive process is not being affected. The effects of this novel plant product observed in the present study represents one of the first investigations of acetogenins as a class of natural insecticides and may lead to the development of a useful pest control agent.

RESOURCE AVAILABILITY, PHENOLIC PRODUCTION, AND HERBIVORY IN THE HAYSCENTED FERN (*DEMNSTEADTIA PUNCTILOBIOLA*)

Gary D. Duxlin and Gillian A. Cooper-Driver. Biology Dept., Boston University, 5 Cummingtion St., Boston, MA, USA 02215.

The Hayscented Fern can be found growing in a range of habitats including fields, forest gaps, and forests. Eight field sites representing a range of habitat types were studied in the White Mountains of New Hampshire, USA. Results will be presented showing how levels of light, soil moisture, and soil nitrogen in various habitats relate to the production of phenolic compounds. Levels of phenolics in leaves varied significantly among habitats and were most closely correlated with light availability ($r = .84$), while phenolic levels correlated with soil moisture ($r = .52$) and soil nitrogen ($r = .40$) to a lesser degree. A negative exponential relationship was found between phenolic levels and C:N in leaves. An inverse relationship ($r = -.57$) was found between the amount of phenolics present and insect herbivory.

WHY IS THE NOCTURNAL GEOMETRID, *HOMOCHLODES FRITILLARIA*, A FERN SPECIALIST?

Gillian A. Cooper-Driver and Gary D. Duxlin. Biological Research Building, Boston University, 5, Cummingtion Street, Boston, Massachusetts 02215, USA.

Homochloides fritillaria is a fern specialist. The major host of the larvae is bracken fern, *Pteridium aquilinum*. In areas where bracken is absent, *H. fritillaria* colonizes the closely taxonomically related weedy fern species *Dennstaedtia punctilobula* (the hay-scented fern). Although closely related taxonomically bracken and hay-scented fern show major differences in their secondary chemistry. The latter synthesizes coumarins and salicylic acid compounds not commonly isolated from ferns. The relative amounts of coumarin and salicylic acid effect both colonization and feeding of the hay-scented fern by the geometrid larvae. Concentrations of these compounds can be changed by manipulation of the environment in which these ferns grow.

USE OF POLYMERIC ADSORBENTS FOR ON LINE EXTRACTION OF BENZOPHENANTHRIDINE ALKALOIDS IN CELL CULTURES

N. Chaurai, C. Bédard, R. Williams and J. Archambault. Biotechnology Research Institute, National Research Council Canada, 6100 Royalmount Avenue, Montréal, QC, Canada, H4P 2R2.

The production of sanguinarine, a benzophenanthridine alkaloid, by plant cell cultures may represent an interesting alternative to agricultural supply of this product. A key requirement for an efficient bioprocess is that the product of interest be released from cells into the medium so that an on line extraction can be performed. Many techniques have been used to achieve the *in situ* removal: solvent extraction, ion-exchange, adsorption, membrane and physical methods. Among these, the use of polymeric adsorbents like XAD resins seems to be very promising. In this presentation, the theoretical aspects of the adsorption-desorption process for different benzophenanthridine alkaloids onto XAD resins will be examined: the influence of the pH, the adsorption capacity, the importance of contact time and type of contact (batch and fluidized bed) of 2 alkaloids (sanguinarine and cheleythine) onto 2 resins (XAD4 and XAD7) will be presented. The choice of eluent and concentration effect involved in the desorption step will also be discussed.

A BIOPROCESS FOR ON-LINE REMOVAL OF SANGUINARINE FROM SURFACE-IMMOBILIZED POPPY CELLS.

C. Bédard, R. Williams, N. Chaurai, and J. Archambault. Biotechnology Research Institute, National Research Council Canada, 6100 Royalmount Ave., Montréal, QC, Canada, H4P 2R2.

Cells lines of Papaveraceae species, including *Eschscholzia californica*, *Sanguinaria canadensis*, and several *Papaver* representatives, were examined for their ability to produce benzophenanthridine alkaloids. Maximal alkaloid production was evaluated by elicitation of the cells with either a fungal (*Bostryis*) homogenate or chitin. Alkaloid yields as high as 2.5% of cell dry weight were observed. A number of cell lines from different species were successfully surface-immobilized and grown on a polyester matrix in 2 or 6 L. bioreactors. Growth in the bioreactors and in suspension were comparable. On-line removal of alkaloids from elicited immobilized cultures was achieved by recirculating the medium through a column containing neutral adsorbent resin (SAD-7). In many cases more than 50% of the total alkaloids produced by the elicited cells were located on the resin.

WEEVIL REPELLENT CONSTITUENTS OF *OCIMUM SUAVE* LEAVES AND *EUGENIA CARYOPHYLLATA* CLOVES

Wilber Lwandu and Ahmed Hassanali. The International Centre of Insect Physiology and Ecology, P. O. Box 30772, Nairobi, Kenya.

The leaves of *Ocimum suave* and the cloves of *Eugenia caryophyllata*, used as grain protectants in parts of East Africa, yield essential oils that are repellent to the maize weevil, *Sitophilus zeamais*, in olfactometric assays. Eugenol, a common constituent of the two, was found to be a potent repellent of the weevil. Eugenol was more repellent than the synthetic commercial compound, DEET (N,N-diethyltoluamide) and the two analogues of eugenol, methyl eugenol and isoeugenol. Results from this study demonstrate a possible scientific rationale for the use of these plants as grain protectants by communities in East Africa.

ERIC CONN AWARDED AN UNUSUAL PRIZE

Eric E. Conn has been awarded the 1990 UC Davis Prize for Teaching and Scholarly Achievement. Established by the Cal Aggie Foundation, the \$25,000 prize pays tribute to faculty members who demonstrate throughout their academic careers a dedication to the skillful teaching of undergraduates as well as to the production of valuable scholarly accomplishments. No other academic institution in the United States is believed to honor this combination of achievements with such a high monetary prize. According to UC Davis Chancellor Theodore L. Hullar, "This extraordinary prize enables the Davis campus to recognize and further encourage its complementary missions of teaching and research. Commitment to the creation of new knowledge and to the stimulation of minds illumines the classroom and ennobles individual scholarship. This commitment characterizes the Davis campus exceptionally well."

A faculty member at UC Davis since 1958, Conn is credited for playing an instrumental role in the development of biochemical research and teaching on campus. He helped shape the campus's budding biochemistry and biophysics department in the late 1950s and established the department's basic biochemistry course, which he continues to teach with his colleagues. He is co-author of the textbook *Outlines of Biochemistry*, now in its fifth edition and used around the world.

Over the years, thousands of undergraduate students have passed through Conn's classes, learning about the chemical processes that power living things. His colleagues say he is a superb teacher. His students consistently give him high ratings for his enthusiasm, ability to teach effectively, and willingness to help outside of class.

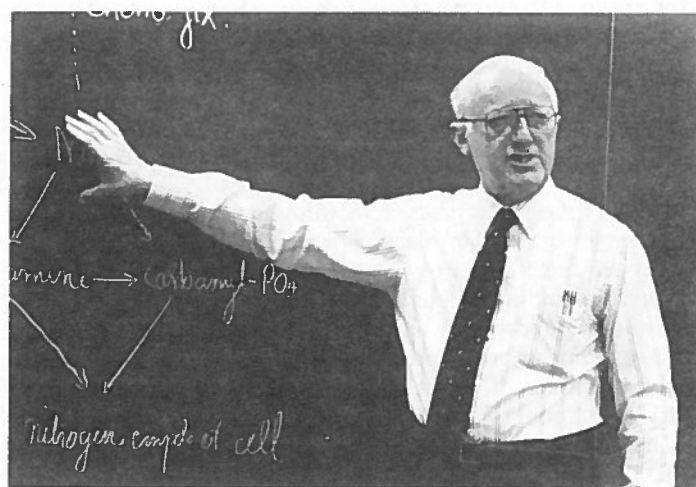
John Haburjak, a first-year veterinary student who studied under Conn as an undergraduate and works in Conn's laboratory during the summer, says he advises students intimidated by the prospect of taking biochemistry to take the class with Conn. "His clarity, patience and explanations are worth waiting for," says Haburjak. "He takes the approach that the topic he talks about is fascinating. It's a real pleasure. It's fun."

According to Conn, his teaching style and attitudes toward his work were influenced greatly by two professors who served as mentors while he was an undergraduate at the University of Colorado and a graduate student at the University of Chicago. He says he admired these professors, Ruben Gustavson and Birgit Vennesland, for their lecturing skills, enthusiasm imparted to students, and encouragement.

While he follows no formal teaching philosophy, Conn says he tries to be as helpful as possible to students in and outside

the classroom. Especially important is mutual respect. "My students deserve my respect just as I hope to merit theirs," says Conn.

Conn is well known for his groundbreaking studies of cyanogenic glycosides, substances that produce cyanide in plants. The focus of his research has been on understanding the process of cyanide formation in plants and the role played by the poisonous substance in plant metabolism. Scientists believe that cyanide, with its varied functions, provides a chemical line of defense for the roughly 2,000 plant species known to produce it, protecting them from grazers and the invading growth of other plants.



Recognized internationally for its emphasis on natural plant products, Conn's laboratory has attracted graduate students and postdoctoral researchers from at least 10 countries, including Germany, Denmark, Australia and Japan.

