

PHYTOCHEMICAL SOCIETY OF NORTH AMERICA

Newsletter

**Volume 28
Number 3**

February 1989

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The Phytochemical Society of North America is a non-profit scientific organization whose membership (currently about 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.

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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 anytime that the office of President may be vacated. The President is not eligible for election to the office of President (or Vice President) at a later date and cannot succeed himself(herself) as President. The Secretary and Treasurer are elected for three year terms (which will end in 1990 and 1991) and may be re-elected.

A form is provided (see center section of the newsletter) for submitting nominations for PSNA President-Elect and Treasurer. Please enter your nominations, remove the sheet, fold, stamp and mail it to Dr. John T. Romeo, Department of Biology, University of South Florida, Tampa, FL 33620. Nomination forms must be mailed by March 15, 1989. Election ballots will be distributed to members on April 15, 1989. All members, including those who joined in the past year, are urged to participate in the society's election process.

POSTSCRIPT - THE 1988 ANNUAL MEETING AT IOWA CITY

At the 28th Annual Business Meeting held last summer at the University of Iowa, it was estimated from preliminary figures that the 1988 PSNA Meeting might cost the Society approximately \$5,500, an amount greater than that needed to support meetings in earlier years. This increase was related to higher travel costs for the twelve symposium speakers, 5 of whom came from overseas to participate in the Plant Nitrogen Metabolism symposium. The co-organizers of the meeting, Jonathan E. Poulton and John T. Romeo report that the final accounting has now revealed a cost of only \$700 to the Society treasury. The financial statements for the meeting will be published in the next Newsletter.

REPORT OF THE TREASURER

As in past years, the Treasury of the Phytochemical Society of North America, continued to grow during 1988, and we closed the year with total assets of \$45,376.02. This figure represents 5% growth in total assets since December 31, 1987. The attached Financial Statement shows that our major sources of income included: refunds from the Univ. of South Florida and the Univ. of Iowa for the 1987 and 1988 meetings (totalling \$8,443.35); membership dues (\$4,237); royalties from sales of Recent Advances in Phytochemistry (3,825.12); and interest from savings and checking accounts (\$2,824.69). Our growing membership resulted in increased membership dues which were up \$315 over 1987 while royalties were down slightly (\$43 less) compared to last year. Savings are currently divided between one 12-month CD (\$25,000) which pays 7.75% interest and one 6-month CD (\$10,000) which earns 7.50%. Remaining funds are maintained in a checking account earning 5.00%. The major expenditures during 1988 included: final payment for the 1988 meeting in Iowa City (\$6,824.35); an advance for the 1989 meeting in Vancouver (\$3,000); printing and mailing costs for the newsletter (\$2,100) and 1988 PSNA Directory (\$1,977.04); and Travel Assistance Awards for graduate students presenting papers in Iowa City (10 students supported at a cost of \$1,820). Expenses for the Treasurer during 1988 were considerably higher (\$804.78) than in 1987. This figure reflects postage costs associated with PSNA mailings (i.e. the PSNA Directory, posters for the 1988 meeting, etc. - (\$466.43) and for opening an account with the Controller's office at Florida International University (\$250) so that I can utilize university services (e.g., mail, duplication services, etc).

This past year saw a welcome upturn in PSNA membership, reversing the trend of the past four years (refer to the membership summary). At the close of 1988, membership stood at 391 active members - our largest membership ever (we are over the 400 mark as of Feb. 1)! The most notable increases were in the student and overseas categories (up by 31% and 24%, respectively). Canadian and U.S. membership grew by 14% and 13%. The majority of new members joined the Society at the Iowa City meeting (ca. 40 new members). An additional 22 members joined prior to the end of the year - 18 of these responded to the brochures included in the Fall newsletter. Clearly, annual meetings, continued efforts by the membership committee and the PSNA membership in general are paying off in substantial membership increases. I would like to encourage all PSNA members (old and new) to continue in this endeavor. If you still have brochures from the fall

newsletter, please distribute them to interested colleagues and students at your institution. If you need additional copies, photocopy the application form on the back page of any newsletter or contact Helen Habermann for additional brochures. Among the many advantages of membership which 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.

Three final reminders: 1) would those who have not already done so, please remit their 1989 dues to me as soon as possible; 2) any members that expect to retire during the next year are reminded that they are entitled to "emeritus status" which exempts them from future dues (please contact me so that I don't continue sending annual dues notices); and 3) if you are planning a move, please get your new address to me as soon as possible so that I can update our records and so you don't miss any mailings, etc.

Copies of all bank statements and the auditor's report are on file. Please feel free to contact me if you have any questions, comments, suggestions concerning investments, or criticisms concerning the PSNA Treasury.

Finally, I would like to express my gratitude to Jonathan Poulton, past-treasurer and president-elect, for explaining (and re-explaining) the intricacies of the Society's finances and for making the transition as efficient as possible. I am looking forward to working with the Executive Committee and meeting as many of you as I can during my tenure as Treasurer. If I can ever do anything for any of you in my capacity as Treasurer, please feel free to contact me.

Respectfully submitted,

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

SUMMARY OF PSNA MEMBERSHIP 1979-1988

| Year | Total Membership | Students | USA | Canadian | Overseas |
|------|------------------|----------|-----|----------|----------|
| 1979 | 290 | 17 | 241 | 34 | 32 |
| 1980 | 315 | 29 | 245 | 36 | 34 |
| 1981 | 344 | 41 | 270 | 37 | 37 |
| 1982 | 364 | 46 | 278 | 46 | 40 |
| 1983 | 358 | a | 264 | 49 | 45 |
| 1984 | 367 | 38 | 273 | 52 | 42 |
| 1985 | 373 | 31 | 282 | 50 | 41 |
| 1986 | 359 | 38 | 279 | 40 | 40 |
| 1987 | 334 | 35 | 258 | 42 | 34 |
| 1988 | 391 | 51 | 297 | 49 | 45 |

^aData unavailable.

FINANCIAL STATEMENT

Jan. - Oct., 1988 - Jonathan Poulton
 Oct. - Dec., 1988 - Kelsey R. Downum

CHECKING ACCOUNT

RECEIPTS

JP KRDCcombined

| | | | |
|-------------------------|-----------------|----------------|-----------------|
| Membership Dues | \$3,950.00 | \$ 287.00 | \$ 4,237.00 |
| Royalties | 3,825.12 | - | 3,825.12 |
| Refunds | | | |
| - 1987 meeting | 3,323.35 | - | 3,323.35 |
| - 1988 meeting | 120.00 | 5,000.00 | 5,120.00 |
| - Sec. exp. - G. Wagner | 204.00 | - | 204.00 |
| Interest on checking | 367.45 | 361.01 | 728.46 |
| Mailing List Rental | 70.00 | 70.00 | 140.00 |
| Sale of PSNA Directory | <u>35.00</u> | <u>-</u> | <u>35.00</u> |
| Total Receipts | \$11,894.92 | \$5,718.01 | \$17,612.93 |

EXPENDITURES

| | | | |
|-------------------------------------|----------------|----------------|-----------------|
| Meetings - 1989 Advance | \$3,000.00 | \$ - | \$ 3,000.00 |
| - 1988 Final Payment | - | 6,824.35 | 6,824.35 |
| - Student Travel | 1,820.01 | - | 1,820.00 |
| - 1988 EC Travel | 575.00 | - | 575.00 |
| - 1988 Best Paper | 100.00 | - | 100.00 |
| Expenses - Secretary | 1,400.00 | 700.00 | 2,100.00 |
| - Treasurer | 535.80 | 268.98 | 804.78 |
| 1988 Directory - printing | 1,977.04 | - | 1,977.04 |
| Royalties paid to ASP | - | 24.64 | 24.64 |
| <u>Rec. Adv. in Phytochem. - 13</u> | | | |
| Check printing charges | 4.72 | 12.95 | 17.67 |
| Auditor expense | 100.00 | - | 100.00 |
| Logo Design | <u>250.00</u> | <u>-</u> | <u>250.00</u> |
| Total Expenditures | \$9,762.56 | \$7,830.92 | \$17,593.48 |

CHECKING ACCOUNT SUMMARY

SAVINGS ACCOUNT ACTIVITY

Receipts \$17,612.93
 Expenditures 17,593.48

Interest- Jan-Oct 88 (JP) \$ 1,600.83
 - Oct-Dec 88 (KRD) 495.40

New Gain \$ 19.45

Net Gain \$ 2,096.23

ASSETS - January 01, 1988

ASSETS - December 31, 1988

Checking \$ 6,080.02
 Savings 37,180.32

\$43,260.34

Checking \$ 9,880.62
 Savings 35,495.40

\$45,376.02

NEW PSNA MEMBERS

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

Mr. John D. Bacheller, III
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POSITION AVAILABLE

UNIVERSITY OF IOWA, IOWA CITY. PLANT PHYSIOLOGIST The Department of Botany invites applications for a tenure-track position effective July 1, 1989. Candidates are sought whose research interests emphasize molecular/biochemical approaches to fundamental problems in plant physiology. The position is approved at the assistant professor level, but applications from individuals with outstanding research records may be considered at a more senior level. Please send a current curriculum vitae, reprints, a brief summary of research goals, and three letters of reference to: Prof. Richard Sjolund, Department of Botany, University of Iowa, Iowa City, IA 52242. The University of Iowa is an equal opportunity, affirmative action employer and encourages applications from women and minorities.

ROYALTIES - RECENT ADVANCES IN PHYTOCHEMISTRY. VOLUMES. 10-21

| Volume | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | Total to Date | |
|--------------------------|---------|--------|---------|---------|---------|---------|---------|---------|---------|---------------|---------|
| | | | | | | | | | | # Sold | Royalty |
| 10 Wallace-Mansell | 496.58 | 418.78 | 369.78 | 255.07 | 120.64 | 62.39 | 57.94 | 45.86 | 55.56 | 1891 | 3417.18 |
| 11 Runeckles-Loewus | 774.08 | 311.08 | 284.30 | 72.67 | 84.50 | 19.00 | 9.35 | 47.64 | 39.46 | 1141 | 4520.96 |
| 12 Swain-Harborne | 3605.35 | 975.39 | 426.00 | 171.67 | 226.21 | 95.62 | 64.30 | 86.78 | 60.50 | 1398 | 5711.82 |
| 13 Swain-Waller | 1386.42 | 211.48 | 166.97 | 45.54 | 81.50 | 31.14 | 23.21 | 24.79 | 24.48 | 833 | 1995.53 |
| 14 Swain-Kleiman | | | 1496.87 | 104.33 | 115.04 | 53.05 | 21.46 | 33.21 | 46.82 | 749 | 1870.78 |
| 15 Loewus-Ryan | | | 2133.37 | 469.07 | 367.89 | 140.10 | 44.71 | 59.50 | 91.30 | 881 | 3306.84 |
| 16 Creasy-Brazdina | | | | 1940.17 | 614.46 | 214.18 | 99.64 | 45.46 | 78.97 | 830 | 2292.88 |
| 17 Mozzolillo-Lea-Loewus | | | | | 1074.92 | 377.01 | 235.19 | 124.45 | 182.23 | 724 | 2993.80 |
| 18 Timmermann | | | | | | 2332.30 | 546.31 | 355.90 | 329.84 | 753 | 3564.35 |
| 19 Swain et al. | | | | | | | 2109.77 | 404.34 | 347.30 | 679 | 2861.41 |
| 20 Conn | | | | | | | | 2640.23 | 280.77 | 558 | 2921.00 |
| 21 Conn et al. | | | | | | | | | 2287.99 | 467 | 2287.89 |

MEETINGS AND PROGRAMS OF INTEREST

UCLA SYMPOSIUM: PLANT GENE TRANSFER: Park City, Utah, April 1-7, 1989. For further information, contact UCLA Symposia, 2032 Armacost Avenue, Los Angeles, CA 90025 (Tel. 213-207-5042).

CENTENNIAL SYMPOSIUM CELEBRATION ON PERSPECTIVES IN BIOCHEMICAL AND GENETIC REGULATION OF PHOTOSYNTHESIS: The Connecticut Agricultural Experiment Station, New Haven, CT, April 5-7, 1989. There is no registration fee and the symposium is open to all who register by February 15, 1989. For further information, contact Dr. I. Zelitch, Department of Biochemistry and Genetics, The Connecticut Agricultural Experiment Stations, P.O. Box 1106, New Haven, CT 06504.

BELTSVILLE SYMPOSIUM XIV: THE RHIZOSPHERE AND PLANT GROWTH: Beltsville, Agricultural Research Center, Beltsville, MD, May 8-11, 1989. For further information, contact Dr. Donald L. Keister, USDA-ARS, Building 011, HH-19, BARC-W, Beltsville, MD 20705.

THE 8TH INTERNATIONAL WORKSHOP ON PLANT MEMBRANE TRANSPORT: Venice, Italy, June 25-30, 1989. For the first circular and other information, please write to Dr. F. Rasi-Caldogno, Organizing Committee, Dipartimento di Biologia, Universita Degli Studi di Milano, Sezione di Fisiologia e Biochimica delle Plante, via Celoria 26, 20133 Milano, Italy.

19TH FEBS MEETING: Rome, Italy, July 2-27, 1989. For further information, contact 19th FEBS Meeting, % EGA, Viale Tiziano 19, 00196 Roma, Italy.

PHYTOCHEMICAL SOCIETY OF EUROPE: SIGNAL PERCEPTION AND TRANSDUCTION IN HIGHER PLANTS: Toulouse, France, July 9-13, 1989. For further information, contact Dr. R. Ranjeva, Centre de Physiologie Vegetale de l'Universite Paul Sabatier, URA CNRS 241, 118, Route de Narbonne, F-31062 Toulouse, Cedex, France.

NORTH AMERICAN SYMBIOTIC NITROGEN FIXATION CONFERENCE: Department of Genetics, Iowa State University, Ames, Iowa, July 30-August 3, 1989. For further information, call Dr. Alan G. Atherly, (Tel. 515-294-3908).

XI INTERNATIONAL COLLOQUIUM ON PLANT NUTRITION: Wageningen, July 30-August 4, 1989. For further information, contact Dr. Ir. M.L. van Beusichem, Department of Soil Science and Plant Nutrition, Wageningen Agricultural University, P.O. Box 8005, NL6700 EC Wageningen, The Netherlands.

VII INTERNATIONAL CONGRESS ON PHOTOSYNTHESIS: Stockholm, August 6-11, 1989. For further information, contact Prof. Margareta Baltschaffsky, Department of Biochemistry, University of Stockholm, S-106 91 Stockholm, Sweden.

