PROGRAM AND ABSTRACTS

COMBINED ANNUAL MEETING

25-30 June 1989

University Hilton, Los Angeles
Los Angeles County Museum of Natural History
Davidson Conference Center, University of Southern California

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IN MEMORIAM

Frank R. Bernard

Gilbert L. Voss

55TH ANNUAL MEETING, AMERICAN MALACOLOGICAL UNION

James H. McLean, President

22ND ANNUAL MEETING, THE WESTERN SOCIETY OF MALACOLOGISTS

Hans Bertsch, President

25-30 JUNE 1989

Meeting Chairpersons

Conference Registrar	Henry W. Chaney
Bourse	Edward C. Nieburger
Logo	Sue Stephens
Tee Shirts	Anne Joffe
AMU Conservation Committee	C. Clifton Coney
Council of Systematic Malacologists	William K. Emerson
WSM Auction	Henry W. Chaney
AMU Student Talk Award	Clement L. Counts III
WSM Student Grant Award	Vida C. Kenk

Symposium Organizers

Biology of Pelagic Gastropods	Roger Seapy
Biology of Scaphopods	Ronald L. Shimek
Western Land Snails	F. G. Hochberg Barry Roth

Field Trip Leaders

Marine Dredging	Robert Howley
Scuba	Hans Bertsch
Pleistocene Fossils	George L. Kennedy
San Gabriel Mountains Excursion	Richard V. Lamb

Facilities Coordinators

University Hilton	Ila Johnson
Davidson Conference Center	Sonia Harris
USC Summer Conference Coordinator	Sandra Plotin
USC Residendial Dining	Donald L. Ouellete
Town and Gown Banquet Hall	Clarence R. Wynne
Natural History Museum	Allison P. Boyer Richard Young

PROGRAM SUMMARY

Sunday, June 25

Monday, June 26

Tuesday, June 27

Wednesday, June 28

9:00 - 5:00	Registration and poster displays. Davidson Conference Center, Room 220.
8:15 -12:00	Symposium: Western North American Land Mollusks, I. Davidson, Room 1 20
1:40 - 5:00	Symposium: Western North American Land Mollusks, II. Davidson, Room 1 21
1:40 - 5:00	Contributed Papers: Marine Gastropods, I. Davidson, Room 221 22
11:00 - 5:00	Bourse (book, shell, and art sales). Davidson, Room 101 7
7:30	Institute of Malacology (closed). University Hilton, Room 212.
7:30 -10:00	Slide Presentions of General Interest. Natural History Museum, Auditorium 23

Thursday, June 29

9:00 - 5:00	Registration and poster displays. Davidson Conference Center, Room 220.
8:30 -12:00	Symposium: Western North American Land Mollusks, III. Davidson, Room 1 24
8:40 -12:00	Contributed Papers: Marine Bivalves & Cephalopods. Davidson, Room 221 25
1:40 - 4:00	Contributed Papers: Marine Gastropods and Miscellaneous Topics, Davidson, Room 1 26
9:00 - 2:00	Bourse (book, shell, and art sales, continued). Davidson, Room 101 7
4:00	Business Meeting, American Malacological Union. Davidson, Room 1 7
5:00	Business Meeting, Western Society of Malacologists. Davidson, Room 1 7
7:00	Social hour, cash bar. USC Town & Gown Banquet Hall 7
8:00	Banquet. Town & Gown 7

Friday, June 30

8:00 - 5:00	Field trips (see bulletin board for departure times).
9:00 - 5:00	Open house at LACM Malacology and Invertebrate Paleontology Collections.

Saturday, July 1

9:00 - 5:00	Open house at LACM Malacology and Invertebrate Paleontology Collections.

REGISTRATION

Following the Sunday registration in the lobby of the University Hilton, the registration tables will be located in Room 220 in the Davidson Conference Center. AMU and WSM publications will be available, as will the meeting Tee shirt, tickets for the barbecue, banquet, and field trips.

ACTIVITIES

AMU Conservation Committee

All registrants are invited to the open meeting of the Conservation Committee in the University Hilton Ballroom at 3:00 Sunday afternoon.

Council of Systematic Malacologists

Members of the CSM are urged to attend the annual meeting in the University Hilton Ballroom at 4:00 Sunday afternoon. The purposes of the CSM are to formulate goals, priorities, and policies concerning the growth, development, maintenance and use of molluscan resources in systematic collections, and to represent malacological collection resources to the Association of Systematic Collections.