Conn has received numerous awards and honors throughout his career, including the Distinguished teaching award and the Faculty Research Lecturer Award, given annually by faculty peers at UC Davis. Conn and colleague Paul K. Stumpf edited the 15 volume *The Biochemistry of Plants: A Comprehensive Treatise* which has become a classic reference for phytochemists. In 1988 he was elected to the National Academy of Sciences. Conn serves as editor or sits on the editorial board of several scientific journals. He is past president of the Phytochemical Society of North America and the American Society of Plant Physiologists. A colleague recently named an Australian acacia species after him, *Acacia conniana*.

MEETINGS AND PROGRAMS OF INTEREST

FIFTH INTERNATIONAL SYMPOSIUM ON THE MOLECULAR GENETICS OF PLANT-MICROBE INTERACTIONS: Interlaken, Switzerland, September 9-14, 1990. For further information, contact Dr. Hauke Hennecke, Mikrobiologisches Institut, Eidgenossische Technische Hochschule, ETH-Zentrum, CH-8092, Zurich, Switzerland.

FIRST INTERNATIONAL CONFERENCE ON NEW INDUSTRIAL CROPS AND PRODUCTS: Riverside, California, October 8-12, 1990. A conference for all those interested in new industrial crops or new agricultural products from existing crops will address many aspects of new industrial crops research. The program will emphasize crops such as jojoba, guayule, kenaf, vernonia and cuphea. To contribute papers/posters or for further information, contact Cindi McKernan, Conference Coordinator, Department of Botany and Plant Sciences, University of California, Riverside, CA 92521 (Tel. 714-787-3423, fax 714-787-4437).

INTERNATIONAL CONFERENCE ON ELECTROPORATION: Marine Biological laboratory, Woods Hole, Massachusetts, October 28-31, 1990. The objective of this conference is to promote communication among scientists who are interested in electroporation and electrofusion, and to review recent progress in this field including advances in the understanding of basic mechanisms, development of new technology and new applications of electroporation and electrofusion in cell biology, molecular biology, immunology, and other areas of biotechnology. *Cost: Registration fee:* \$95 (\$55 for students). *Room and Board:* \$77 (single), \$62 (shared double) per day. There is a bus service connecting Woods Hole and Logan Airport, Boston. The round trip fare is \$25. For further information, contact Dr. Donald C. Chang, Department of Molecular Physiology and Biophysics, Baylor College of Medicine, One Baylor Plaza, Houston, TX 77030.

SECOND NORTH AMERICAN TANNIN CONFERENCE. PLANT POLYPHENOLS: BIOGENESIS, PROPERTIES AND SIGNIFICANCE. *Note change in location and dates:* Michigan Technological University, Houghton, MI, June 17-21, 1991. The program and timing of this meeting complement the 31st annual meeting of the PSNA in Fort Collins, CO. For further information, contact Richard W. Hemingway, Southern Forest Experiment Station, USDA Forest Service, 2500 Shreveport Highway, Pineville, LA 71360 or Peter E. Laks, Institute of Wood Research, Michigan Technological University, 1400 Townsend Drive, Houghton, MI 49931-1295 or Susan L. Bucheger, Public Service Professional Development, Michigan Technological University, 1400 Townsend Drive, Houghton, MI 49931-1255 (Tel. 906-487-2262).

PHYTOCHEMICAL SOCIETY OF NORTH AMERICA: Fort Collins, Colorado, June 22-26, 1991. The symposium topic for this 30th anniversary meeting of the PSNA will be Phenolic metabolism of Plants. For further information, contact Dr. Helen A. Stafford, Biology Dept., Reed College, Portland, OR 97202 (Tel. 503-771-1112) or Dr. Ragai K. Ibrahim, Biology Dept., Concordia University, Montreal, Quebec, Canada H3G 1M8 (Tel. 514-848-3399).

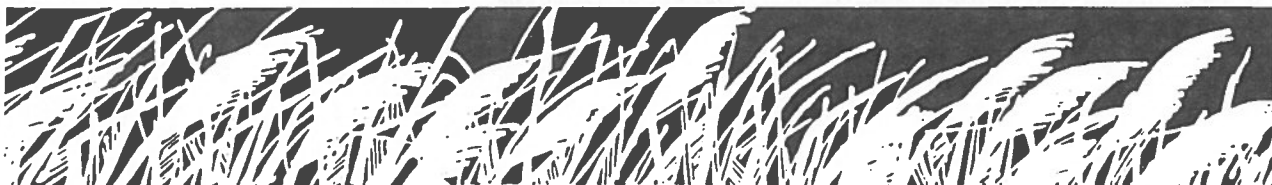
15TH INTERNATIONAL CONGRESS OF BIOCHEMISTRY. Jerusalem, Israel, August 4-9, 1991. For further information, contact: 1st IUB Congress, P.O. Box 50006, Tel Aviv 61500, Israel (Tel. 972-3654571; fax: 972-365-5674; Bitnet BNLITAU@WEIZMANN).

THIRD INTERNATIONAL CONGRESS OF PLANT MOLECULAR BIOLOGY: Tucson, Arizona, October 6-12, 1991. The Congress will stress current research in Molecular Aspects of Plant Growth and Development. Plenary sessions, concurrent symposia, poster, discussion sessions, and workshops will cover Advances in Gene Regulation; Differentiation; Seed and Fruit Development; Hormonal Regulation; Cell Biology; Plant Pathogenesis; Nitrogen Fixation; Responses to Environment; Genome Organization and Mapping; Photosynthesis; and Organelle Genomes. For more information, contact: ISPMB, W00 Wester Conference Consultants, 2934 1/2 Beverly Glen Circle, Suite 383, Los Angeles, CA 90077 (Tel. or fax: 213-474-5894).

IXTH INTERNATIONAL CONGRESS ON PHOTOSYNTHESIS. Nagoya, Japan, August 30-September 4, 1992. For further information, contact Prof. Noria Murata, Secretariat, IXth International Congress on Photosynthesis, National Institute for Basic Biology, Ozaki 444, Japan.

POSITION AVAILABLE

UNIVERSITY OF KENTUCKY, LEXINGTON. POSTDOCTORAL POSITION IN PLANT BIOCHEMISTRY/MOLECULAR BIOLOGY. Available immediately. Research activities will include development of enzyme assays, purification and characterization of enzymes, gel protein maps, and mRNA isolations associated with nicotine metabolism. Send resume, names/addresses and phone numbers of three references to *Dr. Lowell Bush, Department of Agronomy, University of Kentucky, Lexington, KY 40546-0091.* Phone (606) 257-3309.



PHYTOCHEMICAL SOCIETY OF NORTH AMERICA

Newsletter

**Volume 30
Number 2**

November 1990

PSNA Executive Committee 1990-91

Dr. Jonathan Poulton
Past-President, PSNA
Department of Botany
University of Iowa
Iowa City, IA 52242
(319)335-1322

Dr. Brian E. Ellis
President, PSNA
Department of Plant Science
University of British Columbia
Vancouver, B.C., Canada V6T2A2
(604)228-3451

Dr. Murray B. Isman
President-Elect, PSNA
Department of Plant Science
University of British Columbia
Vancouver, B.C., Canada V6T2A2
(604)228-2329

Dr. Helen M. Habermann
Secretary, PSNA
Department of Biological Sciences
Goucher College
Baltimore, MD 21204
(301) 337-6303

Dr. Kelsey R. Downum
Treasurer, PSNA
Department of Biology
Florida International University
University Park
Miami, FL 33199
(305)348-3419

Dr. Helen A. Stafford
Editor-in-Chief, PSNA
Biology Department
Reed College
Portland, OR 97202
(503)771-1112

PSNA Advisory Committee

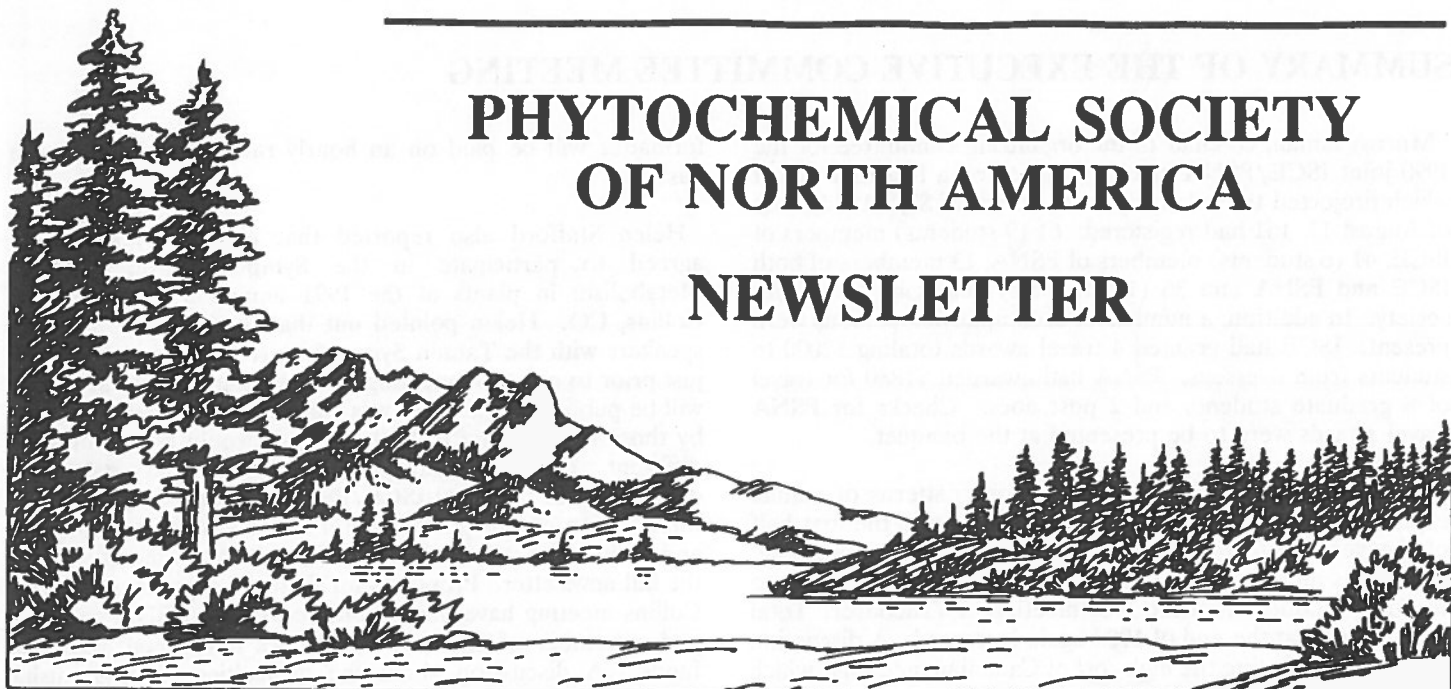
Geza Hrazdina (1991) Richard L. Mansell (1992) George J. Wagner (1992)
Constance Nozzolillo (1993) G.H. Neil Towers (1994)