THIRD INTERNATIONAL WORKSHOP ON SEEDS: RECENT ADVANCES IN DEVELOPMENT AND GERMINATION: College of William and Mary, Williamsburg, VA, August 6-12, 1989. For further information, contact R.B. Taylorson, USDA/ARS, Room 218, Building 004, BARC-West, Beltsville, MD 20705.



Special 40% Discount Offer

RECENT ADVANCES IN PHYTOCHEMISTRY SERIES

| ISBN | EDITOR--TITLE | LIST PRICE | DISCOUNT PRICE |
|---------------------------------|---|------------|----------------|
| <input type="checkbox"/> 429365 | Conn--OPPORTUNITIES FOR PHYTOCHEMISTRY IN PLANT BIOTECHNOLOGY, 1988 (Vol. 22) | \$49.50 | \$29.70 |
| <input type="checkbox"/> 426757 | Saunders et al.--PHYTOCHEMICAL EFFECTS OF ENVIRONMENTAL COMPOUNDS, 1987 (Vol. 21) | \$57.50 | \$34.50 |
| <input type="checkbox"/> 422832 | Conn--THE SHIKIMIC ACID PATHWAY, 1986 (Vol. 20) | \$55.00 | \$33.00 |
| <input type="checkbox"/> 420066 | Cooper-Driver et al.--CHEMICALLY MEDIATED INTERACTIONS..., 1985 (Vol. 19) | \$45.00 | \$27.00 |
| <input type="checkbox"/> 417200 | Timmermann et al.--PHYTOCHEMICAL ADAPTATIONS TO STRESS, 1984 (Vol. 18) | \$49.50 | \$29.70 |
| <input type="checkbox"/> 413779 | Nozzolillo et al.--MOBILIZATION OF RESERVES IN GERMINATION, 1983 (Vol. 17) | \$52.50 | \$31.50 |
| <input type="checkbox"/> 410230 | Creasy/Hrazdina--CELLULAR & SUBCELLULAR LOCALIZATION IN PLANT METABOLISM, 1982 (Vol. 16) | \$49.50 | \$29.70 |
| <input type="checkbox"/> 407582 | Loewus/Ryan--THE PHYTOCHEMISTRY OF CELL RECOGNITION & CELL SURFACE INTERACTIONS, 1981 (Vol. 15) | \$49.50 | \$29.70 |
| <input type="checkbox"/> 405725 | Swain/Kleiman--THE RESOURCE POTENTIAL IN PHYTOCHEMISTRY, 1980 (Vol. 14) | \$39.50 | \$23.70 |
| <input type="checkbox"/> 401886 | Swain/Waller--TOPICS IN THE BIOCHEMISTRY CHEMISTRY OF NATURAL PRODUCTS, 1979 (Vol. 13) | \$45.00 | \$27.00 |
| <input type="checkbox"/> 400286 | Swain et al.--BIOCHEMISTRY OF PLANT PHENOLICS, 1979 (Vol. 12) | \$85.00 | \$51.00 |
| <input type="checkbox"/> 347113 | Loewus/Runeckles--THE STRUCTURE, BIO-SYNTHESIS. AND DEGRADATION OF WOOD, 1977 (Vol. 11) | \$75.00 | 45.00 |

Volumes 1-4, 9 and 10 also available

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PHYTOCHEMICAL SOCIETY OF NORTH AMERICA

Newsletter

**Volume 29
Number 1**

June 1989

Executive Committee PSNA 1988-89

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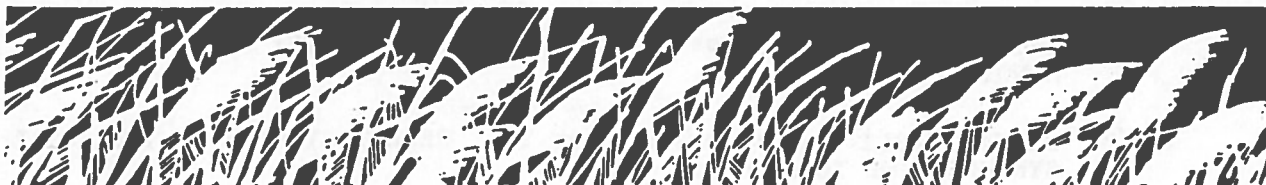
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The Phytochemical Society of North America

BIOLOGICALLY ACTIVE PRODUCTS OF THE MEVALONIC ACID PATHWAY

An International Symposium

June 25-30, 1989

The 29th Annual Meeting of the Phytochemical Society of North America will be held at the University of British Columbia, Vancouver, B.C., Canada June 25-30, 1989. There will be a Symposium on Biologically Active Products of the Mevalonic Acid Pathway as well as contributed oral and poster sessions in all areas of phytochemistry.

Registration forms for the meeting (and special events) and for housing were provided in the February PSNA Newsletter.

All sessions will be held in the U.B.C. Law lecture facilities which are located near the Walter Gage Residence.

Registration will be held in the U.B.C. Law Lecture Facility on Sunday (June 25th) and Monday (June 26th).

A map of the campus and information about transportation to UBC from the airport or from highways leading to Vancouver will be mailed with confirmation of registration from the UBC Conference Centre. Those arriving by air are advised to take a taxi to the University (there is no direct bus or limousine service from the airport to UBC).

THE PSNA 29TH ANNUAL MEETING AND SYMPOSIUM SCHEDULE

SUNDAY, June 25

ARRIVAL AND REGISTRATION
UBC Law Lecture Facility

Housing Check in at Gage Residence

WELCOME RECEPTION

MONDAY, JUNE 26

Morning REGISTRATION

Symposium Session (Bruce A. Bohm, presiding)

8:45 Greetings from PSNA President David S. Seigler

9:00 Rodney Croteau, (Symposium paper 1). BIOCHEMISTRY OF
MONOTERPENES

10:00 Edward Piers. (Symposium paper 2). RECENT STUDIES IN THE TOTAL
SYNTHESIS OF TERPENOIDS

11:00 Coffee Break

11:20 Nikolaus H. Fischer. (Symposium paper 3). SESQUITERPENE
LACTONES: BIOGENESIS AND BIOLOGICAL ACTIVITY

12:30 Lunch

Afternoon Contributed paper session (Murray Isman, presiding)

* Candidates for best student paper award

2:00 Mark A. Bernards* and B.E. Ellis. (Paper 1). PHENYLPROPANOID
METABOLISM IN FUNGAL-CHALLENGED TOMATO CULTURES

2:20 Anita M. Brinker* and D.S. Seigler. (Paper 2). A NEW CYANOGENIC
GLYCOSIDE FROM LOTONIS AFF. FALCATA

2:40 Peter Constabel* and N. Brisson. (Paper 3). STRESS-INDUCED
ALCOHOL DEHYDROGENASE ACTIVITY IN POTATO TUBER DISKS

3:00 Thomas M. Glendening* and J.E. Poulton. (Paper 4). PURIFICATION
AND CHARACTERIZATION OF A PAPS: DESULFOGLUCOSINOLATE
SULFOTRANSFERASE FROM LEPIDIUM SATIVUM

3:20 Lilian Latchinian*, P.M. Charest and R.K. Ibrahim. (Paper 5).
FLAVONOL RING-B O-GLUCOSYLTRANSFERASE FROM CHRYSOSPLENIUM
AMERICANUM: IN SITU LOCALIZATION BY IMMUNOGOLD LABELING

3:40 Dominique Provost-Buisson* AND K. Downum. (Paper 6). LIGHT
ACTIVATED PHYTOTOXIC THIOPHENES IN FLAVERIA LINEARIS.

4:00 Coffee Break

Afternoon Contributed paper session. (Don Champagne, presiding)

- 2:00 Edith L. Camm (Paper 9). HOW SIMILAR ARE THE PHOTOSYNTHETIC MEMBRANES OF CONIFERS AND ANGIOSPERMS?
- 2:20 Luc Varin, Normand Brisson, Vincenzo De Luca and Ragai Ibrahim. (Paper 10). STRATEGY FOR ENGINEERING ALTERED SECONDARY METABOLISM IN BRASSICA
- 2:40 Cecilia A. McIntosh and R.L. Mansell. (Paper 11). BIOSYNTHESIS OF NARINGIN IN CITRUS PARADISI: UDP-GLUCOSYL TRANSFERASE ACTIVITY IN GRAPEFRUIT SEEDLINGS
- 3:00 James A. Saunders, Benjamin F. Matthews and Aref Abdul-Baki. (Paper 12). DNA UPTAKE BY ELECTROPORATION OF GERMINATING POLLEN
- 3:20 Lily Kandra and George J. Wagner. (Paper 13). MODIFIED BRANCHED-CHAIN AMINO ACID (BC-AA) METABOLISM GIVES RISE TO ACYL ACIDS OF TOBACCO SUCROSE ESTERS (SE)
- 3:40 Frank A. Einhellig and Richard Barkosky. (Paper 14). INTERFERENCE WITH PLANT-WATER RELATIONSHIPS AS A MODE OF ACTION OF ALLELOPATHIC CHEMICALS
- 4:00 Coffee Break
- 4:20 Annual Business Meeting

Evening PSNA Banquet

THURSDAY, June 29

Morning Contributed Paper Session (Edith L. Camm, presiding)

- 9:00 David McCaskill and Rodney Croteau. (Paper 15). ISOLATION OF INTACT SECRETORY GLAND FROM PEPPERMINT LEAVES
- 9:20 Charles Mihaliak, Frank Karp and Rodney Croteau. (Paper 16). METABOLISM OF PLANT MONOTERPENES: HYDROXYLATION OF (-)-LIMONENE IN CELL-FREE ENZYME PREPARATIONS FROM SPEARMINT, PEPPERMINT AND PERILLA
- 9:40 Jonathan Gershenzon, David McCaskill, D.J. Williams and Rodney Croteau. (Paper 17). REGULATION OF MONOTERPENE GLYCOSYLATION IN PEPPERMINT LEAVES
- 10:00 D.E. Champagne, M.B. Isman and G.H.N. Towers. (Paper 18). INSECT ANTIFEEDANT AND GROWTH REGULATING ACTIVITY OF LIMONIDS FROM THE MELIACEAE
- 10:20 Coffee Break
- 10:40 Shin Hasegawa and L.K.T. Lam. (Paper 19). BIOCHEMISTRY AND ANTI-CANCER ACTIVITY OF CITRUS LIMONIDS

4:20 Alicja Zobel and Mieczyslaw Kuras. (Paper 7). LOCALIZATION OF PHENOLIC COMPOUNDS IN EMBRYOS AND SEED COVERS OF BRASSICA NAPUS DURING MATURATION, DORMANCY AND GERMINATION OF SEEDS.

4:40 Alicja Zobel and James. E. Nighswander. (Paper 8). INCREASED PHENOLIC COMPOUNDS IN LEAVES OF PINUS NIGRA IN RESPONSE TO SALT AND ACID SPRAY

Evening Supper Cruise.

TUESDAY, June 27

Morning Symposium Session. (G.H.N. Towers, presiding)

9:00 Charles A. West, A.F. Lois, K.Wickham and Y.-Y. Ren. (Symposium Paper 4). DITERPENOID PHYTOALEXINS: BIOSYNTHESIS AND REGULATION

10:00 W. David Nes. (Symposium Paper 5). CONTROL OF STEROID AND TRITERPENOID BIOSYNTHESIS IN PLANTS AND ITS FUNCTIONAL IMPORTANCE TO DEVELOPMENTAL REGULATION

11:00 Coffee Break

11:20 Raymond J. Andersen, E. Dilip de Silva, E.J. Dumdei, Peter T. Northcote, C. Pathirana and Mark Tischler. (Symposium Paper 6). TERPENOID WITH NEW CARBON SKELETONS FROM MARINE INVERTEBRATES

12:30 Lunch

Afternoon Free afternoon. The Museum of Man on the UBC campus is free on Tuesdays. Other local attractions include Stanley Park and Vancouver Public Aquarium, Granville Island and Chinatown.

Evening Bar-B-Q

WEDNESDAY, June 28

Morning Symposium Session. (Bruce A. Bohm, presiding)

9:00 Thomas J. Bach, A. Motel and T. Weber. (Symposium Paper 7). SOME PROPERTIES OF ENZYMES INVOLVED IN THE SYNTHESIS AND UTILIZATION OF 3-HYDROXY-3-METHYL-GLUTARYL-CoA IN PLANTS

10:00 M. Monfar, C. Caelles, L. Balcells, A. Ferrer, F.G. Hegardt and A. Boronat. (Symposium Paper 8). MOLECULAR CLONING AND CHARACTERIZATION OF PLANT 3-HYDROXY-3-METHYLGLUTARYL COENZYME-A REDUCTASE

11:00 Coffee Break

11:20 Bernard O. Phinney and Clive R. Spray. (Symposium Paper 9). THE BIOSYNTHESIS OF GIBBERELLINS IN HIGHER PLANTS

12:30 Lunch

Monday 9:00 - 10:00

Symposium Paper 1

BIOCHEMISTRY OF MONOTERPENES

Rodney Croteau, Institute of Biological Chemistry, Washington State University,
Pullman, Washington, U.S.A. 99164-6340

Monoterpenes are the ten carbon-containing members of the isoprenoid family of natural products which are characteristic components of the essential oils of higher plants. The vast majority of monoterpenes consist of cyclic olefins and their oxygenated derivatives. The origin of cyclic monoterpene olefins from the universal acyclic precursor geranyl pyrophosphate will be described, with an emphasis on the shared properties of the cyclizing enzymes and the mechanistic similarities of the reactions that they catalyze. The secondary transformation of the parent olefins often involves allylic oxygenation followed by reduction of the conjugated double bond(s). Several examples of this strategy will be presented. Finally, the glandular sites of monoterpene biosynthesis in mints will be described, and evidence for the regulation of monoterpene accumulation at the level of the biosynthetic enzymes will be reviewed.

Monday 10:00 - 11:00

Symposium Paper 2

RECENT STUDIES IN THE TOTAL SYNTHESIS OF TERPENOIDS

Edward Piers, Department of Chemistry, University of British Columbia, Vancouver,
British Columbia, CANADA V6T 1Y6

Both in terms of structural novelty and biological activity, the diversity exhibited by the terpenoid family of natural products is remarkable. Most of the currently known naturally occurring terpenoids have been isolated from terrestrial sources. However, particularly in recent years, many marine organisms have been found to contain structurally and biologically interesting terpenoids. This lecture will describe recent results obtained from a research program aimed at developing total syntheses of diterpenoids and sesterterpenoids. The use of new synthetic methods, particularly those involving novel bifunctional reagents, will be emphasized.