Presidents' Reception

All registrants are invited to the reception Sunday evening at 8:00 in the main Foyer of the Natural History Museum. Please enter through the Exposition Blvd. entrance (up the stairs). This is only a short walk from the University Hilton. Parking is available in the museum's lots. Mixed drinks, soft drinks, and desserts will be provided. Come and renew old acquaintances and make new ones.

Evening Programs at the Natural History Museum

On Monday and Wednesday evenings from 7:30 to 10:00 the Conchological Club of Southern California is hosting slide presentations of general interest. Refreshments are provided. Parking is available in the museum's lots. Please enter the Museum through the staff entrance, down the ramp below the main entrance (down the stairs from the staff parking lot).

Barbecue

A social hour (5:30 PM) and outdoor barbecue (6:30 PM) are scheduled for Tuesday evening (adjacent to the parking structure and south of Birnkrant Residence Hall). Please purchase your tickets by Monday afternoon so that the caterer may know the number of guests.

Auction

An auction of books and shells will be held Tuesday evening in the Common Room (2nd floor) of Pardee Tower dormitory by the W.S.M. Henry Chaney will be the auctioneer. A.M.U. and W.S.M. members are invited to participate in the bidding. Immediately preceding the auction there will be a reprint sale (7:45 PM). Auction and reprint proceeds are used to support the student grant fund of the W.S.M.

Bourse

Bourse Chairman Edward Nieburger has arranged for a sales area for shells, books, art work and shell motif objects, in Room 101, the main level of Davidson, open on Wednesday from 11:00 AM to 5:00 PM, and Thursday from 9:00 AM to 2:00 PM. Exhibitors are Al & Bev Deynzer's Showcase Shells (Sanibel Island, Florida), Donald Dan's Selected Specimen Shells (West Friendship, Maryland), Richard Goldberg's Worldwide Specimen Shells (Fresh Meadow, New York), Donald Hahn's Antiquarian Books (Cottonwood, Arizona), Peggy Williams' Shell Elegant (Tallevast, Florida), Mathilda Duffy's shell drawings (Watertown, Massachussetts). This event is open to non-registered participants.

Field Trips

Those who have signed up for a field trip will find information, including names on the list and departure times, posted on the bulletin board in the registration room. All field trips include a box lunch. If you wish to sign up for a field trip please do so early in the meeting so that transportion can be arranged.

Sightseeing Trips

Tour buses stop by advance arrangement at the University Hilton and Vagabond Motel for city tours and day trips to such well-known attractions as Universal Studios and Disneyland.

Business Meetings

The annual business meetings of both organizations will be held consecutively shortly after the close of contributed papers on Thursday afternoon. We hope that all members will be present to contribute to the proceedings.

Social Hour and Banquet

Thursday evening begins with a social hour at 7:00 on the outdoor patio of the Town and Gown Banquet Hall on the campus. Dinner is served at 8:00 PM, followed by a presentation by Robert R. Hessler of Scripps Institution of Oceanography on the most recent developments in the global exploration of deep-sea hydrothermal vents.

Banquet tickets will be available at the registration table until 5:00 PM on Wednesday.

Open House at Natural History Museum

On Friday June 30 and Saturday July 1 the Malacology and Invertebrate Paleontology Sections of the Natural History Museum will be open to conference visitors from 9 AM to 5 PM. Parking will be available in the museum visitor's lot off Menlo Avenue. Please use the staff entrance (down the stairs in the staff parking lot or down the ramp next to the main entrance accessible from the visitor's lot).

AMERICAN MALACOLOGICAL UNION, INC.