The Phytochemical Society of North America is a non-profit scientific organization whose membership (currently over 400) is open to anyone with an interest in phytochemistry, the role of plant substances, and in related fields. Annual membership dues are \$15.00 for regular members and \$8.00 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. A newsletter is circulated to members several times a year to keep them informed of upcoming meetings and developments within the Society.

If you would like additional information about the PSNA or if you have material to be included in the newsletter, please contact the Society Secretary. Annual dues and changes in addresses should be sent to the Society Treasurer.

PHYTOCHEMICAL SOCIETY OF NORTH AMERICA

NEWSLETTER



NOVEMBER, 1990

VOLUME 30, NUMBER 2

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SUMMARY OF THE EXECUTIVE COMMITTEE MEETING

Murray Isman, co-chair of the organizing committee for the 1990 joint ISCE/PSNA meeting, presented a financial report which projected the relatively small deficit of \$2,171 Cdn. As of August 11, 161 had registered: 61 (9 students) members of ISCE, 41 (6 students) members of PSNA, 13 members of both ISCE and PSNA and 36 (14 students) belonging to neither society. In addition, a number of accompanying persons were present. ISCE had granted 4 travel awards totaling \$2000 to students from overseas. PSNA had awarded \$1880 for travel of 8 graduate students and 2 post docs. Checks for PSNA travel awards were to be presented at the banquet.

In Kelsey Downum's treasurer's report, patterns of annual expenditures were noted: most receipts come in the first half of the year while major expenses occur in the second half. There was an unplanned expenditure of \$8,478.96 this year to make up a deficit from the 1989 meeting in Vancouver. Total PSNA assets at the end of 1989 again increased. A discussion followed concerning the high cost of Canadian meetings, which tend not to be supported by grants from U.S. corporations or governmental agencies. The major cause of deficits for annual meetings appeared to be low attendance. Helen Stafford recommended that the responsibility for fund raising be separated from organization of symposia for the annual meeting. Royalties from the *Recent Advances in Phytochemistry* continue to provide annual income for the society with record first year royalties for Volume 23 edited by Poulton *et al.* Membership continues to increase. As of August, 1990 there were 425 members and the PSNA gained 21 new members from the Vancouver meeting. A new directory was distributed to members in 1990. The directory appears to have reached the maximum feasible size for its present format.

The secretary reported that costs of printing and mailing the newsletter increased again this year and currently are more than \$900 per issue. Increased costs were partially offset by the reduced number of pages per issue made possible by a shift to WordPerfect 5.0 with smaller type fonts. Increased input from members concerning meetings, especially of foreign societies, would be very much appreciated. There were relatively few "positions available" and "positions wanted" notices during the past year. These are free advertisements available to all members. The format of the inside cover of the newsletter will be changed this year and members of the advisory committee will be listed. The election mailing will include photographs and biographical information for all candidates.

Editor-in-chief Helen Stafford reported that camera ready copy for Volume 24 of the *Recent Advances in Phytochemistry* was prepared on a Macintosh computer using Word 4. It was published in early July after a several week delay caused by Plenum's confusion about the title. Change to Times 10, a proportional font, and right justified margins will result in major changes in appearance for Volume 25. Every attempt will be made to have the next volume published before the 1991 meeting but this will be difficult because of the late 1990 meeting. \$1844.61 of the \$2000 budgeted for editorial expenses was used to prepare Volume 24. For Volume 25, the

formatter will be paid on an hourly rather than a per page basis.

Helen Stafford also reported that eleven speakers have agreed to participate in the Symposium on Phenolic Metabolism in plants at the 1991 annual meeting in Fort Collins, CO. Helen pointed out that there is an overlap in speakers with the Tannin Symposium to be held in Michigan just prior to our 1991 meeting. Proceedings of both symposia will be published and there was some concern whether papers by those contributing to both volumes would be significantly different. Frank Stermitz prepared a preliminary poster for distribution at the 1990 ISCE/PSNA meeting in Quebec. A final version of this poster with a list of symposium speakers and their topics will be distributed to all PSNA members with the fall newsletter. Proposals for financial support of the Fort Collins meeting have been submitted to the USDA and NSF and a number of chemical companies have been asked for funds. A discussion about the difficulties of fund raising followed and all agreed that a special committee for fund raising would be very desirable.

Kelsey Downum reported that the Greater Miami Convention and Visitors Bureau has been helpful in locating possible facilities for the 1992 joint meeting with the Phytochemical Society of Europe. PSE members want to meet in late July or August. The best hotel prices are available in early August. The most probable dates are a Saturday to Thursday at the beginning of August. The location will be a hotel on Miami Beach (room rates as low as \$55 per day single or double plus 11% room tax will be available). The symposium topic will be "Phytochemical Potential of Tropical Plants" with up to 16 speakers (6 U.S., 6 European and 4 Latinamerican). Papers will be published in *Recent Advances in Phytochemistry* Volume 27 and the PSNA will receive all royalties. A tour of Fairchild Tropical Garden and Research Center, a Biscayne Bay Cruise and other tours will be scheduled. Travel funds for Europeans and Latinamericans will be available. A brochure about the Miami meeting will be prepared and distributed this year.

After discussion of possible sites for the 1992 PSNA meeting, no final decision was reached. It was agreed, however, that the possibility of a June meeting in Lexington, KY would be explored. Possible alternative locations are Corvallis, OR and Pullman, WA.

Election ballots were counted. Murray Isman is our new President-Elect and Helen Habermann will continue as PSNA secretary. The proposed changes in the Constitution and Bylaws to establish corporate membership passed (125 votes for and 4 against).

A discussion followed concerning the cost and privileges of corporate membership. The possibilities of providing corporate members with advertising in the newsletter, use of the PSNA mailing list, access to the PSNA chemical repository (once it is established) and the opportunity to exhibit at the annual meeting were discussed. It was suggested that any corporation donating \$250 or more to support the annual

symposium be given free membership in the PSNA.

Members of the executive committee voted prior to the annual meeting to award life membership to Frank Loewus for his many contributions to phytochemistry and the society. Frank could not attend the Quebec City meeting to accept this award because he had made plans to be in Europe during August and September. Officers of the society signed the award certificate and it was mailed to Frank after the meeting.

A committee chaired by Stewart Brown was set up at the 1989 meeting in Vancouver to investigate the nature, organization and possible sites for a phytochemical bank. A possible site has been located at the Plant Biotechnology Institute in Saskatoon under the direction of Warren Steck. Stewart Brown was to present a complete report at the annual business meeting.

President Jonathan Poulton announced that no new member would be appointed to the Advisory Board this year because two new members had been appointed in 1989.

Electronic communication between members of the executive committee has been increasing as access to Bitnet expands. An electronic bulletin board will probably be set up next year and will be accessible by all PSNA members. This will make possible more rapid communications concerning positions available, positions wanted, meetings and address changes. It will also provide electronic access to registration and abstract forms for the annual meeting.

A call for other business led to a discussion of whether post docs are eligible to be considered for the best student paper

award. It was unanimously agreed that this should be the case. It was also agreed that the award should be expanded so that there will be a best oral paper award and a best poster award beginning next year. After some discussion the following guidelines for travel and best paper awards were established:

1. Travel awards will be based on need and limited to those who are graduate students at the time of the meeting. Ordinarily the amount granted will be equal to 50% of economy class air fare.
2. Student best oral paper and best poster awards will be open to graduate students and to post docs within one year of completing the Ph.D. degree.
3. Individuals must indicate at the time when abstracts are submitted that they wish to compete for an award.
4. Responsibility for administering these regulations will be assumed by the local meeting organizers.

A total of \$3000 will be budgeted for travel and best paper awards for 1991.