Monday 11:20 - 12:20

Symposium Paper 3

SESQUITERPENE LACTONES: BIOGENESIS AND BIOLOGICAL ACTIVITIES

Nikolaus H. Fischer, Department of Chemistry, Louisiana State University, Baton Rouge, Louisiana, U.S.A. LA 70803

Today, well over 3000 naturally occurring sesquiterpene lactones are known, but no detailed biosynthetic data are available on the various skeletal types. Therefore, biogenetic information is mainly based on biomimetic transformations and chemical-mechanistic arguments. Recent findings on the biogenesis of sesquiterpene lactones with major emphasis on biologically active skeletal types will be discussed. In addition, new developments on their biological activities will be reviewed.

- 11:00 Howard E. Nordby and Roy McDonald. (Paper 20). BIOSYNTHESIS OF FIVE SESQUITERPENES IN GRAPEFRUIT PEEL DURING CONDITIONING AGAINST CHILLING INJURY
- 11:20 Hiroki Hamada, G.D. Davis, Margaret Essenberg and Robert D. Stipanovic. (Paper 21). SESQUITERPENES PRODUCED DURING HYPERSENSITIVE RESPONSE OF GOSSYPIUM HIRSUTUM TO XANTHOMONAS CAMPESTRIS PV. MALVACEARUM
- 11:40 Urs Vögelli and Joseph Chappell. (Paper 22). CONTROL OF SESQUITERPENE AND STEROL METABOLISM IN TOBACCO CELL CULTURES
- 12:00 Lunch
- Afternoon Contributed Paper Session (Paul Spencer, presiding)
- 2:00 Alicja Zobel and Stewart A. Brown. (Paper 23). SEASONAL CHANGES OF FURANOCOUMARINS IN ISOLATED TISSUES OF HERACLEUM LANATUM LEAVES
- 2:20 Murray B. Isman, Peter Proksch, Anna Luczynski, Nancy Brard and Curtis Clark. (Paper 24). ANTI-HERBIVORE CHEMISTRY OF ENCELIA SPECIES (ASTERACEAE)
- 2:40 C.D. Carter, J.N. Sacalis and T.J. Gianfagna. (Paper 25). ZINGIBERENE ACCUMULATION IN GLANDULAR TRICHOMES OF LYCOPERSICON HIRSUTUM F. HIRSUTUM
- 3:00 Nancy K. Lane and John T. Romeo. (Paper 26). CHEMISTRY OF ZAPOTHECA FORMOSA SEEDS, ROOTS AND ROOT EXUDATES
- 3:20 Coffee Break
- 3:40 O. T. Chortyk, M.E. Snook and V.A. Sisson. (Paper 27). THE DISTRIBUTION OF FLAVONOL GLYCOSIDES IN THE FLOWERS OF NICOTINE SPECIES
- 4:00 M.E. Snook, O.T. Chortyk and V.A. Sisson. (Paper 28). REVERSE PHASE CHROMATOGRAPHY FOR THE RAPID ISOLATION OF PLANT FLAVONOIDS: APPLICATION TO THE NICOTINE SPECIES' FLOWERS
- 4:20 Richard C. Gueldner, M.E. Snook, B.R. Wiseman and N.W. Widstrom. (Paper 29). MAYSIN, A LUTEOLIN C-GLYCOSIDE, IN THE LEAVES OF CORN AND TEOSINTE
- 4:40 Constance Nozzolillo and Pierre Isabelle. (Paper 30). PURPLING IN JACK PINE SEEDLINGS

POSTER PRESENTATIONS

All posters will be displayed for the duration of the conference for the convenience of interested persons. Presenters should plan to be available for a few minutes before the morning sessions, during coffee breaks or some part of the lunch breaks in order to answer questions.

PROPERTIES OF ENZYMES INVOLVED IN SYNTHESIS AND UTILIZATION OF HMG-CoA IN PLANTS

Thomas J. Bach, A. Motel and T. Weber, Botanisches Institut (Pflanzenphysiologie & Pflanzenbiochemie), Universität Karlsruhe, Kaiserstr. 12, D-7500 Karlsruhe 1, F.R.G.

HMG-CoA reductase (HMGR, EC 1.1.1.34) was recently solubilized and purified from membranes of etiolated radish seedlings. Its purification from maize and kinetic characterization will be described.

An enzyme activity capable of synthesizing HMG-CoA from acetyl-CoA was found associated with a membrane fraction from etiolated radish and maize seedlings. Purification was achieved by mild treatment with detergent, gel filtration and precipitation with polyethylenimine. The system, comprising acetoacetyl-CoA thiolase (AACT, EC 2.3.1.9) and HMG-CoA synthase (HMGS, EC 4.1.3.5), elutes with an apparent molecular weight of 52-56 kDa. Close complex formation by both enzymes is indicated. Further data will be presented.

HMG-CoA lyase (HMGL, EC 4.1.3.4) is largely localized to the same membrane fraction. The enzyme accompanies AACT/HMGS when solubilized by Brij W-1 and has an apparent mass of ca. 70 kDa. HMGL is difficult to purify owing to its instability. The enzyme might play a role in the transmethylglutaconyl-CoA shunt pathway.

MOLECULAR CLONING AND CHARACTERIZATION OF PLANT HMG-CoA REDUCTASE

M. Monfar, C. Caelles, L. Balcells, A. Ferrer, F.G. Hegardt and A. Boronat, Facultat de Farmacia, Universitat de Barcelona, 08028-Barcelona, SPAIN

Characterization of HMG-CoA reductase from *Arabidopsis thaliana* was studied by isolation of a set of cDNA clones using hamster HMG-CoA reductase cDNA as a probe. The nucleotide sequence indicated that the enzyme contains 592 residues with a mass of 63,605 D. The N-terminus contains only two putative membrane-spanning regions. A C-terminal sequence of 407 residues shows a high level of similarity to the region containing the catalytic site of the hamster, human, yeast and *Drosophila* enzymes. The *A. thaliana* HMG-CoA reductase transcript is 2.4 kb long and is encoded by a 2.8 kb gene which includes three introns. A second HMG-CoA reductase gene exists but its expression product is unknown.

The *A. thaliana* clones have been used to isolate the corresponding clones from a pea leaf cDNA library. The pea enzyme shows a great similarity to the *A. thaliana* enzyme in the hydrophobic and C-terminal domains, but not in the hydrophilic N-terminal end and in the linker region. There exist at least three different forms of the pea enzyme showing 84-88% identical residues and 6.5-9% of conservative changes. The significance of this heterogeneity in pea is not known.

THE BIOSYNTHESIS OF GIBBERELLINS IN HIGHER PLANTS

Bernard O. Phinney and Clive R. Spray, Department of Biology, University of California, Los Angeles, CA 90024, U.S.A.

Gibberellins (GAs) are a class of plant hormones that control a wide variety of growth phenomena, including shoot elongation, and the hydrolysis of storage carbohydrates through the *de novo* synthesis of alpha-amylase.

Gibberellins are tetracyclic diterpenes known from higher plants and two species of fungi. While the GAs now number 76, only a relatively small number occur in any one plant or organ. All GAs originate through the standard MVA pathway with cyclization of GGPP to CPP to *ent*-kaurene which is the first tetracyclic diterpene in the pathway. Oxidation and ring contraction leads to GA₁₂-aldehyde, the common precursor for all known GAs. Several pathways diverge from the aldehyde to give families of GAs that differ from each other in hydroxylation pattern and carbon number. One of these pathways, the so-called "early-13-hydroxylation pathway" leads to GA₁, the primary bioactive gibberellin controlling shoot elongation in higher plants. This report will review current work on the enzymology and molecular biology of the hydroxylases that control later steps in the "early" pathway.

DITERPENOID PHYTOALEXINS: BIOSYNTHESIS AND REGULATION

Charles A. West, Augusto F. Lois, Karen Wickham and Yue-Ying Ren, Department of Chemistry and Biochemistry, University of California, Los Angeles, California, U.S.A.

Antimicrobial phytoalexins that are thought to be of importance in disease resistance are one of several groups of defensive agents produced in higher plants in response to challenges by potentially pathogenic microbes. Several different classes of natural products, including terpenes, are represented in the large number of substances that have been characterized as phytoalexins in different plants. Two plants have been shown to produce diterpenoid phytoalexins - castor bean (Ricinus communis), which makes the macrocyclic hydrocarbon casbene, and rice (Oryza sativa), which produces two families of oxygenated diterpenes, the momilactones and the oryzalexins, along with some unidentified diterpenoid substances. Our laboratory has been investigating the biosynthesis of these diterpenes and its regulation during plant-pathogen interactions. These studies have focussed on the delineation of the biosynthetic pathways, the characteristics of some of the enzymes, the nature of biotic signalling molecules that elicit phytoalexin production in the plant and the role of activation transcription in the induction process. Relevance to regulation of secondary metabolism will be considered.

CONTROL OF STEROL AND TRITERPENOID BIOSYNTHESIS IN PLANTS AND ITS FUNCTIONAL IMPORTANCE TO DEVELOPMENTAL REGULATION

W. David Nes, Plant and Fungal Lipid Research, Plant Physiology Research Unit, Russell Research Center, 950 College Station Road, Athens, GA 30613 U.S.A.

Recent developments from this and other laboratories have demonstrated that sterols and sterol-like (pentacyclic triterpenoids) molecules play multiple roles during plant and fungal ontogeny. Control of their biosynthesis has now been obtained in several ways through the use of synthetic and natural product transition-state analogs, mutagenesis, anaerobiosis and molecular cloning techniques. The utility of each of these methods in the regulation of sterol and triterpenoid production will be discussed. The functional significance for sterols having particular 3-dimensional shapes and occurring at specific periods in specific cellular compartments and concentrations to affect stage-specific, growth and reproduction will also be examined.

TERPENOIDS WITH NEW CARBON SKELETONS FROM MARINE INVERTEBRATES

Raymond J. Andersen, E. Dilip de Silva, E.J. Dumdei, P.T. Northcote, C. Pathirana and Mark Tischler, Departments of Chemistry and Oceanography, University of British Columbia, Vancouver, British Columbia, CANADA V6T 1W5

Marine invertebrates are an extremely rich source of terpenoid metabolites. We will present results of recent structural studies on novel terpenoids from two Pacific Ocean sponges Xestospongia vanilla and Aplysilla glacialis, the Indian Ocean nudibranch Chromodoris cavae, and the Atlantic Ocean hydroid Hydrallmania falcata. Xestospongia contains a family of triterpenoid glycosides whose aglycones have the new xestovanane and secoxestovanane skeletons. Nineteen- and 20-carbon metabolites having new skeletons have also been isolated from X. vanilla. The skeletons of these latter compounds appear to have been formed via degradation of the secoxestovanane skeleton. Chromodoris cavae and A. glacialis contain rearranged spongian diterpenoids, A. glacialis has the glacialane skeleton with two conjoint cyclohexane rings, and H. falcata contains a family of diphenyl p-menthane derivatives that show structural similarities to the cannabinoids. Cytotoxic and antimicrobial activities of several of these terpenoids will also be discussed.

PURIFICATION AND CHARACTERIZATION OF A PAPS:DESULFOGLUCOSINOLATE SULFOTRANSFERASE FROM LEPIDIUM SATIVUM

Thomas M. Glendening and Jonathan E. Poulton, Department of Botany, University of Iowa, Iowa City, Iowa 52242

A sulfotransferase which catalyzes the sulfation of desulfobenzylglucosinolate to benzylglucosinolate using 3'-phosphoadenosine 5'-phosphosulfate (PAPS) as the sulfate donor, was partially purified from the shoots of garden cress (Lepidium sativum). The purification scheme included gel filtration, concanavalin A-Sepharose, Matrix-Gel Green A, and ion exchange chromatography using the FPLC MONO Q system. The sulfotransferase had a pH optimum of 8.5 in Tris-HCl buffer, a molecular weight of 31,000, and an apparent pI of 5.2. The kinetic characteristics of the enzyme will be discussed, in addition to its role in glucosinolate biosynthesis.

FLAVONOL RING B-O-GLUCOSYLTRANSFERASE FROM CHRYSOSPLENIUM AMERICANUM: IN SITU LOCALIZATION BY IMMUNOGOLD LABELING
Lilian Latchinian, Pierre M. Charest, and Ragai K. Ibrahim
Plant Biochemistry Laboratory, Department of Biology,
Concordia University, Montreal, Quebec, H3G 1M8 CANADA

Flavonol ring B-O-glucosyltransferase from C. americanum shoot tips was purified to near homogeneity, and used as the source of antigen to raise polyclonal antibodies in rabbits. The antibodies produced were characterized by enzyme-linked immunosorbent assay, and by immunodetection following SDS-polyacrylamide gel electrophoresis (Western blotting). The immune serum was purified by ion-exchange chromatography on Mono Q. The purified IgG pool was used for in situ localization of the O-glucosyltransferase at the subcellular level by immunogold labeling. The majority of the labeling was in cytoplasmic compartments and in the vicinity of the cell wall strongly suggesting association with membrane vesicles, which are believed to be involved in the biosynthesis of polymethylated flavonol O-glucosides. No specific immunolabeling was associated with the chloroplasts, mitochondria, cell wall, or vacuoles.

LIGHT-ACTIVATED PHYTOTOXIC THIOPHENES IN FLAVERIA LINEARIS.
Dominique Provost-Buisson and Kelsey Downum. Dept of Biology, Florida International University, Miami, FL 33199.

Chromatographic analyses of crude leaf extracts of F. linearis reveal the presence of four acetylenic monothiophenes. Three of these compounds have been purified and structurally characterized by UV, NMR, FTIR and GC-MS. Germination, growth and survival/mortality studies with and without UVA, the activating wavelenghs of these metabolites, have been conducted with the crude leaf extract and the purified compounds (taken individually and combined) against different crop species (carrot, lettuce and radish). The phytotoxicity of the crude leaf extract (i.e. the allelopathic potential of F. linearis) through these chemicals will be discussed.

PHENYLPROPANOID METABOLISM IN FUNGAL CHALLENGED TOMATO CULTURES

Mark A. Bernards and Brian E. Ellis Dept. Chemistry and Biochemistry, U. of Guelph, Guelph, Ontario, Canada, N1G 2W1

A co-cultivation system has been developed to study the tomato-*Verticillium albo-atrum* interaction *in vitro*. *V. albo-atrum* grows more slowly in co-cultivation with cultures derived from *Verticillium*-resistant (Ve^+) plant tissue than with cultures derived from *Verticillium*-susceptible (Ve^-) plant tissue. Fungal challenged Ve^+ cultures show an early induction of measurable phenylalanine ammonia-lyase (PAL) activity as well as an accumulation of soluble phenolics. Ve^- cultures, on the other hand, display a delayed PAL induction and no soluble phenolic accumulation. HPLC analysis of soluble phenolics in *V. albo-atrum* challenged cultures indicates the presence of p-coumaric, caffeic, and ferulic acids in Ve^+ extracts, post challenge. The presence of these lignin biosynthesis precursors is consistent with the deposition of lignin-like coating materials in whole plants challenged with *V. albo-atrum*.