Past Presidents

Henry A. Pilsbry	1931-32	William K. Emerson	1962
Paul Bartsch	1933	Albert R. Mead	1963
Junius Henderson	1934	John Q. Burch	1964
William J. Clench	1935	Juan Jose Parodiz	1965
Calvin Goodrich	1936	Ralph W. Dexter	1966
Joshua L. Baily, Jr.	1937	Leo G. Hertlein	1967
Carlos de la Torre	1938	Arthur H. Clarke	1968
Maxwell Smith	1939	Joseph Rosewater	1969
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Frank C. Baker	1942	Arthur S. Merrill	1972
Louise M. Perry	1943-45	Dolores S. Dundee	1973
Henry van der Schalie	1946-47	Harold D. Murray	1974
A. Myra Keen	1948	Donald R. Moore	1975
Elmer G. Berry	1949	Dorothea S. Franzen	1976
Fritz Haas	1950	George M. Davis	1977
Joseph P. E. Morrison	1951	Carol B. Stein	1978
Jeanne S. Schwengel	1952	William E. Old, Jr.	1979
A. Byron Leonard	1953	Clyde F. E. Roper	1980
Joseph C. Bequaert	1954	Richard S. Houbrick	1981
Morris K. Jacobson	1955	Louise Russert-Kraemer	1982
Allyn G. Smith	1956	Alan J. Kohn	1983
Ruth D. Turner	1957	Robert Robertson	1984
Aurele LaRocque	1958	Melbourne R. Carriker	1985
R. Tucker Abbott	1959	James Nybakken	1986
Katherine V. W. Palmer	1960	William G. Lyons	1987
Thomas E. Pulley	1961	Richard E. Petit	1988

HONORARY LIFE PRESIDENT

Harald A. Rehder

HONORARY LIFE MEMBERS

R. Tucker Abbott
William K. Emerson
Harald A. Rehder
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AMERICAN MALACOLOGICAL UNION, INC.

Executive Council, 1988 - 1989

President	James H. McLean
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Vice-President	Carole S. Hickman
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Corresponding Secretary	Paula M. Mikkelsen
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Past Presidents (4 to 10 years)	Richard S. Houbrick Clyde F. E. Roper
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Auditing	Clyde F.E. Roper
Constitution & By-laws	Harold Murray
Membership	Richard E. Petit
Budget	Roger T. Hanlon
History & Archives	George M. Davis
Board of Editors	Robert S. Prezant
Publications	Robert S. Prezant
Newsletter	Paula Mikkelsen
Conservation	Arthur H. Clarke

Student Paper Award

An award is given annually for the best paper delivered by a student at the annual meeting. The recipient of the award is selected by a team of judges who evaluate scientific content, presentation, quality of visual aids, and the manner in which the presenter handles questions and answers. The papers entered in this year's competition are indicated by asterisks on the session schedules.

Symposium Endowment Fund

Interest from the symposium endowment fund is used to partially reimburse symposium participants, as are contributions directed toward specific symposia each year.

WESTERN SOCIETY OF MALACOLOGISTS

Past Presidents

1968	David K. Mulliner
1969	William K. Emerson
1970	A. Myra Keen
1971	Eugene V. Coan
1972	Beatrice L. Burch
1973	Twila Bratcher
1974	James H. McLean
1975	George E. Radwin
1976	James W. Nybakken
1977	Helen DuShane
1978	Peter D'Eliscu
1979	Barry Roth
1980	Vida C. Kenk
1981	Carol C. Skoglund
1982	Donald R. Shasky
1983	David R. Lindberg
1984	George L. Kennedy
1985	William D. Pitt
1986	Terrence M. Gosliner
1987	Carole M. Hertz
1988	Matthew J. James

WESTERN SOCIETY OF MALACOLOGISTS

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President	Hans Bertsch
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Committees

Editor	Hans Bertsch
Mentor-Parliamentarian	Eugene V. Coan
Historian	Barbara W. Chaney
Nominating	Matthew J. James
	Carole M. Hertz
	Terrence M. Gosliner
Audit	Donald R. Shasky
	George L. Kennedy
	William D. Pitt
Student Grant	Vida C. Kenk
	Eugene V. Coan
	James Nybakken
	Terrence M. Gosliner
	Judith Terry Smith

Student Grant Award

A student grant award is given every other year in competition open to graduate students working on mollusks. The award will be given this year and the recipient will be announced at the annual business meeting. The fund is maintained through donations and the annual auction proceeds.

Monday Morning, June 26

Davidson Conference Center, Room 1

8:30 PRESIDENTS' WELCOME: James H. McLEAN and Hans BERTSCH, Los Angeles County Museum of Natural History.

SYMPOSIUM: BIOLOGY OF PELAGIC GASTROPODS, I. Convenor: Roger R. SEAPY, California State University, Fullerton, California.

8:40 INTRODUCTORY REMARKS; PELAGIC GASTROPOD DIVERSITY. Roger R. SEAPY, California State University, Fullerton, California.

8:45 AN IN-SITU PHOTOGRAPHIC SURVEY OF THE PELAGIC GASTROPODS. Ronald W. GILMER, Harbor Branch Oceanographic Institution, Fort Pierce, Florida.