This summarizes matters discussed during a lengthy meeting during the late afternoon and evening of August 11, 1990. Further informal discussions continued during the next several days. Problems involving the implementation of corporate membership and policies concerning the inclusion of advertising in the PSNA newsletter were not resolved.

Respectfully submitted,

Helen M. Habermann

ROYALTIES - Recent Advances in Phytochemistry - 1990

Volumes 11-23

	1985	1986	1987	1988	1989	Total #Sold	Total Royalty
11 Runeckles/Loewus	9.85	47.64	39.46	42.14	71.10	1158	4634.20
12 Swain/Harborne	64.30	86.78	60.50	48.11	11.90	1406	5771.83
13 Swain/Waller	23.21	24.79	24.48	9.08	2.70	837	2007.31
14 Swain/Kleiman	21.46	33.21	46.82	19.29	7.51	758	1897.58
15 Loewus/Ryan	44.71	59.50	91.30	53.08	13.62	894	3373.54
16 Creasy/Hrazdina	99.64	45.46	78.97	59.35	15.05	845	3067.28
17 Nozzolillo et al.	235.19	124.45	182.23	95.11	45.17	750	3134.08
18 Timmermann et al.	546.31	355.90	329.84	183.15	42.72	796	3790.22
19 Cooper-Driver et al.	2109.77	404.34	347.30	194.17	80.20	741	3135.78
20 Conn		2640.23	280.77	234.50	114.53	622	3405.81
21 Saunders et al.			2287.89	135.60	102.36	515	2525.85
22 Conn				2236.98	339.61	538	2576.59
23 Poulton et al.					3566.17	449	3566.17

MINUTES OF THE 30th ANNUAL BUSINESS MEETING

The 1990 business meeting of the PSNA was called to order at 5:50 PM on August 13. President Jonathan Poulton thanked Klaus Fischer and Murray Isman for their efforts in organizing the symposium and making local arrangements and reported that the finances of the 1990 meeting were in good order. There were 166 registrants: 29 students, 41 PSNA members, 61 ISCE members, 13 members of both societies, 36 non-members and 15 accompanying persons.

It was moved and seconded that the minutes of the 1989 business meeting in Vancouver be accepted as published in the November, 1989 PSNA newsletter. Secretary Helen Habermann reported that the evolution of newsletter format has continued. WordPerfect version 5.0 has made it possible to convert to a 10 pt Times proportional typeface and a two-column format. As there have been no complaints, it is assumed that the results have been satisfactory. The possibility of change to glossy paper was investigated, but it would have involved extra cost. The new format has decreased the number of pages and weight per issue, but increased postage rates and per page printing costs have continued to drive up costs. More input of newsletter content from members is needed. Information concerning meetings of European or Latinamerican groups and news items about members would be appreciated. Members were reminded that notices about positions available and positions wanted are free advertisements and among the privileges of membership. Deadlines are late October, late January and early May. To check whether a deadline is past, contact the secretary by phone, FAX or Email.

Treasurer Kelsey Downum distributed copies of the interim financial report. Dues remained a major source of support for the society, but for the first time royalty income exceeded dues income for the first six months of 1990. Record first year royalties were received for Volume 23 of the *Recent Advances in Phytochemistry*. One donation of \$2,546 (\$3,000 Canadian) was received from the Canadian government for this year's meeting. There will be a charge for use of the PSNA mailing list. Dick Mansell questioned why savings account interest was not listed under receipts (as had been done by Jonathan Poulton and John Romeo) and also asked who was doing the society's accounting. Kelsey replied that the accounting was being done by a firm in Florida at a cost of \$300. It was suggested that auditing be done by PSNA members as it has been in the past. Because the society's earnings are less than \$20,000, no tax has to be paid to the IRS. A statement of accounts for the 1989 meeting in Vancouver indicated that this was the most costly meeting in PSNA history and required a contribution of \$8,478.96 from the society to balance the books (compared to \$3,040.65 for the 1988 meeting in Iowa City). One problem with meetings in Canada is the difficulty in getting support from the U.S. government. PSNA membership has continued to grow (currently at 425). A number of students became full members during the past year.

Editor-in-chief Helen Stafford reported that the *Recent Advances in Phytochemistry* Volume 24 was published on time. Composition is now done by computer and there will be change in type font and justified right margins for Volume 25.

The symposium volume may be published later next year because of the late meeting in 1990. Timing will depend on how quickly speakers and editors complete their work.

President Poulton announced that eight students and post docs had received travel awards (ranging from \$50 to \$390). A total of \$1,880 was spent of the \$3000 allocated. The following received travel awards:

Richard Aucoin
Department of Biology
University of Ottawa
Ottawa, Ont. 61N6N5
Canada

John Bacheller
Department of Biology
University of South Florida
4202 E. Fowler Ave.
Tampa, FL 33620

Don Champagne
Department of Entomology
University of Arizona
Tucson, AZ 85721

Emidio De Carolis
Institut Botanique
University of Montreal
4101 Rue Sherbrooke Est
Montreal, Que. H1X2B2
Canada

Estele Inciong
Wood Sci. & For. Prod.
VA Poly.Inst.& State Univ.
Blacksburg, VA 24061

Robin Marles
Biology Department
University of Ottawa
30 George Glinski St.
Ottawa, Ont. K1N 6N5
Canada

Marios Menelaou
Department of Chemistry
Louisiana State University
P.O.Box 19011 LSU
Baton Rouge, LA 70893

Tom Savage
Institute of Bio. Chem.
Washington State Univ.
Pullman, WA 99164

The committee to select the best student paper (C. Nozzolillo, D. Champagne and J. Poulton) had chosen two award winners who would be announced at the banquet (see biographies of Emidio De Carolis and Marios A. Menelaou elsewhere in this newsletter).

President Poulton thanked members of the advisory committee, Connie Nozzolillo, George Wagner, Geza Hrazdina, Stewart Brown, Neil Towers and Dick Mansell for their service to the society. They have contributed input regarding meeting sites, fund raising and other issues.

Helen Stafford reported on the status of planning for the 1991 meeting at Colorado State University. Frank Stermitz is serving as the local organizer. The symposium topic is "Phenolic Metabolism in Plants" and 11 speakers have accepted invitations to participate (see enclosed poster). Helen Stafford submitted proposals to NSF and USDA for funding but there was no response as of August. Ragai Ibrahim presented checks to the society for \$1,500 Cdn from Concordia University and \$1,000 Cdn from the Nobel Foundation in support of the meeting.

Kelsey Downum reported on preliminary plans for the 1992 joint meeting with the Phytochemical Society of Europe in Miami, FL. Funding will be available to support travel of European and Latinamerican phytochemists. The symposium

topic, "Phytochemical Potential of Tropical Plants," should be of interest to members of many botanical and chemical societies. The meeting will probably be held during the first week of August and the site will be a hotel on Miami Beach. A trip to the Fairchild Tropical Gardens will be scheduled during the meeting. This motorized tour will provide a chance to see a unique collection of plants including the largest palm collection in the world. Ragai Ibrahim raised a question about the cost of registration for European phytochemists who are not members of PSE and pointed out that there are other phytochemical societies in Europe such as the Group Polyphenols. It was suggested that all possible groups be contacted and invited to attend.

President Jonathan Poulton listed possible locations for future meetings in the central U.S. (Kentucky) or the west coast (Oregon). Possible symposium topics include: Effects of herbicides on plant physiology; Fungitoxins; Cytological localization of phytochemicals; Mechanisms of disease resistance in plants; Tissue culture production of natural products. Other topics or sites could still be considered. Geza Hrazdina suggested that the society return to Asilomar or Banff. Jonathan Poulton pointed out the advantage of having a PSNA member at or near the meeting site and that commercial meeting centers have transportation and meeting facilities organized. Stewart Brown praised the format and site of the 1969 meeting at Banff with meetings scheduled mornings and evenings, afternoons free for sightseeing.

Stewart Brown next presented a detailed report on the work of an ad hoc committee set up at the Vancouver meeting in 1989 to explore the feasibility of establishing a phytochemical repository (proposed by Stewart Brown). This committee consisted of Jim Saunders, Norman Lewis and Mark Bernards. Ideas were exchanged by mail on the nature and organization of the proposed "bank." Possible sites considered were the USDA in Beltsville and PBI (Plant Biotechnology Institute) at Saskatoon. Restrictions on the kinds of compounds that would be stored (and possible associated health hazards) indicated that the USDA in Beltsville was not a possible site.

Brown's discussions with Warren Steck of PBI two years ago had indicated strong support of the idea of a phytochemical repository, and the possibility of funding, but political cutbacks had forced the idea to be shelved. Last spring Steck was again approached about a more modest operation which would require less funding, with part of the support external to PBI. In July, Brown received a very positive response.

Steck has institutional support to proceed and regards the Phytochemical Bank as having three elements: 1) collection as a repository; 2) sample provision and service; 3) other services and activities. The operation should be international in scope, i.e. extending beyond North America (even if set-up and funding are entirely North American).

Some conditions of operation were considered essential:

1. There would be compensation for donors (but presumably outright gifts would be accepted).
2. Donors would have continued access to donated material.

3. Perhaps donors of chemicals could share income from fees for of samples distributed.
4. Curating the collection would require the ongoing services of a good technician.
5. A file/retrieval system should be set up at the outset. Use of Chemical Abstracts registry numbers seems best, using this database to key in multiple nomenclature. (The idea of working with Chemical Abstracts and using their database was discussed but may not be feasible).