A NEW CYANOGENIC GLYCOSIDE FROM LOTONONIS AFF. FALCATA

Anita M. Brinker and D.S. Seigler, Department of Plant Biology, University of Illinois, Urbana, IL 61801 U.S.A.

The cyanogenic glycoside prunasin was previously found in members of the South African genus *Lotononis*. Preliminary work indicated the presence of a second cyanogenic compound in *Lotononis* aff. *falcata* (E. Mey.) Benth. Dried leaf material was extracted with MeOH:H₂O, 1:1, and the extract chromatographed on silica gel TLC plates. Two distinct cyanogenic zones resulted; one of these contained prunasin. The H-1 NMR spectrum of the other, more polar, substance was similar to that of prunasin, but contained an additional singlet at about 3.4 ppm, which corresponds to that of malonate. The C-13 NMR spectrum was also similar to that of prunasin except in the sugar region. The peak corresponding to carbon 4 of glucose was strongly shifted downfield in comparison to that of prunasin. The peak corresponding to carbon 6 was shifted upfield. These and other changes in the spectra indicate attachment of malonate to prunasin at carbon 4 of the sugar.

STRESS-INDUCED ALCOHOL DEHYDROGENASE ACTIVITY IN POTATO TUBER DISKS

Peter Constabel and Normand Brisson, Biochemistry Department, University of Montreal, Montreal, Quebec, CANADA

Alcohol dehydrogenase (ADH) gene transcripts were shown to accumulate rapidly and at a high level following fatty acid elicitor treatment of potato tuber disks. Several other stress treatments, including anaerobiosis, also induced this response. Western blots using ADH antibodies revealed no increase in ADH protein levels in response to any of the stress treatments, and in crude or partially purified extracts no increase in NAD-dependent ADH activity was detected. Screening with other alcohol substrates, however, demonstrated the induction of another, NADP-dependent, alcohol dehydrogenase in the extracts following several of the treatments. This enzyme showed high specificity towards geraniol and cinnamyl alcohol, and shows an induction pattern very different from the ADH transcript. By these and other criteria, we conclude that the enzyme appears to represent an unrelated alcohol dehydrogenase.

LOCALIZATION OF PHENOLIC COMPOUNDS IN EMBRYOS AND SEED COVERS OF BRASSICA NAPUS DURING MATURATION, DORMANCY AND GERMINATION OF SEEDS

Alicja Zobel, Dept. of Chemistry, Trent University, Peterborough, Ont. K9J 7B8, and Mieczyslaw Kuras, Electron Microscopy, Warsaw University, 00-927 Warsaw, Poland.

Localization of phenolic compounds was investigated by electron microscopy after fixation of embryos in glutaraldehyde + 0.1% caffeine. Small vesicles with phenolic compounds were not observed in embryogenesis but appeared during maturation. The number of vesicles differed in different embryo tissues. Inside the epidermal cells, in the dormant embryo, vesicles with dark deposits were observed outside the plasmalemma but on the inside of the cell wall. During the germination period (3-24 h) the greatest number of vesicles was after 3 h, decreasing in 6 h. After 24 h phenolic compounds were not confined to the small vesicles but were in different-sized vacuoles as well. Already after 3 h these dark deposits were on the embryo surface in direct contact with the seed cover. On the surface of the dormant embryo were substances giving greenish autofluorescence under UV, one of which was identified as sinapin. Longer imbibition of 15 min leads to leakage of substances with a bluish fluorescence.

INCREASED PHENOLIC COMPOUNDS IN LEAVES OF PINUS NIGRA IN RESPONSE TO SALT AND ACID SPRAY.

Alicja Zobel and James E. Nighswander, Dept. of Chemistry and Dept. of Biology, Trent University, Peterborough, Ontario K9J 7B8.

Potted P. nigra plants growing under controlled greenhouse conditions were sprayed daily with saturated solutions of NaCl or H₂SO₄ pH 2.5 or H₂O (as the control) and covered with polyethylene bags. Samples of base, mid-part and tip of needles were fixed in glutaraldehyde plus 0.1% caffeine for precipitation of phenolic compounds. Semi-thin cross sections of pine needles showed subepidermal necrosis appeared first in the vicinity of stomata. Under the electron microscope damage was visualized as being done to the endomembrane system. The density of phenolic compounds first increased in the cell vacuoles, followed by disorganization of membranes because of their precipitation with phenolics, leading to lysis and death of the mesophyll cells. The endodermis played the role of an inner barrier and wax plugs with associated phenolic compounds appeared to increase in size in stomata adjacent to damaged areas. These increased concentrations of phenolic compounds were the first signs of cell damage.

HOW SIMILAR ARE THE PHOTOSYNTHETIC MEMBRANES OF CONIFERS AND ANGIOSPERMS?

Edith Camm, Departments of Botany and Forest Sciences, U.B.C., Vancouver, B.C.

While there exists a striking similarity among photosynthetic membranes in green plants and algae, extending even to some bacteria, each group of photosynthetic organisms has unique features. Much of our current picture of photosynthetic membranes in land plants is based on research on agricultural angiosperm annuals, and our knowledge of gymnosperms is less extensive. In this report, current gel electrophoretic methods will be used to compare the antennal chlorophyll-protein complexes in native and introduced species from a number of families. An unusual antennal component has been identified from two members of the Pinaceae. While it appears to be part of Photosystem II, its role is unclear. An additional difference between most conifers and angiosperms is that conifer needles, unlike angiosperm leaves, last for a number of yearly cycles. Levels of chloroplast membrane proteins will be compared for six years of Douglas fir needles, and examined in terms of age and light environment of the needle.

STRATEGY FOR ENGINEERING-ALTERED SECONDARY METABOLISM IN BRASSICA
 Luc Varin¹, Normand Brisson², Vincenzo De Luca² and Ragai K. Ibrahim¹
¹Plant Biochemistry Lab, Department of Biology, Concordia University,
 Montreal H3G 1M8 and ²Departments of Biochemistry & Biology, University
 of Montreal, Montreal H3C 3J7, Canada

Brassica napus (Canola) is an important source of vegetable seed oil and seed meal protein. However, it accumulates several glucosinolates which are the oviposition cues of various specialized insects, resulting in large losses in crop yield. Rather than suppressing the pathway of glucosinolate biosynthesis in Brassica, we propose to create a new pathway that diverts the existing pool of the sulfate donor, 3'-phosphoadenosine 5'phosphosulfate towards the synthesis of novel sulfated metabolites; thus impairing the sulfation of desulfoglucosinolates in canola.

The results of some aspects of this strategy will be presented and discussed in relation to plant improvement through modification of secondary metabolic pathways.

BIOSYNTHESIS OF NARINGIN IN CITRUS PARADISI: UDP-GLUCOSYL TRANSFERASE ACTIVITY IN GRAPEFRUIT SEEDLINGS

Cecilia A. McIntosh and Richard L. Mansell, Department of Biology, University of South Florida, Tampa, FL 33620

A UDP-glucosyl transferase activity capable of position-specific transfer of glucose to the 7 position of naringenin has been isolated from grapefruit seedlings. Leaves are the richest source of this activity. Isolation involves ammonium sulfate fractionation followed by gel filtration chromatography which results in a 80-100 fold increase in the specific activity. Analysis of this enriched fraction has shown that the enzyme has a pH optimum of 6.5-7.5, a temperature optimum of 37°C, and an apparent Km for naringenin of 0.08 mM. The enzyme activity is anionic and binds to DEAE-Cellulose and AG4X-4 resins. The isoelectric point is being determined by column chromatofocusing.

The identification of the product as naringenin-7-O-glucoside (prunin) was established by chromatography of the products and their acetate derivatives, by comparison of absorption spectra, and by hydrolysis of the sugar moiety and identification of the aglycone and labeled sugar. Substrate specificity studies have shown that naringenin and its chalcone can be glucosylated with similar efficiencies. Other aglycones are being tested.

DNA UPTAKE BY ELECTROPORATION OF GERMINATING POLLEN

James A. Saunders¹, Benjamin F. Matthews², and Aref Abdul-Baki²,

¹Germplasm Quality & Enhancement Lab, and ²Plant Molecular Biology Lab, USDA/ARS, Beltsville, MD 20705.

The area of plant gene transfer suffers from the lack of techniques effective in moving foreign genes into mature plant germplasm rapidly and reliably. Few plant gene transfer methods are currently available and their use is normally restricted by a limited host range of the pathogen (A. tumefaciens) or by the requirement of tissue culture to regenerate plants. We are developing an electroporation technique to insert foreign DNA into germinating pollen which is used to produce transformed seed through pollination of receptive stigmas. Our results, using radioactively labelled DNA demonstrate that the germinating pollen from Nicotiana glauca can effectively take up DNA by electroporation and that viable seed is produced by pollen treated in this manner. In addition, plasmid DNA containing the gene encoding E. coli β-glucuronidase (GUS) has been electroporated into pollen. The pollen GUS has shown transient expression of the enzyme 24 hrs after electroporation. This should be an effective gene transfer technique usable with most flowering plants.

MODIFIED BRANCHED-CHAIN AMINO ACID (BC-AA) METABOLISM GIVES RISE TO ACYL ACIDS OF TOBACCO SUCROSE ESTERS (SE)

Lili Kandra and George J. Wagner, Plant Physiology/Biochemistry/Molecular Biology Program, University of Kentucky, Lexington, KY 40546-0091, U.S.A.

SE exuded from *N. tabacum* T.I. 1068 trichomes are 6-0-acetyl-2,3,4,-tri-0-acyl- α -D-glucopyranosyl- β -D fructofuranosides (predominant acyl groups, C₄ to C₆ fatty acids). Labeled precursors of BC-AA principally labeled acyl acids of SE (i.e., after labeling with ¹⁴C threonine, 79% of ¹⁴C in SE was in 3-methylvaleric acid). Acetate and pyruvate principally labeled the 6-0-acetyl group of SE (i.e., after labeling with [1-¹⁴C] acetate, 61% of ¹⁴C in SE was recovered as acetic acid). Sucrose most efficiently labeled the sugar moiety.

Chlorosulfuron, an inhibitor in conversion of threonine to isoleucine reduced branched-chain acyl acid formation and increased labeling of straight chain acyl acids which are usually minor components.

Results together with (Kandra and Wagner, Arch. Biochem. Biophys. 265:425, 1988) indicate that methylpropionyl, methylbutyryl and methylvaleryl groups of SE are formed via reactions of BC-AA biosynthesis/catabolism and not via fatty acid synthesis.

INTERFERENCE WITH PLANT-WATER RELATIONSHIPS AS A MODE OF ACTION OF ALLELOPATHIC CHEMICALS

Frank A. Einhellig and Richard R. Barkosky, Department of Biology, University of South Dakota, Vermillion, South Dakota 57069

Soybean [*Glycine max* (L.) Merr.] seedlings grown in the greenhouse in aqueous culture medium were the test species for these investigations. Ten-day old seedlings were subjected to mild allelochemical stress by adding either salicylic acid (SA), p-hydroxybenzoic acid (pHB), hydroquinone (HQ), or a combination of these phenolics to the nutrient medium. During a 28-day treatment time, periodic monitoring showed that these allelochemicals caused an increase in leaf diffusive resistance and a decrease in transpiration and water uptake. Treated plants often had a lower water potential than controls. At harvest, the carbon isotope ratio (¹³C : ¹²C) was lower in tissue from allelochemical-stressed soybeans. This reduction in discrimination against ¹³C indicates that SA, pHB, and HQ caused a sustained change in stomatal diffusion and altered the plant integrated water-use efficiency. Alteration in the carbon isotope ratio correlated with reductions in leaf area, plant weight, and other growth parameters, indicating probable cause-effect relationships.

ISOLATION OF INTACT SECRETORY GLANDS FROM PEPPERMINT LEAVES

David McCaskill and Rodney Croteau, Institute of Biological Chemistry, Washington State University, Pullman, WA 99164-6340

Glandular trichomes on the leaves of peppermint are the only site for synthesis and storage of monoterpenes. Peppermint leaves have capitate and peltate trichomes surrounded by a thick cuticle layer. Both types contain a large basal cell embedded in the epidermis, a stem cell, and either one (capitate) or eight (peltate) secretory cells. In the case of the peltate glands, the layer of cutin is expanded to enclose a large sub-cuticular space containing an oily droplet of terpenes. These specialized structures are expected to have a unique complement of enzymes responsible for terpene biosynthesis. Hydrolytic digestion of leaves with cellulase and pectinase releases both mesophyll and epidermal cells, leaving behind undigested strips of cuticle with intact trichomes still attached. The thick cuticle surrounding the secretory glands prevents access of the digestive enzymes to the cells, resulting in release of the glands as an intact unit. Vital staining indicates the cells in the peltate glands are still viable whereas those in the capitate glands are not. A preliminary characterization of these isolated glands with respect to terpene and enzyme content is reported. The application of this technique will be discussed.

METABOLISM OF PLANT MONOTERPENES: HYDROXYLATION OF (-)-LIMONENE IN CELL FREE ENZYME PREPARATIONS FROM SPEARMINT, PEPPERMINT AND PERILLA

Charles Mihaliak, Frank Karp and Rodney Croteau, Institute of Biological Chemistry, Washington State University, Pullman, WA 99164-6340, U.S.A.

Cell free enzyme preparations were used to characterize the conversion of (-)-limonene to (-)-trans-isopiperitenol, (-)-trans-carveol and (-)-perillyl alcohol in Mentha piperita, Mentha spicata and Perilla frutescens, respectively. Using a variety of classical methods including CO inhibition, NADPH and O₂ requirement and inhibition by known P-450 inhibitors, each conversion was demonstrated to proceed via a cytochrome P-450 dependent hydroxylase. The hydroxylase from each species was determined to produce only a single product from (-)-limonene.

REGULATION OF MONOTERPENE GLYCOSYLATION IN PEPPERMINT LEAVES

Jonathan Gershenzon, David McCaskill, D.J. Williams and Rodney Croteau, Institute of Biological Chemistry, Washington State University, Pullman, WA 99164-6340 U.S.A.