9:00 REMARKS ON THE ECOLOGY AND DISTRIBUTION OF SOME GASTROPOD LARVAE FROM THE TROPICAL ATLANTIC. Gotthard RICHTER, Forschungsinstitut Senckenberg, Frankfurt, Federal Republic of Germany. (p. 44)

9:30 * BIOLOGY AND DISTRIBUTION OF ATLANTIC HETEROPOD MOLLUSCS FROM THE GREAT BARRIER REEF, AUSTRALIA. Leslie J. NEWMAN, University of Queensland, St. Lucia, Queensland, Australia. (p. 41)

10:00 BREAK

10:20 NET SAMPLING OF HETEROPODS: PROBLEMS AND RECOMMENDATIONS. Roger R. SEAPY, California State University, Fullerton, California. (p. 45)

10:50 SHELL GROWTH RATES AND ARAGONITE PRODUCTION OF PTEROPOD AND HETEROPOD MOLLUSCS. Victoria J. FABRY, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts. (p. 33)

11:20 EVOLUTIONARY CYTOTAXONOMY IN PELAGIC GASTROPODS. Catherine THIRIOT-QUIEVREUX. Station Zoologique, Universite P. et M. Curie, Villefranche-sur-Mer, France. (p. 48)

The Symposium on the Biology of Pelagic Gastropods was supported by the University of Southern California Sea Grant Program, in addition to support from the AMU Symposium Endowment Fund.

Monday Afternoon, June 26

Davidson Conference Center, Room 1

SYMPOSIUM: BIOLOGY OF PELAGIC GASTROPODS, II. Convenor: Roger R. SEAPY, California State University, Fullerton, California.

1:30 DISTRIBUTION AND ANNUAL CYCLE OF LIMACINA RETROVERSA FLEMING, 1823, IN PATAGONIAN WATERS. Jose R. DADON. Universidad de Buenos Aires, Buenos Aires, Argentina. (p. 32)

2:00 FIELD BEHAVIOR OF THECOSOMATOUS PTEROPODS: ARE THEY MORE LIKE CLAMS OR SPIDERS? Ronald W. GILMER and G. Richard HARBISON, Harbor Branch Oceanographic Institution, Fort Pierce, Florida. (p. 35)

2:30 * MORPHOLOGY OF THE WINGS OF EUTHECOSOMATOUS PTEROPODS. Dieter FIEGE, Westfalische Wilhelms-Universitat, Munster, Federal Republic of Germany. (p. 34)

3:00 BREAK

3:20 BIPOLAR VARIATION IN CLIONE, A GYMNOSOMATOUS PTEROPOD. Ronald W. GILMER, Harbor Branch Oceanographic Institution, Florida, and Carol M. LALLI, University of British Columbia, Vancouver, B.C., Canada. (p. 35)

3:50 COMPARATIVE REPRODUCTIVE BEHAVIOR OF TWO PELAGIC NUDIBRANCHS, FAMILY GLAUCIDAE. Langdon B. QUETIN and Robin M. ROSS, University of California, Santa Barbara, California. (p. 42)

4:20 RECENT RECORDS OF PHYLLIROE BUCEPHALA (GASTROPODA, OPISTHOBRANCHIA) IN THE SUBTROPICAL CENTRAL NORTH PACIFIC. Beatrice L. BURCH and Thomas A. BURCH, Bishop Museum, Honolulu, Hawaii. (p. 29)

* Student paper competition

Monday Afternoon, June 26

Davidson Conference Center, Room 221

CONTRIBUTED PAPERS: NON-MARINE MOLLUSKS. Chair: C. Clifton CONEY, Los Angeles County Museum of Natural History.

1:40 MORPHOLOGICAL AND MOLECULAR GENETIC COMPARISON OF U.S. HYDROBIA TRUNCATA AND EUROPEAN HYDROBIA VENTROSA. George M. DAVIS, Academy of Natural Sciences of Philadelphia, Pennsylvania. (p. 32)

2:00 GENUS FONTIGENS PILSBRY (GASTROPODA: HYDROBIIDAE). Robert HERSHLER, National Museum of Natural History, Smithsonian Institution, Washington, D.C. (p. 37)

2:20 INTERPLAY OF THE CIRCULATORY AND EXCRETORY SYSTEMS IN BIVALVE FERTILIZATION: EVIDENCE FROM ANODONTA GRANDIS (UNIONIDAE). Richard J. TRDAN, S. E. CORDOBA, Saginaw Valley State University, University Center, Michigan, and W. R. HOEH, Museum of Zoology, University of Michigan, Ann Arbor, Michigan. (p. 48)