One primary service of the repository would be to provide very small samples (usually microgram amounts) with the option of providing only spectra as an alternative. This operation could be managed by one technician. Charges should be levied for all services. New WHMIS legislation should not be a serious impediment, since there are apparently explicit provisions for this type of sample business virtually amounting to an exemption. In any event, any restrictions would apply as much to an individual as to a bank.

Other (secondary) activities would include:

1. Provision of on-line spectra and spectral comparisons.
2. Research on the environmental stability of phytomolecules and other environmentally oriented studies.
3. Custom re-isolation (or synthesis) of gram amounts. What happens if a collection item is exhausted or if a research group wants larger amounts, or even if further purification is necessary? Steck is convinced that the bank must include or have ready access to facilities for general phytochemistry.
4. Preservation of voucher specimens of newly reported phytochemicals.

Someone must decide how we will define phytochemicals. Do we include macromolecules? Should we restrict the bank to small molecules?

The NRC of Canada is prepared to fund and participate in the phytochemical repository as follows:

1. It will provide permanent premises at PBI: an equipped laboratory, office space, utilities and physical plant services for the first five years (annual value, \$15,000).
2. A start-up staff person with salary for the first two years of operation, contingent on the site being at PBI (\$40-60K/yr).
3. Phytochemical facilities: access at regular cost-recovery rates to services and facilities at PBI, including computer systems, communications networks, and storage.
4. Donation to the bank of PBI's large collection of phytochemicals (some rare, of unknown aggregate value) not contingent on the site.
5. Intangibles: Stability and support of a strong government research organization, long experience in phytochemistry of many of the PBI staff.

\$70,000 to 80,000 Cdn would be committed annually in the formative years. Other NRC resources might be available through other of their programs, especially if industry partners were involved in a North American consortium. It may be useful to establish the Bank on an organizational basis, i.e. a legal entity. Some such action may be required for a more aggressive pursuit of funding. Steck expects to play a key role in the initial operations even if this requires a leave of absence from his present post as director of PBI.

A lengthy discussion followed Stewart Brown's report. Norman Lewis questioned the scope of the proposed organization and suggested that NIH and the USDOE also may be interested in the bank and a formal proposal by DOE has been put together. He favored the ACS system of listing compounds and suggested that Albersheim's carbohydrate bank could be used as a model. There are other banks for proteins. NIH solicits and receives compounds but NIH becomes the owner and will not supply samples. There is a possibility of NIH support. Brown stated that we should seek international funding for the bank. Lewis stated that more formal contact with NIH is needed. Brown suggested that PSNA should commit some funds for organization of the bank and travel for individuals involved. Ragai Ibrahim asked whether the NRC officially backs the organization proposed by Steck (it does). Murray Isman stated that the PBI offer is an expensive and inefficient way to achieve the goal of providing small quantities of phytochemicals to use as standards. This plan goes beyond the original intent and Norman Lewis' computer network seems much more cost effective. Jonathan Poulton pointed out that the original concern was loss of phytochemical collections when individuals retire. Norman Lewis added that Eric Conn's collection is already gone. Brown stated that the repository is needed for "orphaned" compounds. Isman proposed that a list of available chemicals appear in the PSNA newsletter. Brown replied that a list doesn't solve the problem of storage. Brian Ellis raised the problem of need for continued support of the program. Donors of samples will receive a portion of income. Who decides on prices of chemicals? Margaret Essenberg asked whether NIH would support an international center. Lewis replied that they can be approached, but international borders are a problem. Harold Norbert asked who owns research chemicals? Can they be dispensed by a repository? Brown replied that this can be a condition of the donation. Alina Walther stated that there can be difficulties within academic departments. Often a donor must have clearance to give away a chemical. Brown pointed out that departments tend to discard chemicals. Ellis stated that departments should be pleased to have this option for disposing of chemicals. Jonathan Poulton requested that the Executive Committee be allowed to examine the document describing the proposed PBI phytochemical bank. Brown asked whether the society wished

the ad hoc committee to continue its search for support. Poulton requested the committee to continue to function.

President Poulton asked the ad hoc committee (consisting of Joe Olechno and Kelsey Downum) studying PSNA-corporate interactions and sources of donations to the society to report. Joe Olechno stated that corporations are approached for money every day and that they support many meetings. Because zoologists work harder, they tend to raise more money than botanists. The PSNA has to be more aggressive in approaching corporations. Instrument manufacturers are obvious companies to ask for support of symposia where research done with their instruments is described. Members will have to want to do this and to solicit money in order for support to be given. Kelsey Downum added that money from companies like Monsanto does not come regularly. Corporate membership might bring in less money but support would be more regular. Jonathan Poulton proposed a standing committee on fund raising (three members to serve three years) to take pressure off the organizers of meetings. Klaus Fisher added that personal contacts are important. Murray Isman stated that many companies were contacted for support of the 1990 meeting with very little success. Downum added that the number of PSNA members who work for corporations is decreasing. Olechno indicated that a permanent committee would change the nature of the PSNA's commitment from members. To bring in money takes efforts and contacts at meetings.

President Jonathan Poulton reported that the proposed changes in the constitution and bylaws to establish corporate membership in PSNA passed (125 for, 4 against) and he requested that Kelsey Downum and Joe Olechno continue the work of their committee. Murray Isman was elected President Elect.

Past President Dave Seigler announced that proposed changes in NSF review and funding practices might have profound effects on those doing interdisciplinary research (which includes most involved in aspects of phytochemistry). He asked for input from PSNA members. Dick Mansell stated that Dave Seigler is the only one in a position to respond to NSF on the situation. Alina Walther moved that Seigler respond on behalf of the PSNA.

The meeting was turned over to new president Brian Ellis who thanked Jonathan Poulton for his accomplishments as PSNA president and moved that the meeting be adjourned.

Respectfully submitted,

Helen M. Habermann

BIOGRAPHIES OF BEST STUDENT PAPER AWARD WINNERS

EMIDIO DE CAROLIS received his B.Sc. degree in Biochemistry from Concordia University, Montreal, in 1986. As an undergraduate, he worked for two summers in the laboratory of Dr. R.K. Ibrahim. Continuing graduate study in Plant Biochemistry with Dr. R.K. Ibrahim, he earned an M.Sc. degree in 1989. His Master's research included the purification, characterization and kinetics of a Phenylpropanoid O-methyltransferase. Emidio is presently in his first year of the Ph.D. program at the University of Montreal in the laboratory of Dr. V. De Luca. He is working on the purification and characterization of a novel dioxygenase involved in the biosynthesis of vindoline. His research interests include purifying and characterizing enzymes involved in the biosynthesis of natural products (vindoline) and using these studies as a basis for the molecular genetic studies which would give information about the regulation of natural products.



MARIOS A. MENELAOU is currently completing his Ph.D. in Organic Chemistry at Louisiana State University (LSU), Baton Rouge, Louisiana. After receiving his Bachelor's degree in Chemistry from LSU in 1986, he started graduate work in Organic Chemistry with Dr. N.H. Fisher. His research on allelochemicals from *Solidago pauciflosculosa* (Asteraceae) and *Calamintha ashei* (Lamiaceae), two species of the Florida scrub community, involves the isolation and elucidation of structure of natural compounds. Another area of interest involves biosynthetic studies of chemical constituents of root cultures of *Tagetes patula* using ^{13}C -labeled precursors. The biosynthetic pathways of two bithiophenes and a sesquiterpene hydrocarbon, beta-farnesene, were established from the above experiments.

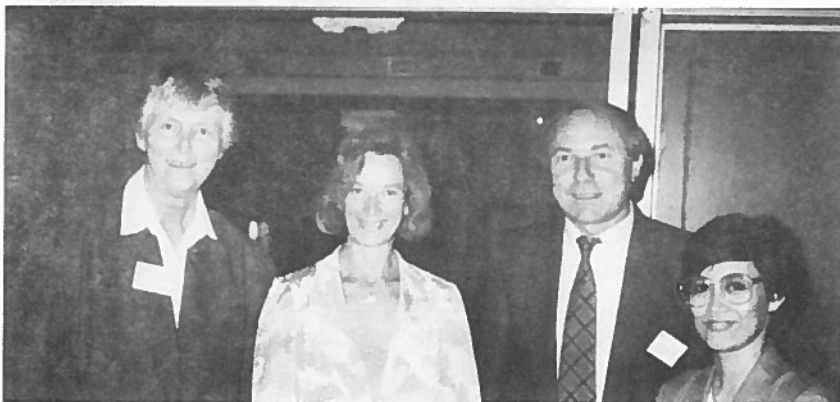
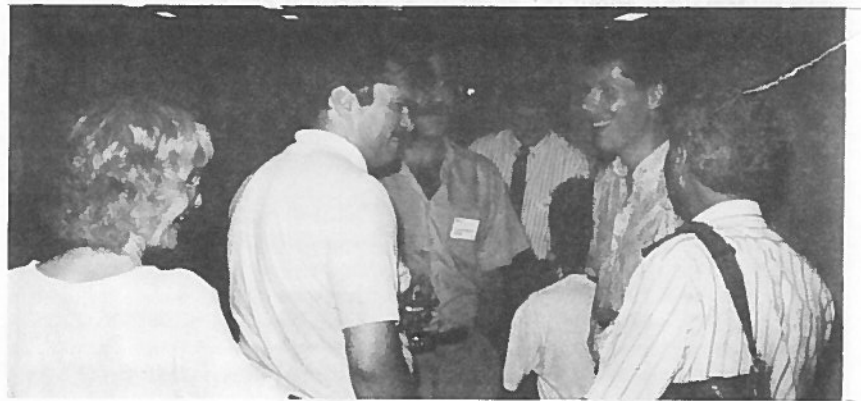
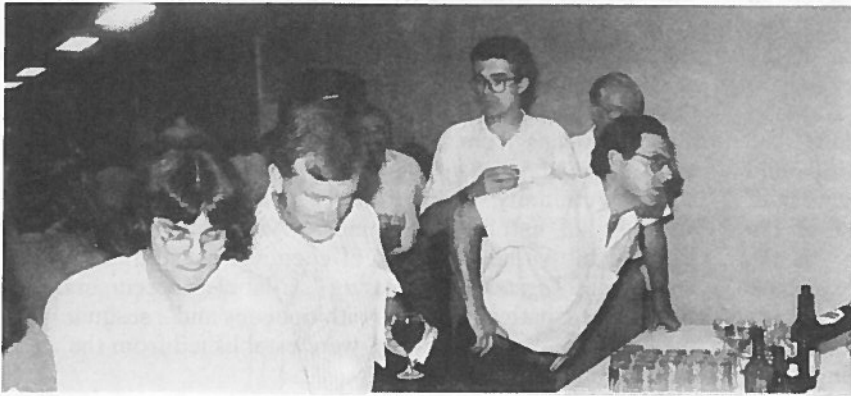