The monoterpenes of peppermint are synthesized and stored in glandular trichomes found on the leaf surfaces. Most monoterpene accumulation occurs early in leaf development. During onset of flowering, over 50% of the monoterpenes of mature leaves are lost. The principal monoterpene constituent, (-)-menthone, is reduced to near equal amounts of (-)-menthol and (+)-neomenthol. The (-)-menthol remains in the trichomes, while the (+)-neomenthol is glucosylated and transported to the rhizome where it is catabolized. We have begun to investigate how monoterpene loss from peppermint leaves is regulated by measuring the levels of (+)-neomenthol glucosyltransferase during leaf development. The activity of (+)-neomenthol glucosyltransferase increased during the principal period of monoterpene loss suggesting that this enzyme might regulate the glycosylation of monoterpenes in peppermint and their subsequent transport to the rhizome.

INSECT ANTIFEEDANT AND GROWTH REGULATING ACTIVITY OF LIMONOIDS FROM THE MELIACEAE

D.E. Champagne, M.B. Isman, and G.H.N. Towers, Depts of Botany and Plant Science, University of British Columbia, Vancouver, B.C. V6T 2B1

Limonoids (or tetranortriterpenoids), characteristic secondary metabolites of the plant families Meliaceae and Rutaceae, are thought to have a role in defense against insect herbivores. We compared the antifeedant, growth-inhibiting, and molt-inhibiting activity of a series of limonoids against the variegated cutworm, Peridroma saucia and the milkweed bug Oncopeltus fasciatus. Some simple limonoids with an intact apo-euphol skeleton inhibit insect growth; cedrelone inhibits O. fasciatus molting at 16 ug/nymph, but anthothecol, with an acetoxy substitution at C11, was inactive in this assay. Features required for activity include a 14,15-epoxide on the D ring and a lactol bridge or cyclohexenone function on the A ring. Oxidation of the A, B, or D rings leads to less toxic compounds. Oxidative opening of the C ring leads to highly toxic or antifeedant structures including the well-known insecticide azadirachtin. The toxicology of azadirachtin in P. saucia and the migratory grasshopper Melanoplus sanguinipes will be discussed.

BIOCHEMISTRY AND ANTI-CANCER ACTIVITY OF CITRUS LIMONOIDS

Shin Hasegawa, USDA, ARS, Fruit and Vegetable Chemistry Laboratory, 263 So. Chester Avenue, Pasadena CA 91106. Luke K. T. Lam, Gray Freshwater Biological Institute, University of Minnesota, Navarre MN 55392

Limonoids are a group of chemically related triterpene derivatives. Bitterness due to limonoids in citrus juices is a serious economic problem. Radioactive tracer work has well established the biosynthetic pathways, sites of biosynthesis, translocation and accumulation in citrus. Recently, limonoids were found to be also present as glucosides in citrus. Ten limonoid glucosides were isolated and identified. We found also that certain limonoids induce glutathione S-transferase, a detoxifying enzyme, and inhibit benzo(a)pyrene-induced neoplasia in mice. Citrus fruits and juices contained high concentrations of limonoid glucosides. For example, commercial orange juice averaged 320 ppm of total limonoid glucosides. Limonoid glucosides may be hydrolyzed in the intestinal flora to liberate the limonoid aglycones. For this reason, citrus may be good sources of glutathione S-transferase inducing limonoids. This work is still at a preliminary stage and further research is needed to determine whether levels of limonoids present have sufficient effect as anti-cancer dietary sources.

BIOSYNTHESIS OF FIVE SESQUITERPENES IN GRAPEFRUIT PEEL DURING CONDITIONING AGAINST CHILLING INJURY

Harold E. Nordby and Roy McDonald, USDA, ARS, Horticultural Research Laboratory, Orlando, Florida 32803.

In previous work we showed an inverse relationship between the biosynthesis of squalene in the peel of grapefruit subjected to a temperature-conditioning treatment for reducing chilling injury when fruit were stored at 5°C. In a continuation of this study, we found five sesquiterpenes to likewise increase during the conditioning treatment. Caryophyllene and Farnesene increased during the first 7 days of conditioning at 15°C. Under further holding at 15°C, the caryophyllene level remained constant and the alpha-farnescene level decreased while levels of the other three isoprenoids began to increase. In mid-season fruit which is more resistant to chilling injury, the levels of the five isoprenoids with the exception of Farnescene were substantially higher prior to temperature conditioning. These results suggest that the levels of these five isoprenoids in the peel of grapefruit may have a role in mitigating chilling injury.

SESQUITERPENES PRODUCED DURING HYPERSENSITIVE RESPONSE OF *GOSSYPIUM HIRSUTUM* TO *XANTHOMONAS CAMPESTRIS* PV. *MALVACEARUM*

Hiroki Hamada, Gordon D. Davis, Margaret Essenberg, Department of Biochemistry, Oklahoma State University, Stillwater OK 74075-0454, and Robert D. Stipanovic, Southern Crops Research Laboratory, USDA-ARS, Route 5, Box 805, College Station, Texas 77840, USA.

In leaves and cotyledons of bacterial blight-resistant cotton, the sesquiterpene phytoalexins 2,7-dihydroxycadalene and lacinilene C accumulate in the hypersensitively responding, fluorescent cells closest to intercellular colonies of *X. c. pv. malvacearum*. These phytoalexins have photoactivatable antibacterial activity. We have begun a search for their biosynthetic precursors. GC/MS analysis of cotyledonary extracts prepared during the period of rapid phytoalexin accumulation (30-45 hr post-inoculation) revealed the presence of infection-induced substances with molecular weights 204, 206, 216, 218, and 232, whose mass spectra indicated the expected isopropyl and methyl substituents. The compounds are being resolved by HPLC on silica. The high resolution mass spectrum of the MW 218 compound shows that it has elemental composition C₁₅H₂₂O. (Supported in part by the Oklahoma Agricultural Experiment Station and National Science Foundation Grant DMB 86-16650)

CONTROL OF SESQUITERPENE AND STEROL METABOLISM IN TOBACCO CELL CULTURES

Urs Vögeli and Joseph Chappell, Plant Physiology/Biochemistry Program, University of Kentucky, Lexington KY 40546-0091

Addition of fungal elicitors to tobacco cell suspension cultures results in the rapid synthesis and secretion of sesquiterpene phytoalexins, and is paralleled by an equally rapid decline in sterol biosynthesis. The decline in sterol biosynthesis has been correlated with a suppression of squalene synthetase activity. In comparison, the induction of sesquiterpene biosynthesis has been correlated with an induction of sesquiterpene cyclase activity. Sesquiterpene cyclase is a putative branch point enzyme competing with squalene synthetase for farnesyl diphosphate. Sesquiterpene cyclase has been purified and antibodies developed. The induction of sesquiterpene cyclase has been correlated with the absolute amount of cyclase protein (immunoblotting techniques). Changes in the *in vivo* synthesis rate of the cyclase protein and the cyclase mRNA translational activity have been correlated with the induction of the cyclase protein and enzyme activity. Our results suggest that the induction of the sesquiterpene cyclase enzyme activity is mediated by transcriptional activation of the cyclase.

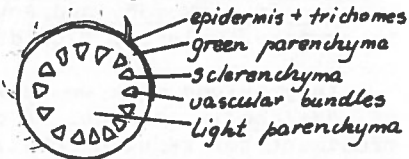
Thursday 2:00

Contributed Paper 23

SEASONAL CHANGES OF FURANOCOUMARINS IN ISOLATED TISSUES OF HERACLEUM LANATUM LEAVES

Alicja Zobel and Stewart A. BROWN, Department of Chemistry, Trent University, Peterborough, Ontario K9J 7B8

Leaves of *H. lanatum*, growing outdoors, were collected at weekly intervals for the entire vegetative period, and 4 types of tissue were separated. Surface furanocoumarins were localized by extraction involving brief dipping in almost-boiling water, followed by HPLC quantitative analysis. Surface furanocoumarin concentration increased until the middle of May and decreased afterwards, but concentration on autumn leaves (new growth) was 20-100 times as high as the ones in May or those of similar size in April. Furanocoumarin concentrations in the whole leaf at different stages of leaf development varied, being the highest April 25, then decreasing sharply with rapid leaf enlargement. Again in the small autumn leaves the coumarin concentration was 2-3 times that in April. Concentrations also varied in different tissues: epidermis usually contained the highest, and parenchyma the lowest, but in new fall growth totals were highest in the parenchyma. Lower totals of furanocoumarins in late spring leaves after maturity suggested further metabolism. The highest totals, in new fall growth, may be due to cold stress.



Thursday 2:20

Contributed Paper 24

ANTI-HERBIVORE CHEMISTRY OF *ENCELIA* SPECIES (ASTERACEAE)

Murray B. Isman, Peter Proksch*, Anna Luczynski, Nancy Brard and Curtis Clark**
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The role of acetylchromenes and benzofurans in the chemistry of defense against insect herbivory in *Encelia* species was investigated by quantitative HPLC analysis of crude organic extracts combined with parallel bioassay of the extracts against the variegated cutworm (*Peridroma saucia*, Noctuidae), a generalist herbivore. The major acetylchromene, encocalin, which occurs at concentrations up to 0.75% dry weight of foliage, has both insecticidal and antifeedant activity against the cutworm in laboratory bioassays. The major benzofuran, euparin, is relatively inactive against this and other insects when compared to the acetylchromenes. However, there is no apparent relationship between encocalin content of the various extracts bioassayed (representing 15 *Encelia* species) and inhibition of larval growth on diets spiked with the extracts. The three most inhibitory species, *E. asperifolia*, *E. actoni* and *E. ventorum*, have in common an unidentified substance, possibly a sesquiterpene, which may account for their strong bioactivity.

ZINGIBERENE ACCUMULATION IN GLANDULAR TRICHOMES OF LYCOPERSICON HIRSUTUM F. HIRSUTUM
C.D. Carter, J.N. Sacalis, and T.J. Gianfagna, Department of Horticulture and Forestry,
Cook College, Rutgers University, New Brunswick, NJ 08903.

We have previously shown that the sesquiterpene zingiberene is associated with resistance to Colorado potato beetle in Lycopersicon hirsutum f. hirsutum. To determine the location of zingiberene in L.h.f. hirsutum, the glandular tips of Type VI trichomes were removed from leaves into hexane and the remaining leaf surface and interior matrix were then extracted separately in hexane, and zingiberene contents were determined by GC. Zingiberene occurred almost exclusively in the Type VI trichome tips.

L.h. f. hirsutum Type VI trichome tips contained more chlorophyll than Type VI trichomes of L.h.f. glabratum and L. esculentum, which do not produce zingiberene. Type VI trichomes on young L.h.f. hirsutum leaflets contained about 20 pg of chlorophyll per glandular tip, and chlorophyll contents declined as leaflets matured. L.h.f. hirsutum Type VI trichomes contained up to 85 ng zingiberene per tip. Maximum zingiberene levels were reached before chlorophyll content declined. Results of ¹⁴C-labelled isoprene precursor incorporation into sesquiterpenes in the trichomes will also be presented.

CHEMISTRY OF ZAPOTECA FORMOSA SEEDS, ROOTS, AND ROOT EXUDATES.
Nancy K. Lane and John T. Romeo, Department of Biology, University of South
Florida, Tampa FL, 33620.

Zapoteca, a small Mimosoid genus of legumes, is native to Southern Mexico. The germinating seeds and roots of Zapoteca formosa emit a pungent sulphur odor similar to garlic. Aqueous and chloroform extracts of these tissues were analyzed by GC/MS and HPLC. Root exudates also were collected on XAD-4 resin and volatiles trapped on Tenax-GC resin and analyzed. Isolated sulphur compounds include: benzothiazole, djenkolic acid, taurine, a cyclic polysulphide tentatively identified as 1,2,4,6-tetrathiepane, and several uncharacterized sulphides. Two volatiles, diethoxyethane and 2-octanol, were other major constituents of the roots. As in other plants, the garlic odor is complex. The sulphide composition changes with time. A number of benzene derivatives, naphthalenes, phthalates, fatty acids and amino acids were also identified.

THE DISTRIBUTION OF FLAVONOLGLYCOSIDES IN THE FLOWERS OF THE NICOTIANA
SPECIES. O. T. Chortyk and M. E. Snook, USDA-ARS, P. O. Box 5677, Athens, GA
30613; V. A. Sisson, USDA-ARS, P. O. Box 1555, Oxford, NC 27565.

The flowers from 65 of the 66 recognized species of the genus Nicotiana were analyzed for their flavonolglycoside content by high-performance liquid chromatography. Flowers of all species were found to contain quercetin (Q)- and kaempferol (K)-3-rutinosides. Flowers of several species contained unknown flavonolglycosides, which were isolated and identified as Q- and K-glycosides: -sophorosides, -glucosophorosides, -galactorhamnosides, -glucorutinosides, and -rhamnorutinosides. Interesting distributions of these flavonols throughout the species were observed. For example, only 7 flowers (out of 22 species) in the Section Suaveolentes contained Q- & K-3-rutinoside-7-glucoside and thus could represent a separate section or subsection. The distribution of the other flavonols throughout the species will also be discussed.

REVERSE-PHASE CHROMATOGRAPHY FOR THE RAPID ISOLATION OF PLANT FLAVONOIDS:
APPLICATION TO THE NICOTIANA SPECIES' FLOWERS. M. E. Snook and O. T. Chortyk,
USDA-ARS, Russell Research Center, P. O. Box 5677, Athens, GA 30613; V. A. Sisson,
USDA-ARS, Crops Research Lab., P. O. Box 1555, Oxford, NC 27565

Previous methods for the isolation of plant flavonoids have included column chromatography on silica gel, cellulose, XAD resin, polyamide, or Sephadex. Usually, additional chromatographic steps, such as paper or thin-layer chromatography, are needed to obtain pure isolates. This paper will describe the isolation of pure flavonolglycosides from extracts of the flowers of Nicotiana species using only C18 reverse-phase chromatography, with methanol/water solvents. A 2.5 cm X 30 cm gravity elution column, containing Waters' PrepPAK500 C18 material, gave an initial separation of the flavonolglycosides from free sugars. Final separation employed gradient elution on a similar 2.5 cm X 50 cm column. Isolated and identified compounds included kaempferol- and quercetin-sophorosides, -glucosophorosides, -glucorutinosides, -rhamnorutinoside, and -robinobiosides.