2:40 NOTES ON CALCIFICATION IN MOLLUSKS: THE PRIMARY FORMATION OF THE NACREOUS SHELL LAYER IN ANODONTA NUTTALLIANA LEA, 1838. C. Clifton CONEY, Los Angeles County Museum of Natural History. (p. 31)

3:00 BREAK

3:20 * INDEPENDENT EVOLUTION OF TERRESTRIALITY IN TRUNCATELLID GASTROPODS IN CARIBBEAN ISLANDS (RISSOACEA: PROSOBRANCHIA). Gary ROSENBERG, Academy of Natural Sciences, Philadelphia, Pennsylvania. (p. 44)

3:40 HABITAT AFFINITIES AND SPECIES DIVERSITIES OF LAND SNAILS FROM THE RUBY MOUNTAINS, NORTHEASTERN NEVADA. Mark A. PORTS, Northern Nevada Community College, Elko, Nevada. (p. 42)

4:00 * SEASONAL VARIATION OF REPRODUCTIVE ORGANS FROM TWO POPULATIONS OF CARACOLUS CARACOLLA (PULMONATA: CAMAENIDAE) IN PUERTO RICO. Patricia R. MARCOS, University of Puerto Rico, Rio Piedras, Puerto Rico. (p. 40)

4:20 ECOLOGY AND TAPHONOMY OF ENVIRONMENTALLY STRESSED NON-MARINE MOLLUSCAN POPULATIONS, GRAND PRAIRIE PROVINCE, EAST-CENTRAL TEXAS. Jules R. DUBAR, The University of Texas at Austin, Austin, Texas. (p. 33)

4:40 COMPARATIVE SHELL MORPHOMETRICS IN SOME RELATED SPECIES OF FOSSIL AND RECENT GASTROCOPTA (PULMONATA: PUPILLIDAE). C. Clifton CONEY and J. D. STEWART, Los Angeles County Museum of Natural History. (p. 31)

* Student paper competition

Monday Evening, June 26

Museum Auditorium

SLIDE PRESENTATIONS OF GENERAL INTEREST

WELCOME: Lindsey GROVES, Los Angeles County Museum of Natural History, and President, Conchological Club of Southern California.

7:30 MALACOLOGICAL EXPLORATION ALONG THE INNER AND OUTER COASTS OF BAJA CALIFORNIA. Hans BERTSCH, Associate, Los Angeles County Museum of Natural History.

8:00 SOME EXOTIC MINUTE SHELLS OF THE WESTERN PACIFIC. Bertram C. DRAPER, Associate, Los Angeles County Museum of Natural History.

8:30 Intermission -- Refreshments provided by Conchological Club of Southern California.

8:50 LANDSNAILS OF THE CALIFORNIA CHANNEL ISLANDS. F. G. HOCHBERG, Santa Barbara Museum of Natural History, Santa Barbara, California. (p. 37)

Tuesday Morning, June 27

Davidson Conference Center, Room 1

SYMPOSIUM: BIOLOGY OF SCAPHOPODS. Convenor: Ronald L. SHIMEK, Parametrix, Inc., Bellevue, Washington.

8:45 INTRODUCTORY REMARKS. Ronald L. SHIMEK, Parametrix, Inc. Bellevue, Washington.

8:50 * OBSERVATIONS ON THE ANATOMY OF THE SCAPHOPOD MANTLE. Gerhard STEINER, University of Vienna, Vienna, Austria. (p. 47)

9:30 * STRUCTURE AND FUNCTION OF THE SCAPHOPOD EXCRETORY SYSTEM. Patrick D. REYNOLDS, University of Victoria, Victoria, British Columbia, Canada. (p. 43)

10:10 BREAK

10:30 RESOURCE UTILIZATION IN A MULTI-SPECIES SCAPHOPOD ASSEMBLAGE. Ronald L. SHIMEK, Parametrix, Inc., Bellevue, Washington. (p. 46)

CONTRIBUTED PAPER: SCAPHOPODA. Chair: Ronald L. SHIMEK, Parametrix, Inc., Belleview, Washington.