SUMMARY OF PSNA MEMBERSHIP - 1979-1990

Year	Total				Students
	Membership	USA	Canada	Foreign	
1979	290	241	34	32	17
1980	315	245	36	34	29
1981	344	270	37	37	41
1982	364	278	46	40	46
1983	358	264	49	45	*
1984	367	273	52	42	38
1985	373	282	50	41	31
1986	359	279	40	40	38
1987	334	258	42	34	35
1988	391	297	49	45	51
1989	411	317	43	51	53
1990	425	311	64	50	53

*Data not available

PSNA/ISCE JOINT MEETING CENTERFOLD



FORT COLLINS AND VICINITY

Participants enjoy the rich educational atmosphere of one of the nation's foremost natural resource schools in a stimulating university environment. Colorado State University is located in the foothills of the Rocky Mountains. Within an hour's drive you can hike in the unparalleled scenery of Rocky Mountain National Park, visit spectacular wild flower areas west of Fort Collins, enjoy world class trout fishing along the Cache La Poudre River, or tour the cultural offerings of Metropolitan Denver. Minutes from campus, there are opportunities for picnicking, boating or windsurfing at Horsetooth Reservoir, a man-made mountain lake and recreation area. Within the city, bike trails lead to historic Old Town or take you along the Poudre River. Parks throughout the city offer diverse recreational opportunities.

Enjoy free time touring the Anheuser Busch Brewery, riding the historic Fort Collins Municipal Trolley or shopping in Old Town.

Local attraction brochures will be available at on-site registration for your convenience.

At 5,000 feet elevation, Fort Collins provides magnificent weather. In late June, days are usually sunny with highs in the low 80's, but bring a jacket or sweater for cooler evenings.

For a free Colorado vacation kit write or call:

Colorado Tourism Board
P. O. Box 38700
Denver, CO 80238
(303) 779-1067

PROJECTED SCHEDULE

Saturday, June 22	4-6 PM: Registration 7:30-9 PM: Reception
Sunday, June 23	AM: Symposium PM: Contributed papers Evening: Steak barbeque
Monday, June 24	AM: Symposium PM: Free time (mountain trips, tours)
Tuesday, June 25	AM: Symposium PM: Contributed papers; poster session Evening: Banquet and entertainment
Wednesday, June 26	AM: Symposium PM: Contributed papers and business meeting

PHYTOCHEMICAL SOCIETY OF NORTH AMERICA
31ST ANNUAL MEETING, FORT COLLINS, COLORADO
JUNE 22-26, 1991

TRAVEL

In driving to Colorado, Interstates 70 and 80 and Interstate 25 provide easy access to Fort Collins. Air travel is available on most major airlines to Stapleton International Airport in Denver. Travel from Stapleton to Fort Collins is convenient by limousine shuttle, rental car or bus. Airport shuttle information will be sent to participants with registration confirmation materials; current average cost is \$14.00 per person one-way. Destinations include University residence halls and several Fort Collins hotels or motels. A list of nearby hotels/motels will be sent upon receipt of registration.

The Stapleton Airport Information Hotline phone provides information on traffic around the airport, flight information, parking, paging, weather, and related subjects. The number is 1-800-247-2336.

CAMPUS LODGING

For convenience and economy, housing space has been reserved on campus in a summer adult-education residence hall. This facility features adjoining bedrooms -- each with twin beds, vanity with sink, wardrobes, drawers, study desks and telephone. The bathroom and shower are shared between the two rooms. All linen and towels are provided and may be exchanged at the housing desk. One child under 10 years of age may sleep in parents' room with cot, sleeping bag or crib (furnished by participant) at no extra charge. Family suites consist of both rooms and bath and are suitable for families of up to six persons (two under age 10). Reservations may be made on registration form.

Television is not provided in on-campus accommodations. Air conditioning is not available but is usually unnecessary due to cool evenings.

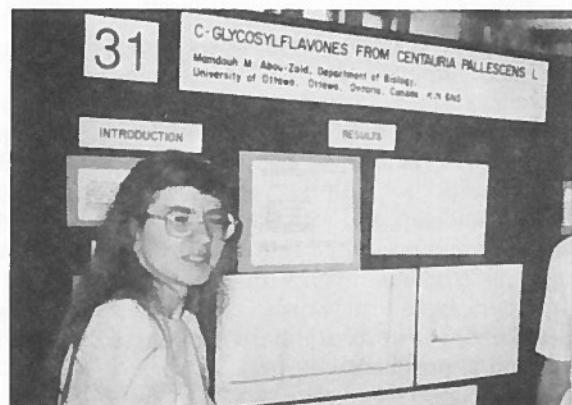
MEALS

Over 150 restaurants in Fort Collins provide a wide variety of dining options. At least 10-15 restaurants are within an easy walk from the Colorado State University campus and several options are available on campus in the Lory Student Center. A complete listing will be provided at the on-site registration desk.

SPECIAL EVENTS AND LEISURE ACTIVITIES

Evening events begin on Saturday, June 22, 7:30 p.m., with the welcoming reception to be held in the University Club. An outdoor steak barbeque will be held Sunday evening. Monday afternoon and evening will be free for participants and their families to explore the campus, community, and mountain areas, on their own. On Tuesday evening the banquet will be held at the University Park Holiday Inn, a few blocks from campus. Entertainment will be provided by Gary McMahan, a cowboy poet, singer and yodeler with a nationwide reputation.

QUEBEC CITY, P.Q. AUGUST 11-15, 1990



HANS GRISEBACH REMEMBERED

The following obituary by Klaus Hahlbrock was published in *Biosciences/Zeitschrift für Naturforschung* 45 (1990). It is reprinted here with permission of the publisher and Professor Hahlbrock.

We are left with grief and feelings of gratitude and admiration for Hans Grisebach, who died on March 19, 1990. We are grateful for the example he gave as a person and scientist, and we will continue admiring his strong will and optimism that helped him accept a physical handicap, caused by polio, for so many years without complaint.

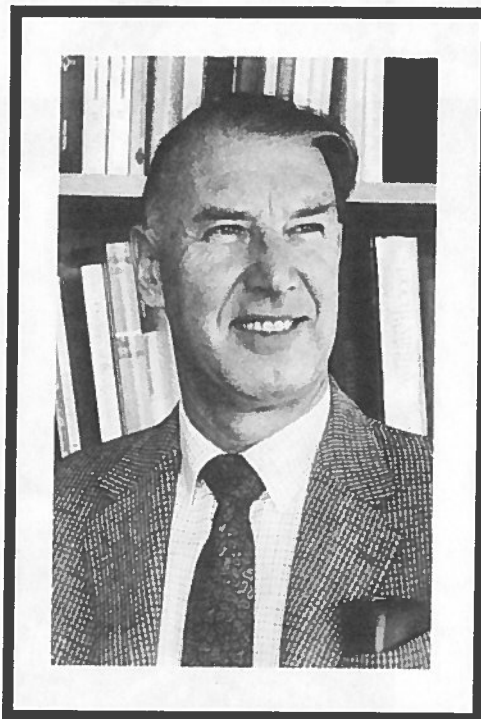
In the scientific literature, Hans Grisebach is widely known as a biochemist with an unusual, broad interest in many aspects of biochemistry, extending from pure chemistry to biology. He was equally successful in several different areas of research, owing to a gifted combination of an unbiased, efficient approach to his scientific endeavors with a deep affection for nature in all its appearances. Those who knew him personally were impressed by his open, unconventional and unselfish character which allowed him to do everything out of curiosity and interest, whether dealing with people or unsolved questions. To him, selfishness and vanity were unknown motivations. His driving force was the fascination by nature's beauty, blueprints and riddles. His satisfaction was the understanding of new realms.