MAYSIN, A LUTEOLIN C-GLYCOSIDE, IN LEAVES OF CORN AND TEOSINTE. Richard C. Gueldner and Maurice E. Snook, USDA-ARS, Russell Research Center, P. O. Box 5677, Athens, GA 30613; Billy R. Wiseman and Neil W. Widstrom, USDA-ARS, P. O. Box 748, Tifton, GA 31793

Maysin, a luteolin C-glycoside, and an isomer of maysin have been isolated and identified from leaves of Teosinte, a close relative of corn, that is resistant to the fall armyworm. In the corn varieties examined, leaves and most silks contained maysin and variants of maysin as major flavonoid constituents. As indicated by laboratory bioassays, maysin is a growth inhibitor for two pests of corn, the corn earworm and the fall armyworm, and has been proposed as a resistance factor to the corn earworm. The developmental stage of the corn plant and its maysin distribution will be discussed in relation to corn earworm and fall armyworm feeding behaviors. Prospects for genetic manipulations of maysin levels in silks and leaves will be discussed.

PURPLING IN JACK PINE SEEDLINGS

Constance Nozzolillo and Pierre Isabelle, Department of Biology, University of Ottawa, Ontario K1N 6N5 CANADA

Needles of jack pine seedlings in their first and second years of growth at the C. Howard Ferguson Forest Nursery Station were analysed during the summer and fall of 1987 for chemical changes associated with the purpling phenomenon. Anthocyanins, responsible for the color, appeared after the first frost and increased in amount thereafter, mainly in the needles of first year seedlings, and in parallel with an increase in proanthocyanidins. Total phenolics increased continuously from July as did total sugars. Total chlorophyll did not change significantly. At least six anthocyanins are produced in the needles along with a considerable array of flavones and flavonols. Parallel observations in the greenhouse and growth cabinet point to low temperature as the major factor in purpling.

ANTHOCYANIN PRODUCTION AND OCCURRENCE OF ANTHOCYANOPLASTS IN VITIS VINIFERA CELL SUSPENSIONS

Francois Cormier, Chi Bao Do and Christiane Dufresne, Food Research and Development Centre, Agriculture Canada, St.-Hyacinthe (Quebec), J2S 8E3 CANADA

Vitis vinifera cell suspensions accumulated anthocyanins throughout the growth cycle. Increasing the osmotic pressure of the growth medium by the addition of sucrose and/or mannitol resulted in an increase in the concentration of anthocyanins within the pigmented cells. Microscopic observations revealed that the vacuole of cells submitted to osmotic stress was more intensely pigmented and that strongly pigmented bodies, i.e. anthocyanoplasts, occurred in the cytoplasm and in the vacuole. HPLC of anthocyanin extracts showed that extracts were composed of 17 peaks of which the major peak was malvidin 3-glucoside (approx. 50%). Experiments are currently being done to identify other anthocyanins and to determine the role of anthocyanoplasts in the production of anthocyanins.

DEMONSTRATION OF TRITIUM TRANSFER IN THE BIOSYNTHESIS OF 2,7-DIHYDROXYCADALENE, AN ANTI-BACTERIAL SESQUITERPENE OF COTTON

Gordon D. Davis¹, Margaret Essenberg¹, and E.J. Eisenbraun², Department of Biochemistry¹, Department of Chemistry², Oklahoma State University, Stillwater, OK 74078-0454.

2,7-Dihydroxycadalene (DHC) is an anti-bacterial sesquiterpene produced in cotton inoculated with *Xanthomonas campestris* pv. *malvacearum* (Xcm), the causative agent of bacterial blight of cotton. To determine if 1-³H-farnesyl pyrophosphate (1-³H-FPP) would be an appropriate substrate for cyclase activity involved in DHC biosynthesis, a mixture of 5-RS-³H-mevalonolactone and 2-RS-¹⁴C-mevalonolactone was injected into Xcm-infected cotton cotyledons. Recovered doubly-labeled DHC was chemically degraded to yield doubly-labeled isobutyric acid (indicating tritium transfer). However, the ³H:¹⁴C ratio was unexpectedly elevated, a finding similar to that of Arigoni in the degradation of doubly-labeled avocettin [*Pure Appl. Chem.* (1975) 41, 219]. Treatment with 12N HCl at high temperature removed tritium from the isobutyric acid. Our results suggest 1) a 1,3-tritide shift accompanied cyclization, 2) 1-³H-FPP is a suitable substrate for cyclase assay, and 3) show an unexpectedly high ³H:¹⁴C ratio appeared in the degradation product which may have resulted from a tritium isotope effect that selectively protects 2-³H-isobutyric acid from further degradation (relative to 3-¹⁴C isobutyric acid). (Supported in part by the Oklahoma Agricultural Experiment Station and National Science Foundation Grant DMB 86-16650)

INHIBITION OF INFECTIVITY OF TOBACCO MOSAIC VIRUS BY METHYLATED QUERCETIN DERIVATIVES

Christopher J. French, Ragai K. Ibrahim and G.H. Neil Towers, Agriculture Canada, 6660 N.W. Marine Drive, Vancouver, B.C., CANADA V6T 1X2; Plant Biochemistry Department, Biology Department, Concordia University, Montreal, Quebec, CANADA H3G 1M8; Department of Botany, University of British Columbia, Vancouver, B.C., CANADA V6T 2B1.

Infectivity of tobacco mosaic virus (TMV) (U1 strain) was assessed by half-leaf local lesion assay on *Nicotiana glutinosa*. Prior to assay, TMV at 5 ug/ml was incubated for 30 min. with test compound at concentrations of 90, 9 or 0.9 ug/ml in 5% dimethylsulfoxide (DMSO)/NaPO₄ buffer, 10mM, pH 7.3. The following compounds were tested: 3-methyl quercetin (3-MQ); 3,7-dimethyl quercetin (3,7 DMQ); 4,7-dimethyl quercetin (4,7-DMQ); 3,3',4'-trimethyl quercetin (3,3',4'-TMQ); 3,7,4'-trimethyl quercetin (3,7,4'-TMQ); 3,7,3'4'-tetramethyl quercetin (3,7,3'4'-tetraMQ). 3-MQ and 4,7-DMQ did not affect infectivity. The order of effectiveness of the other compounds was 3,7,4'-TMQ > 3,3,4'-TMQ = 3,7,3',4'-tetraMQ = 3,7-DMQ. Methylation at the 3-, plus either the 7- or 4'-position was required for inhibition of virus infectivity.

The biosynthesis of furanocoumarins in parsley

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Parsley plants (*Petroselinum crispum*) respond upon infection with the fungal soybean pathogen *Phytophthora megasperma* by secreting antimicrobial coumarin derivatives into the infection droplets. Major components have been identified as umbelliferone and the linear furanocoumarins marmesin, psoralen and its methoxylated derivatives xanthotoxin, bergapten and isopimpinellin. The latter products are also present in healthy tissue, where they accumulate exclusively in the lumen of oil ducts. Cultured parsley cells secrete an almost identical pattern of coumarins into their culture medium upon treatment with a cell wall fraction of the fungus (elicitor). This system of reduced complexity was used to generate specific probes (antibodies and cDNA) for the analysis of gene expression in elicitor-treated cells and infected plants.

We could demonstrate that the mRNA activity changes of two enzymes, specific for the furanocoumarin pathway (SAM:xanthotoxol O-methyltransferase, XMTI; and SAM:bergapten O-methyltransferase, BMT), are regulated on the level of gene transcription. According to the bilocal occurrence of furanocoumarins in parsley leaves, constitutive and induced gene activities of BMT were observed in epithelial cells of oil ducts and a small area surrounding the penetration site of the fungus.

EXPRESSION OF THE TRICHODIENE SYNTHASE GENE OF FUSARIUM SPOROTRICHIOIDES IN E. COLI

Thomas M. Hohn and R.D. Plattner, Northern Regional Research Center, Agricultural Research Service, USDA, Peoria, IL 61604, U.S.A.

Trichodiene synthase is a sesquiterpene cyclase involved in the biosynthesis of trichothecene mycotoxins. A putative 60-nucleotide intron sequence was specifically deleted from the trichodiene synthase gene of *Fusarium sporotrichioides*. Insertion of the intron-deleted gene into the *E. coli* expression vector pDR540 resulted in the production of active enzyme. Trichodiene synthase activity in crude extracts from induced cultures was 0.07 nmol/min/mg of protein and represented 0.05-0.10% of the total cell protein. A cross-reactive protein was present with the same apparent M_r as the subunit of native trichodiene synthase. The recombinant enzyme was partially purified, and shown to have properties closely resembling those of the native enzyme. Trichodiene was detected in ethyl acetate extracts from induced cultures at a concentration of 60 g/l after 4.5 h. These findings confirm the primary structure recently reported for trichodiene synthase, and demonstrate that the expression of a sesquiterpene cyclase in *E. coli* results in sesquiterpene production.

REGULATION OF SOLANIDINE GLUCOSYLTRANSFERASE IN POTATO

Lisbeth Jonsson, Annika Bergenstrahle and Elisabeth Tillberg, Department of Plant Physiology, Swedish University of Agricultural Science, S-750 07 Uppsala, SWEDEN

Solanidine glucosyltransferase (GT) was partially characterized and studied in relation to glycoalkaloid accumulation in potato (*Solanum tuberosum* cv. Bintje). The enzyme was present in the soluble phase of leaves, sprouts and tubers. A partially purified preparation was obtained by ammonium sulfate fractionation, chromatofocusing and gel filtration of a tuber extract. The enzyme catalyzed glucosylation of solanidine but not of other steroidal alkaloids such as solasodine or tomatidine. UDP-Glucose, but not UDP-galactose was accepted as sugar donor. The GT had a pH optimum of 7.5, an apparent pI of 4.8 and an apparent molecular weight of 38,000.

The GT was induced in ageing potato slices, concomitant with markedly increased concentrations of glycoalkaloids. The sterol biosynthesis inhibitor tridemorph (10mg/l) reduced glycoalkaloid production in these slices to 25%, but without any effect on the level of GT activity. The results indicate that the level of solanidine GT activity in this system is independent of the amount of sterol precursors.

BIOTRANSFORMATION OF TRICOTHECENES BY FUSARIUM SPOROTRICHIOIDES MB5493

Susan P. McCormick, S.L. Taylor, R.D. Plattner and M.N. Beremand, USDA-Agricultural Research Service, Northern Regional Research Center Peoria, IL 61604 U.S.A.

Trichothecenes are sesquiterpenoid mycotoxins produced by several genera of fungi, including Fusarium. The biosynthesis of trichothecenes proceeds from the alicyclic hydrocarbon trichodiene (TD), which is the cyclization product of farnesyl pyrophosphate. The conversion of TD to T-2 toxin, the major trichothecene produced by F. sporotrichioides, is known to involve six oxygenations by molecular oxygen, but oxygenated intermediates have not been identified. Mutant strains of F. sporotrichioides have been generated with UV irradiation and selected by means of a monoclonal antibody screen. A number of possible oxygenated precursors of T-2 toxin were isolated from these mutants and from T. roseum, and others were obtained from chemical or biological transformations. In order to investigate the role of these compounds in T-2 toxin biosynthesis, they were fed to F. sporotrichioides MB5493, a mutant strain that accumulates trichodiene. Biotransformation of trichotriol, but not trichodiol, to T-2 toxin, suggests that oxygenation at the 3-position occurs prior to cyclization to the trichothecene skeleton.

Poster 8

PHYLOGENETIC DISTRIBUTION OF STEROLS IN ALGAE

Robert A. Norton, Sihua Xu, and W. David Nes. Plant and Fungal Lipid Research, Plant Physiology Research Unit, Russell Rsch. Ctr., 950 College Station Rd., Athens, Ga. 30613.

Three different algal systems were examined for their sterol content; I, Codium fragile; II, Ulva sp.; and III, Prototheca wickerhamii. The major sterols ($\geq 90\%$ the mixture) of I, II, and III were characterized by a combination of chromatographic (TLC, GLC, and HPLC) and spectral (MS and $^1\text{H NMR}$) techniques and shown to be 24 β -ethyl cholesta-5,27-dienol (clerosterol), 24E-ethyliden-cholest-5-enol (isofucosterol) and 24 β -methyl-cholesta-5,7,22-trienol (ergosterol), respectively. While I and II are filamentous and green, III is a single-cell colorless organism throughout its life cycle. Some investigators have considered Prototheca to be a yeast-like cell or protozoan. From the 4,4-dimethyl sterol fraction of III cycloartenol was detected. The presence of cycloartenol in the cells supports a photosynthetic lineage from the algal ancestor Chlorella. Many minor sterols were also isolated from the algae including cholesterol. Apparently the genes for the Δ^{24} -reductase and S-adenosylmethionine C-24 transferase are distributed generally throughout the algae but regulated in unknown ways. Interestingly, when 10 $\mu\text{g/ml}$ of cholesterol, isofucosterol, clerosterol, or ergosterol were fed to the mutant yeast (GL-7) sterol auxotroph each satisfactorily played the bulk membrane role.

Poster 9

PURIFICATION AND BIOASSAY OF ZINGIBERENE FROM GINGER ROOT AND TOMATO

J.N. Sacalis, T.J. Gianfagna, and C.D. Carter, Department of Horticulture and Forestry, Cook College, Rutgers University, New Brunswick, NJ 08903.

Hexane extracts of ginger (Zingiber officinale) root were partially purified by HPLC, using two 57 cm by 6.5 mm preparative columns in series packed with C-18 Porasil, and a flowrate of 5 ml/min with a gradient from aqueous 40% acetonitrile to 100% acetonitrile. The peak containing zingiberene and closely related sesquiterpenes was fractionally collected and contained 66% zingiberene, 33% curcumene and 1% bisabolene, as determined by GC-MS. This fraction (Z+) was concentrated under nitrogen and redissolved in ethanol for bioassay on Colorado potato beetle, resulting in an LD_{50} of 7 μg sesquiterpenes per larva.

A concentrated hexane extract of leaves of the wild tomato species Lycopersicon hirsutum f. hirsutum was subjected to argentation TLC on silica gel G, using hexane, ethyl acetate, and ether (100:2:1) as a mobile phase. Bands of interest were extracted into hexane and the compounds identified by GC-MS. Isolation of zingiberene by this method resulted in better than 99% purity. Results of CPB bioassays of purified zingiberene will be presented.

BIOLOGICALLY ACTIVE FURANOCOUMARINS OF THE MORACEAE

Lee A. Swain and Kelsey R. Downum, Department of Biological Sciences, Florida International University, Miami, FL 33199

The furanocoumarins constitute an important class of secondary plant compounds which, when activated by UVA irradiation, are toxic to many potentially deleterious organisms. The plant families Rutaceae (Citrus family), Umbelliferae and Moraceae (fig family) are characterized by the presence of these compounds. Unlike the Rutaceae and the Umbelliferae, the distribution of furanocoumarins in the Moraceae is limited to the genus Ficus. We have recently discovered furanocoumarins in the two herbaceous genera of this family, Dorstenia and Fatoua. To date, all species of these genera tested have yielded at least one furanocoumarin. Extracts of Dorstenia and Fatoua, particularly root extracts, displayed phototoxic effects toward laboratory test organisms. This suggests that furanocoumarins may provide an important chemical defense against soil-bound invaders.