11:10 ON THE RETENTION OF THE EMBRYONIC SHELL OF FISSIDENTALIUM PHANEUM DALL FROM HAWAII. Beatrice L. BURCH and Thomas A. BURCH, B. P. Bishop Museum, Honolulu, Hawaii. (p. 29)

* Student paper competition

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11:45 GROUP PHOTO: East Entrance (facing Rose Garden) to to Natural History Museum.

Tuesday Afternoon, June 27

Davidson Conference Center, Room 1

CONTRIBUTED PAPERS: FOSSIL MOLLUSKS. Chair: Richard L. SQUIRES, California State University, Northridge, California.

1:40 EARLY GASTROPODS: NEW TWISTS IN THE TALE. Bruce N. RUNNEGAR, University of California, Los Angeles. (p. 45)

2:00 * MOLLUSKS OF THE IRVINGTONIAN (MIDDLE PLEISTOCENE) SHUTT RANCH LOCAL FAUNA, RIVERSIDE COUNTY, CALIFORNIA. Richard V. LAMB, California State University, Northridge. (p. 39)

2:20 RECORD OF PLEISTOCENE MARINE MOLLUSKS IN THE LOS ANGELES BASIN, SOUTHERN CALIFORNIA, DURING THE LAST MILLION YEARS: AN OVERVIEW. George L. KENNEDY, Los Angeles County Museum of Natural History. (p. 38)

2:40 FROM TRICHOTROPIDAE TO CALYPTRAEIDAE BY WAY OF LYSIS GABB, 1864. L. R. SAUL, Los Angeles County Museum of Natural History. (p. 45)

3:00 BREAK

3:20 * MOLLUSCAN SPATIAL AND TEMPORAL DISTRIBUTIONS: ASSESSING MACROEVOLUTIONARY HYPOTHESES. Michael P. RUSSELL, University of California, Berkeley, California. (p. 45)

3:40 COMMENTS ON THE "CARIBBEAN ASPECT" OF FOSSIL MOLLUSKS FROM THE GULF OF CALIFORNIA. Judith Terry SMITH, Palo Alto, California. (p. 46)

4:00 * A REVIEW OF NORTH AMERICAN CRETACEOUS CYPRAEIDAE AND THREE NEW SPECIES FROM SAN DIEGO AND YOLO COUNTIES, CALIFORNIA. Lindsey T. GROVES, Los Angeles County Museum of Natural History. (p. 36)

4:20 CONSERVATION SURVEY: INVERTEBRATE PALEONTOLOGY TYPE COLLECTION, ACADEMY OF NATURAL SCIENCES, PHILADELPHIA. Elana BENAMY, Academy of Natural Sciences, Philadelphia. (p. 28)

4:40 FIRST REPORT OF THE EOCENE TETHYAN GASTROPOD VELATES PERVERSUS IN MEXICO. Richard L. SQUIRES, California State University, Northridge, and Robert A. DEMETRION, University of Southern California, Los Angeles. (p. 47)

* Student paper competition

Tuesday Afternoon, June 26

Davidson Conference Center, Room 221

CONTRIBUTED PAPERS: OPISTHOBRANCH GASTROPODS. Chair: Hans BERTSCH, Associate, Los Angeles County Museum of Natural History.

1:40 MARINE GASTROPODA COLLECTED BY THE STEAMER ALBATROSS FROM THE PHILIPPINES IN 1908. Terrence M. GOSLINER, California Academy of Sciences, San Francisco, California, and Diane M. TYLER, National Museum of Natural History, Washington, D.C. (p. 35)

2:00 THE NEW WHITE MICE: HERMISSENDA AND OTHER OPISTHOBRANCHS AS BIOMEDICAL MODELS. Alan M. KUZIRIAN, Marine Biological Laboratory, Woods Hole, Massachussetts. (p. 35)

2:20 POPULATION BIOLOGY OF FLORIDA ASCOGLOSSA (GASTROPODA: OPISTHOBRANCHIA). Kerry B. CLARK, Florida Institute of Technology, Melbourne, Florida. (p. 30)

2:40 * ALGAL HOST USE BY THE MARINE SPECIALIST HERBIVORE PLACIDA DENDRITICA. Cynthia D. TROWBRIDGE, Oregon State University, Marine Science Center, Newport, Oregon. (p. 48)

3:00 BREAK

3:20 ADDITIONS TO THE AEOLIDACEAN NUDIBRANCH FAUNA OF THE TROPICAL EASTERN PACIFIC. Terrence M. GOSLINER, California Academy of Sciences, San Francisco, California. (p. 36)