This was the spirit in which a large number of predoctoral, doctoral and postdoctoral students worked under the liberal guidance of a devoted scientist who believed in his goals but not in rigid direction. Although his position was that of an academic teacher, he never spoke in a didactic tone. His teaching was exemplified by his integrity and convincing personality, coupled with a mutual sharing of information and discussion.

In almost 30 years of various types of collaboration, I did not once hear him use the words describing his own qualities: tolerance, respect, fairness, modesty, intellectual uprightness. To him, essentials didn't require words; he lived them and thus demonstrated them most effectively. He was very disciplined in many respects: with the values of his personality, with his physical handicap, and with the organization of his time (which always left an undisputed share for his family). Such a person taught his students much without words. The gain was time for other types of words conveying the enjoyment of determined, but never stubborn or obsessed, scientific work in a relaxed atmosphere.

After completion of his studies in chemistry, Hans Grisebach was introduced to complex chemical structures and early questions regarding their biosynthesis in the laboratories of Karl Freudenberg, Friedrich Weygand and Melvin Calvin. As a young "Dozent" (approximately equivalent to Assistant Professor), he joined the Chemistry Department of the University of Freiburg in 1958 and a few years later became the head of a newly established laboratory for research with radioactive isotopes.

The young generation of scientists will be interested in learning that, in those days, there was no Amersham or NEN catalogue from which to choose and order the proper labelled compounds, and no scintillation counter for getting quick results. Nearly every ^{14}C -labelled organic chemical, however complex the structure, had to be synthesized from $[^{14}\text{C}]$ carbonate or $[^{14}\text{C}]$ acetate. More than one difficult organic synthesis in the Grisebach laboratory started truly from scratch by the transfer of ^{14}C from barium $[^{14}\text{C}]$ carbonate to potassium cyanide in a hot melt of the two salts, conversion of the resulting $[^{14}\text{C}]$ cyanide to $[^{14}\text{C}]$ malonitrile, hydrolysis, and condensation of $[^{14}\text{C}]$ malonate with proper aldehydes or ketones, etc. The predicted position of the label had then to be confirmed by degradation of some of the valuable material, combustion of the products to CO_2 , and determination of the radioactivity in a Geiger-Muller counter in the gas phase. Many a Ph.D. student spent most of her or his time synthesizing, purifying and confirming the desired substrate for a few feeding experiments at the end of the thesis



work.

These were the conditions under which Hans Grisebach started his work in Freiburg. Almost from the beginning, he pursued simultaneously three technically related, but intellectually independent, projects. For many years, he worked in parallel on the biosynthetic pathways of flower pigments (anthocyanins and related compounds) in higher plants, of macrolide antibiotics in microorganisms, and of branched-chain sugars in both plants and microorganisms. In all three fields, he quickly became a leading expert with a high international reputation.

Hans Grisebach was a true pioneer in the comprehensive sense that he was among the few who introduced a new method of previously unimagined power, applied it successfully to the solution of several unrelated questions, and above all, demonstrated convincingly to a doubtful majority of scientists that plants were as useful and interesting for biochemical work

as microorganisms or animals. All it required was thorough work, a good knowledge of the specifics of plants, and a determined will -- in addition to the intuitive feeling for the relative importance and accessibility of a scientific problem. This type of intuition was one of his special gifts.

We cannot overestimate Hans Grisebach's impact on the shaping of our present state of plant biochemistry. It was to a large extent his work that marked the transition period from the structural elucidation of plant-derived "natural products" *via* "tracer" experiments with radioactively labelled precursors to present-day enzymology and molecular biology.

Around 1962, Hans Grisebach started thinking of isolating and studying enzymes. The beginning was slow and difficult, as evidenced by my own complete failure to demonstrate in my Ph.D. work the existence of his first hobbyhorse in plant enzymology, the chalcone synthase that he had postulated on the basis of more and more sophisticated feeding experiments. In such situations, he always remained optimistic and, by his positive reaction with very few words, urged us to be content with what we had and not give up a goal that was too high only temporarily.

If the work was done properly, a failure to him was a fact and not a crack in one's self-confidence. He showed an unusual combination of self-confidence and modesty that quickly released all tension from a seeming failure, whether his own or somebody else's, with a liberating, humorous laugh. This humor was one of his most impressive qualities. It was the rare kind of genuine humor that laughs about oneself and rejoices with others. It is sad that those who knew him only recently saw this humor suppressed by pain.

Over the years, starting in the late 1960's, the elucidation of pathways shifted completely from tracer experiments to the characterization of enzymes and their modes of action. Again, Hans Grisebach set the standards by combining investigations of the mechanisms of pathway fluxes with thorough determinations of the chemical structures of precursors, intermediates and products of the individual reactions. His fascination for biological complexity was always paired with an interest in details of the structure and function of molecules. Unlike many others, he was not deterred by structures as complex as lignin or reactions as difficult to measure as those

involving radical or ionic forms of oxygen.

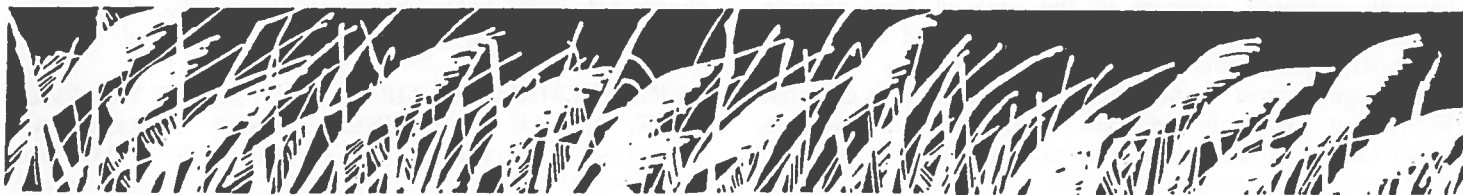
In 1968, Hans Grisebach moved to the Biological Institute where a new chair of plant biochemistry had been established and had been offered to him a few years earlier. In this position, he contributed much to the rapid development of a very stimulating scientific environment that was created with the expansion of biological sciences and the remodeling of the Faculty. He saw and taught biochemistry as an independent, yet interrelated discipline, not as a branch of chemistry nor biology. To him, biochemistry was one of many possible ways of looking at nature whose subdivision into scientific disciplines was based only on practical reasons. In both his teaching and research, biochemistry was as broad a field as one could look as a chemist into biology.

In the new biological environment, his research continued to be firmly based on a strong foot in chemistry, while the other was stepping more and more deeply into biology. He regarded this environment as extremely beneficial. He gradually discontinued his projects on microbial antibiotics and branched-chain sugars and developed instead a new, more biologically-oriented interest in plant-pathogen interactions. This choice was not surprising for a chemist-turned-biochemist with a life-long fascination for the microcosmos, who as a child had wondered about the chemical forces behind the beautiful minerals in his collection. With his studies on molecular mechanisms of plant defense, he helped open a new door in plant biochemistry. Once again, he clarified from the beginning that only thorough investigations with much attention to chemical as well as biological detail will be of long-term value.

Many journals, including this one, and many institutions, societies, granting agencies and academic bodies, owe Hans Grisebach much for his altruistic service in many capacities. His attitude was to serve and fill a position when called, never for the sake of showing his presence. He was always an unbiased, helpful and unselfish arbiter.

Hans Grisebach was a remarkable teacher, friend and example. He will live on in our memories and help us remember what counts.

Klaus Hahlbrock



NEW PSNA MEMBERS

The following are new members of the society. We welcome you and invite your participation in society business and at PSNA meetings.

Dr. V. Balasubramanian
NOVA Pharmaceutical Corp.
6200 Freeport Centre
Baltimore, MD 21224-2788

Dr. Federico Gomez-Garibay
Instituto de Quimica, UNAM
Circuito Exterior
Ciudad Universitaria
0451010 Mexico, D.F.
MEXICO

Karin Readel
289 Morrill Hall
Dept. of Plant Biology
University of Illinois
Urbana, IL 61820

Dr. Charles Bedard
8A Perrault #2
Ste-Anne-de-Bellevue, PQ
H9X 2C7 CANADA

Lynn D. Holappa
Box 7612, Botany Dept.
North Carolina State University
Raleigh, NC 27695-7612

Mr. Peter J. Rider
Chemistry Dept., PCPS
43rd St. & Woodland Ave.
Philadelphia, PA 19104

Dr. Nathalie Chauret
National Research Council
6100 Royalmount
Montreal, PQ H4P 2R2
CANADA

Dr. Ronald A. Martin
Chemistry Dept., 1 University Place
Louisiana State Univ. in Shreveport
Shreveport, LA 71115

Dr. Tirso Rios-Castillo
Instituto de Quimica, UNAM
Circuito Exterior
Ciudad Universitaria
04510 Mexico, D.F.
MEXICO

Dr. Arthur J. Dick
Chemistry Department
Acadia University
Wolfville, NS BOP 1X0
CANADA

Mr. Marios Menelaou
P.O. Box 19011
Louisiana State University
Baton Rouge, LA 70893

Michael B. Sady
Western Nevada Community College
Carson City, NV 89703

Dr. Gary Frederick
MST Division, BYU-Hawaii
Laie, HI 96762

Dr. Hajime Mizukami
Faculty of Pharmaceutical Sciences
Nagasaki University
Nagasaki 852
JAPAN