Poster 11

INDOLE ALKALOIDS FROM HAIRY ROOT CULTURES OF CATHARANTHUS ROSEUS

Leena Toivenen, John Balsevich, and Wolf G.W. Kurz, Plant Biotechnology Institute, National Research Council of Canada, Saskatoon, Saskatchewan, CANADA S7N 0W9

Hairy root cultures of Catharanthus roseus were established by infection with six different Agrobacterium rhizogenes strains. Two plant varieties were used and found to exhibit significantly different responses to infection. Forty-seven hairy root clones derived from normal plants and two derived from the flowerless variety were screened for their growth and indole alkaloid production. The growth rate and morphological appearance showed wide variations between the clones. The alkaloid spectra observed were qualitatively but not quantitatively very similar to that of the corresponding normal plant roots. No vindoline or deacetyltransferase activity could be detected in any of the cultures studied. O-Acetylvallesamine, an alkaloid which has not been previously observed in C. roseus was identified from extracts of hairy root clone #8. Two root clones were examined for their growth and alkaloid accumulation during a 26-day culture period. Alkaloid accumulation paralleled growth in both clones with ca. 2 mg ajmalicine and catharanthine per g dry weight being observed.

Poster 12

LOCALIZATION OF PHENOLIC COMPOUNDS IN THE SEEDS OF SOLANUM PTYCANTHUM.

Alicja Zobel, Katherine Ward and Christine Maxwell, Department of Chemistry and Department of Biology, Trent University, Peterborough, Ontario K9J 7B8.

Localization of phenolic compounds was investigated in hand cut sections of unfixed seeds and the material fixed in glutaraldehyde + 0.1% caffeine. Examination with the electron microscope revealed phenolics located in the vacuoles of cells of different tissues, varying with stages of embryo development. In semi-thin sections, histochemical reactions showed the presence of phenolic compounds in the seed coat. Their appearance is strictly correlated with the development of the characteristic thickening of the cell walls in the outermost layer of the seed coat. UV fluorescence on hand cut cross sections of mature seeds suggests that the deposition of phenolics is between the seed coat and the embryo itself.

MEETINGS AND PROGRAMS OF INTEREST

19TH FEBS MEETING: Rome, Italy, July 2-27, 1989. For further information, contact Studio EGA s.r.l., Viale Tiziano 19, 00196 Roma, Italy. (Tel. 6-3960341).

PHYTOCHEMICAL SOCIETY OF EUROPE: SIGNAL PERCEPTION AND TRANSDUCTION IN HIGHER PLANTS: Toulouse, France, July 9-13, 1989. For further information, contact Dr. R. Ranjeva, Centre de Physiologie Vegetale de l'Universite Paul Sabatier, URA CNRS 241, 118, Route de Narbonne, F-31062 Toulouse Cedex, France.

NORTH AMERICAN SYMBIOTIC NITROGEN FIXATION CONFERENCE: Department of Genetics, Iowa State University, Ames, Iowa, July 30-August 3, 1989. For further information, call Dr. Alan G. Atherly, (Tel. 515-294-3908).

XI INTERNATIONAL COLLOQUIUM ON PLANT NUTRITION: Wageningen, July 30-August 4, 1989. For further information, contact Dr. Ir. M.L. van Beusichem, Department of Soil Science and Plant Nutrition, Wageningen Agricultural University, P.O. Box 8005, NL6700 EC Wageningen, The Netherlands.

VII INTERNATIONAL CONGRESS ON PHOTOSYNTHESIS: Stockholm, August 6-11, 1989. For further information, contact Prof. Margareta Baltschaffsky, Department of Biochemistry, University of Stockholm, S-106 91 Stockholm, Sweden.

THIRD INTERNATIONAL WORKSHOP ON SEEDS: RECENT ADVANCES IN DEVELOPMENT AND GERMINATION: College of William and Mary, Williamsburg, VA, August 6-12, 1989. For further information, contact R.B. Taylorson, USDA/ARS, Room 218, Building 004, BARC-West, Beltsville, MD 20705.

SIXTEENTH ANNUAL MEETING OF THE PLANT GROWTH REGULATOR SOCIETY OF AMERICA (JOINT MEETING WITH THE BRITISH PLANT GROWTH REGULATOR GROUP): Arlington, VA, August 6-10, 1989. For further information, contact Dr. Tom Davenport, Univ. of Florida, TREC, 18905 SW 280th St., Homestead, FL 33031 (Tel. 305-246-6341).

FIRST INTERNATIONAL SYMPOSIUM ON THE MOLECULAR BIOLOGY OF THE POTATO: Bar Harbor, ME, August 13-18, 1989. For further information, contact Dr. Michael E. Vayda, Dept. of Biochemistry, 177 Hitchener Hall, Univ. of Maine, Orono, ME 04469 (Tel. 207-581-2821) or Dr. William Park, Dept. of Biochemistry and Biophysics, Texas A & M Univ., College Station, TX 77843.

FIFTEENTH EMBO SYMPOSIUM ON MOLECULAR COMMUNICATION IN HIGHER PLANTS: Heidelberg, West Germany, September 18-21, 1989. Participants will be limited to 250. Applications should be addressed to Dr. J. Tooze, EMBO, Postfach 1022.40, D-6900 Heidelberg, West Germany.

SECOND INTERNATIONAL SYMPOSIUM ON BIOTECHNOLOGY AND FOOD SAFETY: College Park, MD, October 10-12, 1989. For additional information, contact Dr. Donald Bills (Tel. 301-344-3338).

NINTH ANNUAL SYMPOSIUM ON CURRENT TOPICS IN PLANT BIOCHEMISTRY AND PHYSIOLOGY: Columbia, MO, 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, CO, 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.

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 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 before May 30, 1989 to Prof. Raymond Bouillard, JIEP 90, Universite Louis Pasteur, Institut de Chimie - BP296R8, 1 Rue Blaise Pascal, 67008 Strasbourg Cedex - France. (The PSNA secretary has a pre-registration form and will send a xerox copy to anyone who requests one. Call 301-337-6303.)

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, Eidgenössische Technische Hochschule, ETH-Zentrum, CH-8092, Zürich, Switzerland.



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PHYTOCHEMICAL SOCIETY OF NORTH AMERICA

Newsletter

**Volume 29
Number 2**

November 1989

THE 1989 ANNUAL MEETING AT VANCOUVER

As participants gathered at the University of British Columbia, skies were clear and the weather was unusually warm. Of the 75 registered participants, 35 were members, 17 non-members, 14 graduate students and eight graduate students presenting a paper.

Following the warm welcoming reception, rains came overnight. The cooler weather and cloudy skies were good incentives for conscientiously attending symposium and contributed paper sessions in the Law School lecture hall. These outstanding facilities were only a short walk from the

Gage Residences. Recreational activities included the Monday Evening Supper Cruise, a free afternoon on Tuesday followed by a salmon Barb-B-Q in the evening, the PSNA Banquet at the UBC Faculty Club on Wednesday evening and a post-meeting tour of the Triumph facility adjacent to the UBC campus.

Again, many PSNA meeting activities were recorded on film and a collection of photographs taken by Bruce B. Stowe and Connie Nozzolillo can be found in the meeting centerfold.

MINUTES OF THE 29TH ANNUAL BUSINESS MEETING

The 1989 business meeting of the Phytochemical Society of North America was called to order by President David Seigler at 4:25 P.M., June 28, 1989.

It was moved and seconded that the minutes of the 1988 Annual Meeting at Iowa City be accepted as published in the November 1988 Newsletter. Secretary Helen Habermann reported that postage rates and printing costs for the newsletter have risen appreciably during the past year. These increases should be compensated for in part by implementation of desktop publishing some time in the next year. Newsletters with smaller print and more material per page should have fewer pages and reduced mailing costs per copy. The PSNA brochures printed and distributed to all members with the fall 1988 newsletter resulted in more than 50 new members (increased numbers have also added to postage and printing costs). Additional copies of the brochure are available from the secretary (one will be distributed with each copy of the fall 1989 newsletter). The secretary welcomes notices of positions available and positions wanted (these are free advertisements!) and would appreciate being informed about meetings and programs on subjects of interest to PSNA members. Those who attend meetings of other societies, especially meetings held abroad, are urged to send reports to the secretary for inclusion in the newsletter. Book reviews would also be most welcome.

Neil Towers reported that there were 75 registered participants at the 1989 meeting and thanked Bruce Bohm for his assistance in organizing the program.

Klaus Fischer reported on plans for the PSNA meeting in Quebec City, Canada, during August, 1990. This will be a joint meeting with the International Society of Chemical Ecology. The PSNA Symposium will be on "Methodologies in Phytochemistry" (including new developments in separations). Several speakers had already been contacted.

President Seigler announced that the 1991 annual meeting, the 30th anniversary of the founding of our society, will be held at Colorado State University, site of the first meeting in 1961. Frank Stermitz has agreed to organize the meeting and the symposium will be on phenolic compounds (as it was in 1961). The 1992 meeting will be in Miami, a joint meeting with the Phytochemical Society of Europe. The symposium will be on Tropical Botany.

President Seigler announced the appointment of two new

members to the Advisory Committee: G.B.N. Towers and George Wagner. Continuing members of the committee are Lee Creasy, Giza Hrazdina, Dick Mansell and Connie Nozzolillo. Members of the advisory committee have been asked to explore the possibilities for increased corporate support and future meeting sites. It was suggested that Advisory Committee members be listed on the inside cover of the newsletter or in the directory in order to be identifiable by members wishing to communicate with them.

Jim Saunders announced that there were two Best Student Paper award winners this year: Thomas Glendenning, University of Iowa, and Lillian Latchinian, Concordia University, Montreal. Both received checks for \$100 for their excellent research and presentations.

Travel awards in amounts up to 50% of economy air fare were awarded to the following students who presented papers:

Mark A. Bernards
Department of Chemistry and Biochemistry
University of Guelph
Guelph, Ontario N1G 2W1
Canada

Anita M. Brinker
Department of Plant Biology
University of Illinois
Urbana, IL 61801

Peter Constabel
Biochemistry Department
University of Montreal
Montreal, Quebec H3C 3J7
Canada

Thomas M. Glendenning
Department of Botany
University of Iowa
Iowa City, IA 52242

Nancy K. Lane
Department of Biology
University of South Florida
Tampa, FL 33620

Lilian Latchinian
Plant Biochemistry Laboratory
Department of Biology
Concordia University
Montreal, Quebec H3G 1M8
Canada

Cecilia A. McIntosh
Department of Biology
University of South Florida
Tampa, FL 33620

Dominique Provost-Buisson
Department of Biology
Florida International University
Miami, FL 33199

Lee A. Swain
Department of Biological Sciences
Florida International University
Miami, FL 33199

Treasurer Kelsey Downum reported that the PSNA now has record assets and numbers of members (see table summarizing membership for the years 1979-1989). Royalties on volumes of *Recent Advances in Phytochemistry* continue to add between \$3,000 and \$4,000 per year to PSNA income (see table summarizing royalties for volumes 10-21). A complete financial report will be included in the February issue of the newsletter.

Dave Seigler acknowledged support for the Vancouver meeting from the following sources: The Natural Sciences and Engineering Research Council of Canada (\$3,500), Monsanto Company (\$700), and American Cyanamid Company (\$250).

Volume 23 of *Recent Advances in Phytochemistry* was scheduled to be available in July. Helen Stafford has agreed to serve as editor-in-chief to replace Eric Conn who last year announced that he would retire after publication of Volume 23. A new contract with Plenum Publishing Corporation was signed during the spring. Terms of the new contract are essentially unchanged with continued availability of a 40% discount for PSNA members on all *Recent Advances in Phytochemistry* volumes published by Plenum.

Dave Seigler praised the contributions to the PSNA of Eric Conn as editor of the symposium volumes and announced that he was recovering from quintuple bypass surgery. Bernard Phinney proposed that the best wishes of the society be communicated to Eric (a get-well card was circulated at the Thursday morning session for all to sign).

Election results were announced. Brian Ellis is our president-elect.

Stewart Brown proposed establishing a Phytochemical Repository citing the following reasons:

1. Many investigators face the problem of finding rare chemicals that are not available from commercial sources. They may be available from other investigators but are difficult to locate without a centralized listing.

2. If there is a change in direction of research, an investigator frequently has a collection of chemicals that are no longer needed. They take up space and most would prefer to donate them to a repository rather than discard them.

3. Investigators approaching retirement are also reluctant to discard collections of chemicals. Frequently there is no colleague willing to assume responsibility for maintaining samples or distributing chemicals to those who need them. Also in cases of sudden death, there is no possibility of distributing collected chemicals to colleagues or investigators at other institutions.

It was noted that most institutions would need long-term external funding to support the cost of housing, maintaining, cataloguing and distributing chemicals in the proposed repository. Decisions would have to be made concerning the site of the repository, the number of personnel required, what fees should be charged for use of the collection, how a diverse stock of chemicals could be acquired and how to distribute information about the collection. Cataloguing would most likely be done by computer.

Steward Brown moved that (1) the PSNA approve in principle the establishment of a Phytochemical Repository and (2) the society establish a committee to study the feasibility of establishing the repository and make its recommendations to the Executive Committee before the next annual meeting.

In the discussion which followed, there was general support for the idea of a phytochemical "bank." Connie Nozzolillo suggested that the American Type Culture Collection might serve as a model for its organization. Jim Saunders indicated that the USDA may be interested in housing and supporting it. Jonathan Poulton proposed the establishment of a computerized directory of chemicals as an alternative means of facilitating exchange of information about the location and availability of rare plant chemicals. Bruce Bohm reported that he had received an inquiry from a commercial firm in Great Britain which serves as an agent for location and sale of unusual chemicals.

At the end of the discussion Dave Seigler asked for volunteers to investigate the establishment of a Phytochemical Repository. Stewart Brown, Norman Lewis, Jim Saunders and Klaus Fischer agreed to serve on this committee.

A further item of new business was raised by Stewart Brown who questioned the use of postcards as ballots for PSNA elections. It was suggested that those members who are concerned about the secrecy of their ballots could return them in envelopes.

The meeting was turned over to new president Jonathan Poulton who entertained a motion to adjourn. Frank Einhellig moved adjournment, his motion was seconded and the meeting ended at 5:25 P.M.

Respectfully submitted,

Helen M. Habermann

SUMMARY OF THE EXECUTIVE COMMITTEE MEETING

Neil Towers, chairman of the local organizing committee for the 1989 annual meeting, reported that all was well. A tour of the Triumph nuclear facility for all interested had been arranged for Friday, June 30. No figures were available on the number registered for the meeting. Neil noted that the Phytochemical Society of Europe was having the same symposium topic this year as the PSNA and stressed the need for closer communication between the two societies.