3:40 THE SIGNIFICANCE OF ADDITIONAL CHROMODORID NUDIBRANCHS FROM CENTRAL PACIFIC ISLANDS. Hans BERTSCH, Associate, Los Angeles County Museum of Natural History, and Terrence M. GOSLINER, California Academy of Sciences, San Francisco, California. (p. 28)

4:00 OBSERVATIONS ON THE SWIMMING ACTIVITY OF THE DORIDACEAN NUDIBRANCHS HEXABRANCHUS SANGUINEUS AND SEBADORIS CROSSLANDI FROM THE NORTHWESTERN RED SEA. Gamil N. SOLIMAN, University of Cairo, Egypt. (p. 47)

* Student paper competition

Tuesday Evening, June 29

University of Southern California Campus

5:30 OUTDOOR SOCIAL HOUR (cash bar). Near west entrance to Birnkrant Residence Hall.

6:30 OUTDOOR BARBECUE (purchase ticket in advance at registration table). Near west entrance to Birnkrant Residence Hall.

7:30 REPRINT SALE AND AUCTION PREVIEW. Pardee Tower, Common Room (2nd floor).

7:45 WSM AUCTION. Pardee Tower, Common Room (2nd floor).

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Posters

Monday through Thursday

Davidson Conference Center, Room 220

A NOTE ON THE FECAL ANALYSIS OF PLEUROBRANCHAEA CALIFORNICA MACFARLAND, 1966 (OPISTHOBRANCHIA, NOTASPIDEA). Philip K. BAIRRINGTON, Moss Landing Marine Laboratories, Moss Landing, California. (p. 28)

SEM AND ENERGY-DISPERSIVE X-RAY MICROANALYSIS OF MURICID PROSOBRANCH RADULAE. Philip K. BAIRRINGTON, Moss Landing Marine Laboratories, Moss Landing, California. (p. 28)

MICROCOMPUTER-BASED VIDEO MACROPHOTOGRAPHY SYSTEM. Kerry B. CLARK, Florida Institute of Technology, Melbourne, Florida. (p. 30)

FEEDING ECOLOGY AND SIZE DISTRIBUTION OF OLIVELLA BAETICA (NEOGASTROPODA). Elaine J. DEL PRETE, Moss Landing Marine Laboratories, Moss Landing, California. (p. 32)

MORPHOLOGY OF THE VELUM IN LARVAE OF ARCHIDORIS PSEUDOARGUS VON RAPP, 1827. Dieter FIEGE, Westfalische Wilhelms-Universitat, Munster, Federal Republic of Germany. (p. 34)

EFFECTS OF INTENSIVE FISHING EFFORT ON THE POPULATION STRUCTURE OF QUAHOGS, MERCENARIA MERCENARIA (LINNE), IN NARRAGANSETT BAY, RHODE ISLAND. Michael A. RICE, Itrat ZEHRA, and Charles HICKOX, University of Rhode Island, Kingston, Rhode Island. (p. 43)

Wednesday Morning, June 28

Davidson Conference Center, Room 1

SYMPOSIUM: SYSTEMATICS, ANATOMY AND EVOLUTION OF WESTERN NORTH AMERICAN LAND MOLLUSKS IN HONOR OF WALTER B. MILLER. Organized by F. G. HOCHBERG and Barry ROTH. Session I. Chair: F. G. HOCHBERG, Santa Barbara Museum of Natural History, Santa Barbara, California.

8:15 WELCOME & INTRODUCTION. F. G. HOCHBERG, Santa Barbara Museum of Natural History.

8:30 BIOGEOGRAPHY OF WESTERN NORTH AMERICAN AND CARIBBEAN HELICOIDEA (GASTROPODA: PULMONATA). Walter B. MILLER, University of Arizona, Tucson, Arizona, and Edna NARANJO-GARCIA, Universidad Nacional Autonoma de Mexico, Mexico, D.F. (p. 40)

9:00 TAXONOMIC STATUS AND PHYLOGENETIC CONNECTIONS IN THE HELICOIDEA. Anatolij A. SCHILEYKO, USSR Academy of Sciences, Moscow, USSR. (p. 46)

9:30 DISTRIBUTION OF THE BULIMINAE WITH RELATION TO MICROPLATE TECTONICS. James E. HOFFMAN, Tucson, Arizona. (p. 37)