Dr. Thomas Vogt
Department of Plant Science, 2357
Main Mall
University of British Columbia
Vancouver, BC V6T 2A2
CANADA

Marco L. Gomez
1315 Bob Pettit #54
Baton Rouge, LA 70820

Dr. Sally Van Wert
ARS/USDA
Bldg. 9, Room 5
Beltsville, MD 20705

POSITIONS AVAILABLE

LOUISIANA STATE UNIVERSITY, BATON ROUGE. ASSOCIATE/ASSISTANT PROFESSOR (TENURE TRACK) IN FOOD SCIENCE. Available January 1, 1991. Position is approximately one-third teaching and two-thirds research. Individual will teach undergraduate and graduate courses in food analysis, color and flavor; advise students; and develop a rigorous research program in the area of food analysis, composition and flavor. A Ph.D. in Food Science or Chemistry, Biochemistry or related area is required. Knowledge of sensory and analytical food analysis is essential. Equipment available includes state-of-the-art GC/MS, GC/FTIR, computer data stations, etc. Postdoctoral and grantsmanship experience desirable to interact with industry and government agencies in grant and contract arrangements. Salary will be commensurate with qualifications and experience. Benefits include university holidays, earned annual

and sick leave, optional group hospitalization, life insurance and retirement. Send letter of application, vitae, official transcripts of all college credits, list of publications, grants/contracts, and three letters of recommendation to: *A. M. Mullins, Professor & Head, Department of Food Science, South Campus Drive, Louisiana State University, Baton Rouge, LA 70803-4200.* Phone: (504) 388-5206. Application deadline: October 1, 1990 or until position is filled.

AGRO-CHEMICAL COMPANY, RESEARCH TRIANGLE PARK, NORTH CAROLINA. PLANT METABOLISM CHEMIST. Entry level chemist with Ph.D. or M.S. and several years relevant experience. Excellent opportunity with a fast-growing firm. Send resume to *Edward Marcus, Technical Management Advisors, P.O. Box 307110, Columbus, OH 43230.* Phone (614) 863-0673.

POSITIONS AVAILABLE (CONTINUED)

UNIVERSITY OF KENTUCKY, LEXINGTON. GRADUATE RESEARCH FELLOWSHIP (PH.D. LEVEL) IN PLANT PHYSIOLOGY/BIOCHEMISTRY/MOLECULAR BIOLOGY. A position is available to support efforts to target the Cd-chelator metallothionein to the plant cell wall using regulatory gene sequences which direct secretion to the cell wall. The long term objective of the research is to regulate uptake and partitioning of the potentially-toxic, pollutant heavy metal Cd so as to reduce Cd content of vegetable components of the human diet. The graduate student will study and conduct research under the direction of Dr. G.J. Wagner. He/She will

also do research (for up to 2 months each year) at the Noble Foundation Laboratories, Ardmore Oklahoma under the direction of Dr. R. Gonzales. Support will include a four-year stipend for time spent at the University of Kentucky, a salaried wage for time spent at the Noble Foundation, funds for travel to the Noble Foundation and one scientific meeting each year. The research assistantship has a stipend the equivalent of \$12,000.00/12 months. For more information contact Dr. G.J. Wagner, Plant Physiology/Biochemistry/Molecular Biology Program, University of Kentucky, Lexington, KY 40546-0091. Phone (606) 257-5974.

MEETINGS AND PROGRAMS OF INTEREST

FOURTEENTH ANNUAL SYMPOSIUM IN PLANT PHYSIOLOGY: University of California, Riverside. January 10-12, 1991. Molecular approaches to compartmentation and Metabolic Regulation. Sessions include: Glycolysis, Respiration and Mitochondria; Photosynthesis, Photorespiration and Chloroplasts; Lipid Metabolism, Plastics and Glyoxysomes; Metabolite Transport; Protein Bodies, Vacuoles and Intracellular Protein Trafficking. The Symposium is limited to 175 persons. A fee of \$25 (non-students) or \$10 (students) will cover registration and a luncheon on Saturday. For more information contact Cindi McKernan, Department of Botany and Plant Sciences, University of California, Riverside, CA 92521. (Tel. 714-787-3423).

ADVANCES IN LABIATE SCIENCE, AN INTERNATIONAL SYMPOSIUM: Royal Botanic Gardens, Kew, U.K., April 2-5, 1991. This conference is sponsored by the Royal Botanic Gardens, The Phytochemical Society of Europe and the Linnean Society of London. Topics will include: Biographical and Chemical overviews; Supragenic Groupings; the tribe Prostanthereae; Taxonomy of Stachys in Africa; New-World Ocimeae; Taxonomic review of the Mentheae; Essential oils as taxonomic markers; Terpenoids and Flavonoids; Chemistry of flower color; Chromosomal evolution; Chloroplast DNA in Asteridae; Breeding systems; Pollen and Pollination; Animal-Plant interactions; Economic importance of Chinese and New-World Labiatae; Chemical components of Labiatae Oils. Poster presentations are invited. For further information, contact Dr. H. Harley or Dr. G. Kite, Royal Botanic Gardens, Kew, Richmond, Surrey TW93AE, U.K.

SECOND NORTH AMERICAN TANNIN CONFERENCE. PLANT POLYPHENOLS: BIOGENESIS, PROPERTIES AND SIGNIFICANCE. Michigan Technological University, Houghton, MI, June 17-21, 1991. The program and timing of this meeting complement the 31st annual meeting of the PSNA in Fort Collins, CO. For further information, contact Richard W. Hemingway, Southern Forest Experiment Station, USDA Forest Service, 2500 Shreveport Highway, Pineville, LA 71360 or Peter E. Laks, Institute of Wood Research, Michigan Technological University, 1400 Townsend Drive, Houghton, MI 49931-1295 or Susan L. Bucheger, Public Service Professional Development, Michigan Technological University, 1400 Townsend Drive, Houghton, MI 49931-1255 (Tel. 906-487-2262).

PHYTOCHEMICAL SOCIETY OF NORTH AMERICA: Fort Collins, Colorado, June 22-26, 1991. The symposium topic for this 30th anniversary meeting of the PSNA will be Phenolic Metabolism in Plants. See enclosed posters.

15TH INTERNATIONAL CONGRESS OF BIOCHEMISTRY: Jerusalem, Israel, August 4-9, 1991. For further information, contact: 1st IUB Congress, P.O. Box 50006, Tel Aviv 61500, Israel (Tel. 972-3654571; fax: 972-365-5674; Bitnet BNLITAU@WEIZMANN).

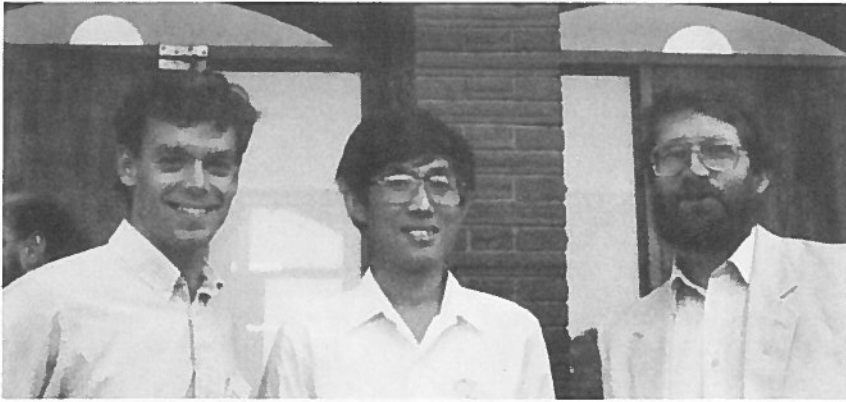
THIRD INTERNATIONAL CONGRESS OF PLANT MOLECULAR BIOLOGY: Tucson, Arizona, October 6-12, 1991. The Congress will stress current research in Molecular Aspects of Plant Growth and Development. Plenary sessions, concurrent symposia, poster, discussion sessions, and workshops will cover Advances in Gene Regulation; Differentiation; Seed and Fruit Development; Hormonal Regulation; Cell Biology; Plant Pathogenesis; Nitrogen Fixation; Responses to Environment; Genome Organization and Mapping; Photosynthesis; and Organelle Genomes. For more information, contact: ISPMB, Woo Wester Conference Consultants, 2934 1/2 Beverly Glen Circle, Suite 383, Los Angeles, CA 90077 (Tel. or fax: 213-474-5894).

IXTH INTERNATIONAL CONGRESS ON PHOTOSYNTHESIS: Nagoya, Japan, August 30-September 4, 1992. For further information, contact Prof. Noria Murata, Secretariat, IXth International Congress on Photosynthesis, National Institute for Basic Biology, Ozaki 444, Japan. (Phone/Fax 81 (JAPAN) 564-54-4866).

WANTED

REQUEST FOR INFORMATION ON CARDIAC GLYOSIDES FROM CALOTROPIS PROCERA. An investigator at the University of Rajasthan in Jaipur, India, whose work involves extracting and identifying anti-tumor, anti-bacterial and anti-fungal compounds of natural origin, requests reprints or lists of publications on the above topic. He has extracted a cardiac glycoside from *Calotropis*, a common plant in Jaipur. Please send reprints or correspondence to Dr. Mustafa K. Said, 2-Gha-4, Jawahar Nagar, JAIPUR - 302 004, INDIA.

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