President Dave Seigler reported on the 1990 meeting in Quebec. Klaus Fischer had the symposium mostly planned but dates for the meeting had not yet been set. Jeremy MacNeill, the local organizer, will try not to schedule concurrent sessions of PSNA and ISCE symposia so that these talks can be attended by members of both societies. Jonathan Poulton expressed concern about the uncertain dates (probably August?) and the possible length of the meeting. It was suggested that shorter talks might reduce the time needed for symposia. There was no report on symposium speakers, but Dave Seigler indicated that Klaus Fischer had most speakers lined up.

The 1991 meeting will be held at Colorado State University, Fort Collins, CO, and the local organizer will be Frank Stermitz. After considerable discussion the symposium topic "Recent Advances in Phenolic Biochemistry" was chosen. Ragai Ibrahim and Helen Stafford were appointed to organize the symposium. The 1991 meeting will be the 30th anniversary of the founding of the society and Fort Collins was the first meeting site. It seemed appropriate that the topic of the first meeting be chosen again. A mini-symposium on "Alkaloids" was suggested by John Romeo. The "Bioassay" topic originally suggested by Dave Seigler was tentatively scheduled for the 1993 meeting.

Dave Seigler reported that the Phytochemical Society of Europe enthusiastically agreed to the proposed joint meeting in Miami in 1992. Kelsey Downum was selected to be the local organizer. The program will be organized by Kelsey Downum and John Romeo. Kelsey reported that Florida International University and Fairchild Tropical Garden have promised support (financial and otherwise). The meeting could be held at Miami Beach (in a hotel on the beach) or the north campus of Florida International University (on the inland waterway). The symposium topic, "Phytochemistry of Tropical Plants," should fit nicely with the subtropical setting. One day of the meeting will be spent at Fairchild Tropical Garden with talks, a tour of the garden and research facilities. Participation of Latin American phytochemists will be encouraged and several were suggested as possible symposium speakers. The committee unanimously agreed to provide PSE \$5,000 for support of travel from Europe to Miami.

There are no firm plans for meeting locations for years beyond 1992. However, Blacksburg, VA, was suggested and "Bioassays" was proposed as a symposium topic. Norman Lewis will be contacted concerning organization of the meeting. Potential topics for future meetings will be circulated by executive committee members and discussed at future meetings.

It was unanimously agreed to accept the PSNA logo design for incorporation into the society's stationery and newsletter.

Improvements in the newsletter were discussed. The executive committee felt that further improvements should be made and that the contents of the newsletter should be expanded to include 1) biographies of members nominated to run for office; 2) reports on meetings that might be of interest to PSNA members; 3) more positions available; 4) listings of new books and book reviews; 5) news of members including moves, promotions, retirements, deaths, etc.; and 6) increased scientific content including mini-reviews of selected topics.

Kelsey Downum mentioned that the society has obtained a desktop publishing program which could be used to assemble the newsletter. The use of electronic mail was suggested as a way of transmitting newsletter information rapidly.

Dave Seigler announced that he had appointed Neil Towers and George Wagner to the Advisory Committee. It was suggested that names, addresses and terms of Advisory Committee members be listed on the inside of the newsletter cover. The need for funds to cover phone, travel, postage or other costs of Advisory Committee members was discussed. The possibility of creating a PSNA award for outstanding paper or research during the previous year was raised.

All agreed that support of student travel to the annual meeting was a good investment. Three-thousand dollars was allocated for student travel in 1990.

The Life Membership Award was discussed but no nominations were made.

Kelsey Downum presented the treasurer's report. The society currently has a record number of members and a record balance in the treasury.

The question of order of listing of editors for the *Recent Advances in Phytochemistry* volumes was discussed. It was agreed that the meeting organizer(s) should be listed first and followed by the editor-in-chief. A budget of \$2000 was approved for the work of the editor-in-chief. The use of electronic mail to transmit manuscripts was discussed. A copy of the new contract with Plenum was circulated.

In the 1989 election, 135 ballots were received. The candidates for president-elect were George Wagner and Brian Ellis. Brian Ellis was elected. No other officers were being elected and there were no constitutional amendments on the ballot. There was a brief discussion of the duties of the past president.

This summarizes matters discussed during a lengthy meeting of the executive committee during the morning of June 25, 1989. The secretary, who was not informed of the time of the meeting, thanks Kelsey Downum for taking notes.

Respectfully submitted,

Helen M. Habermann

BIOGRAPHIES: BEST STUDENT PAPER AWARD WINNERS

THOMAS M. GLENDENING received his B.S. degree in Agronomy from Purdue University in 1974. After serving four years in the U.S. Army, he worked three years as an agronomist for Standard Oil of Ohio. He then began his graduate work at The University of Iowa where he obtained an M.S. degree in Botany in 1986. His master's research was in the area of plant tissue culture of Crucifers and included: regeneration of plants from callus and suspension cultures, protoplast isolation and culture, and genetic analysis of regenerated plants. Tom is currently completing his Ph.D. degree in the laboratory of Dr. Jonathan E. Poulton where his research involves the purification and characterization of a novel sulfotransferase involved in the biosynthesis of glucosinolates. His research interests include purifying and characterizing proteins, enzyme kinetics, and elucidating biosynthetic pathways in plant natural product metabolism.



LILIAN LATCHINIAN-SADEK is currently completing her Ph.D. in Plant Biochemistry at Concordia University, Montreal, Canada. After receiving her Bachelor's degree in Pharmaceutical Sciences from the Faculty of Pharmacy, Cairo University, Egypt, in 1983, she enrolled in the M.Sc. program at the Department of Pharmaceutics of the same Faculty. She completed a number of graduate courses prior to moving to Canada in the summer of 1985. In Montreal, she started her graduate work in Plant Biochemistry with Dr. R.K. Ibrahim at Concordia University. By fall of 1987 she had progressed from the M.Sc. to the Ph.D. program. Lilian's research interests include characterization, purification, and localization of enzymes involved in the biosynthesis of plant natural products (particularly flavonoids). Her studies also deal with the production, identification, and purification of polyclonal and monoclonal antibodies to such plant enzymes. After completion of her Ph.D., Lilian intends to pursue post-doctoral studies in the field of Plant Biochemistry.

PSNA BROCHURE ENCLOSED: PLEASE PASS IT ON!

Some copies of the PSNA brochure prepared last year are still available. One is enclosed with each copy of this newsletter. Please pass it along to a colleague, a student or postdoc, an acquaintance at another institution, someone from whom you request a reprint or someone who requests a reprint from you. Non-members can be identified by checking your PSNA Directory.

If you need additional copies of the brochure, please write, call or contact the secretary by electronic mail.

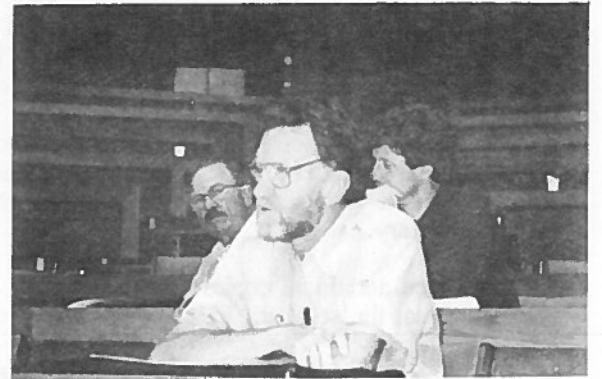
Applications for membership in PSNA (in the brochure or inside the back cover of every issue of the newsletter) should be mailed to the treasurer.

The brochure will be reprinted when copies of the current version are exhausted. Your suggestions concerning color, contents, graphics, etc., should be sent to the secretary. If someone doesn't come up with a substitute for the Iowa corn fields design, it will be used again.

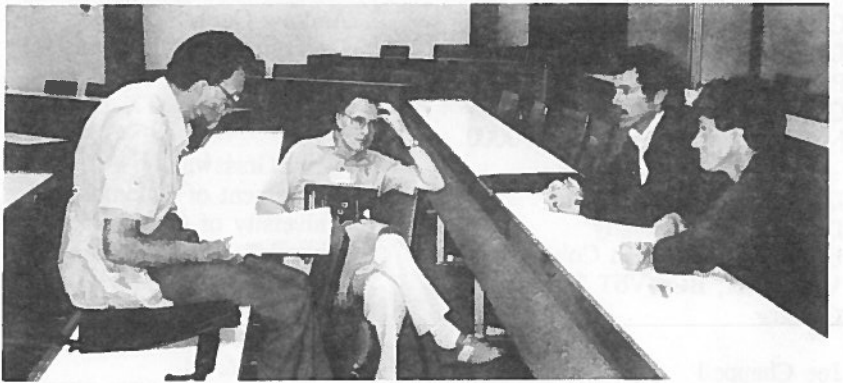
RECENT ADVANCES IN PHYTOCHEMISTRY ROYALTIES

| Volume | | 1984 | 1985 | 1986 | 1987 | 1988 | Total | # Sold |
|--------|--------------------------|---------|---------|---------|---------|--------|---------|--------|
| 10 | Wallace/Mansell | 62.39 | 57.94 | 45.86 | 55.56 | 31.06 | 3448.24 | 1897 |
| 11 | Runeckles/Loewus | 19.00 | 9.85 | 47.64 | 39.46 | 42.14 | 4563.10 | 1148 |
| 12 | Swain/Harborne | 95.62 | 64.30 | 86.78 | 60.50 | 48.11 | 5759.93 | 1404 |
| 13 | Swain/Waller | 31.14 | 23.21 | 24.79 | 24.48 | 9.08 | 2004.61 | 836 |
| 14 | Swain/Kleiman | 53.05 | 21.46 | 33.21 | 46.82 | 19.29 | 1890.07 | 755 |
| 15 | Loewus/Ryan | 140.10 | 44.71 | 59.50 | 91.30 | 53.08 | 3359.92 | 891 |
| 16 | Creasy/Hrazdina | 214.18 | 99.64 | 45.46 | 78.97 | 59.35 | 3052.23 | 842 |
| 17 | Nozzolillo <i>et al.</i> | 377.01 | 235.19 | 124.45 | 182.23 | 95.11 | 3088.91 | 741 |
| 18 | Timmermann | 2332.30 | 546.31 | 355.90 | 329.84 | 183.15 | 3747.50 | 787 |
| 19 | Swain <i>et al.</i> | | 2109.77 | 404.34 | 347.30 | 194.17 | 3055.58 | 723 |
| 20 | Conn | | | 2640.23 | 280.77 | 234.50 | 3155.50 | 601 |
| 21 | Conn <i>et al.</i> | | | | 2287.89 | 135.60 | 2423.49 | 496 |

PSNA ANNUAL MEETING CENTERFOLD



VANCOUVER, B.C., JUNE 25 - 30, 1989



NEW PSNA MEMBERS

We welcome the 46 new members listed below. All are invited to participate in society business and future PSNA meetings.

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Canada

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** | 34 | 67 | 45 | 53 | 446 |

*Data not available

**As of November, 1989

PLANS FOR PSNA MEETINGS: 1991 AND BEYOND

Our 31st Annual Meeting will be held June 22 to 26, 1991, at Colorado State University, Fort Collins, CO. Frank Stermitz and Sue Martin will serve as the local organizing committee. This meeting marks the 30th anniversary of the founding of the PSNA, originally called the Plant Phenolics Group of North America, at a meeting also held at Colorado State University, in 1961. The symposium topic for 1991 will be "Phenolics in Plants." Meeting organizers, Helen Stafford and Ragai Ibrahim, are already inviting speakers on a wide range of subjects including the chemistry, biochemistry, molecular genetics and biology of phenolics in plants.

The 1992 joint meeting with the Phytochemical Society of Europe will be held in Miami, Florida. Kelsey Downum will chair the local organizing committee. Kelsey Downum and Jack Romeo will co-chair the symposium committee. Latin American Phytochemists also will be invited to attend this meeting. The symposium topic will be "Phytochemistry of Tropical Plants." Travel support will be available for both PSE members and Latin Americans coming to the Miami meeting.

THE PHYTOCHEMICAL SOCIETY OF NORTH AMERICA 30TH ANNUAL MEETING, 1990

The next annual meeting of the PSNA will be held August 12-15, 1990, on the campus of Laval University, Quebec City, Canada. It will be a joint meeting with the International Society of Chemical Ecology (ISCE). The meeting organizers are N.H. Fischer of Louisiana State University, M.B. Isman of the University of British Columbia and J.N. McNeil of Laval University. As in past years, the meeting will consist of contributed papers, posters and a symposium. The 1990 symposium is entitled: "Modern Phytochemical Methods." Contributed papers are welcome on any aspect of plant chemistry.

The following have accepted our invitation to participate in the 1990 symposium. The titles of their papers are listed.

Dr. Joe P. Foley, Department of Chemistry
Louisiana State University, Baton Rouge, Louisiana

Supercritical Fluid Chromatography in Natural Products Analysis

Dr. Jonathan Gershenzon, Institute of Biological Chemistry
Washington State University, Pullman, Washington

Ecological Function of Trichome Constituents in Higher Plants

Dr. Kurt Hostettmann, Institute of Pharm. & Phytochemistry
University of Lausanne, Switzerland

New Developments in the Separation of Natural Products

Dr. Charles Pidgeon, Department of Industrial
& Physical Pharmacology
Purdue University, West Lafayette, Indiana

Immobilized Artificial Membrane Chromatography

Dr. Jan St. Pyrek, College of Pharmacy
University of Kentucky, Lexington, Kentucky

New Mass Spectral Methods in Natural Products Structure Elucidations

Dr. Nikolaus H. Fischer, Department of Chemistry
Louisiana State University, Baton Rouge, Louisiana

New NMR Methods in Phytochemical Studies

Dr. David L. Smith, Department of Medicinal Chemistry
Purdue University, West Lafayette, Indiana

Methods of Mass Spectrometry for the Structure Elucidation of Natural Products

Dr. Otmar Spring, Institut für Biologie I
University of Tübingen, West Germany

Trichome Microsampling of Sesquiterpene Lactones for the use of Systematic Studies

No information is yet available about the time of registration, schedules for symposium or contributed paper sessions, excursions or social events.

Funds will be available to provide travel assistance (up to half of the cost of economy air fare) for graduate students presenting oral papers at the 1990 meeting. In addition, an award of \$100 will be presented for the best paper by a graduate student or postdoc.

If you would like further information about the 1990 PSNA meeting, please contact:

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