10:00 BREAK

10:30 COMPARATIVE ANATOMY OF STERKIA AND NEARCTULA (PULMONATA: VERTIGINIDAE). C. Clifton CONEY, Los Angeles County Museum of Natural History, and F.G. HOCHBERG, Santa Barbara Museum of Natural History, Santa Barbara, California. (p. 31)

11:00 ZOOGEOGRAPHY OF LAND SNAILS IN THE CENTRAL GREAT BASIN. William L. PRATT, Museum of Natural History, University of Nevada, Las Vegas, Nevada, and Mark A. PORTS, Northern Nevada Community College, Elko, Nevada. (p. 42)

11:30 PHYLOGENY OF THE HELICOIDEA, ESPECIALLY THE XANTHONYCHIDAE. Hartmut NORDSIECK, Villingen-Schwenningen, Federal Republic of Germany.

The Symposium on Western North American Land Mollusks was supported by the Santa Barbara Museum of Natural History, in addition to support from the AMU Symposium Endowment Fund.

Wednesday Afternoon, June 28

Davidson Conference Center, Room 1

SYMPOSIUM: SYSTEMATICS, ANATOMY AND EVOLUTION OF WESTERN NORTH AMERICAN LAND MOLLUSKS IN HONOR OF WALTER B. MILLER. Organized by F. G. HOCHBERG and Barry ROTH. Session II. Chair: Barry ROTH, Associate, Santa Barbara Museum of Natural History, Santa Barbara, California.

1:40 HISTORICAL AND ECOLOGICAL ZOOGEOGRAPHY OF THE MOLLUSKS OF THE TEXAS PANHANDLE AND ADJACENT REGIONS. Raymond W. NECK, Texas Parks and Wildlife Department, Austin, Texas. (p. 41)

2:00 OLIGOCENE LAND SNAILS OF THE ROCKY MOUNTAINS AND ADJACENT AREAS. Emmett EVANOFF, University of Colorado, Boulder, Colorado. (p. 33)

2:30 POLYGYRID ORIGINS: WEST OR EAST? Kenneth C. EMBERTON, Academy of Natural Sciences, Philadelphia, Pennsylvania. (p. 33)

3:00 BREAK

3:30 A REVIEW OF THE SYSTEMATICS AND BIOLOGY OF ASHMUNELLA (PULMONATA: POLYGYRIDAE). Richard L. REEDER, University of Tulsa, Tulsa, Oklahoma. (p. 43)

4:00 CYTOGENETIC STUDIES ON TWENTY-TWO SPECIES/SUBSPECIES POPULATIONS OF ASHMUNELLA (MOLLUSCA: PULMONATA: POLYGYRIDAE). Noorullah BABRAKZAI, Central Missouri State University, Warrensburg, Missouri. (p. 28)

4:30 PRINCE SNAIL: A TSIMSHIAN MYTH. Glenn A. LONG, Coral Gables, Florida. (p. 39)

Wednesday Afternoon, June 28

Davidson Conference Center, Room 201

CONTRIBUTED PAPERS: MARINE GASTROPODS. Chair: Rudiger BIELER, Delaware Museum of Natural History, Wilmington, Delaware.

1:40 EVOLUTIONARY HISTORY OF CANTHARIDINE GASTROPODS IN SEAGRASS BEDS. Carole S. HICKMAN, University of California, Berkeley. (p. 37)

2:00 * ON THE DISTRIBUTION AND MORPHOMETRY OF SOME SPECIES OF CHICOREUS (PHYLLONOTUS) IN VENEZUELA. Roberto CIPRIANI, Universidad Simon Bolivar, Caracas, Venezuela. (p. 30)

2:20 ANATOMY OF ARCTOMELON STEARNSII AND A. BENTHALIS (PROSOBRANCHIA: VOLUTIDAE): SYSTEMATIC AND ZOOGEOGRAPHIC IMPLICATIONS. M. G. HARASEWYCH, National Museum of Natural History, Washington, D.C. (p. 37)

2:40 ACCESSORY BORING ORGAN (ABO) OF CHILEAN "LOCO," CONCHOLEPAS CONCHOLEPAS (MURICIDAE, GASTROPODA). Gregory L. GRUBER, Maryland Department of the Environment, Annapolis, Maryland, and Melbourne R. CARRIKER, University of Delaware, Lewes, Delaware. (p. 36)

3:00 BREAK

3:20 STUDIES ON EGG CAPSULE STRUCTURE, EGGS, EMBRYONIC DEVELOPMENT AND EARLY LARVAL DEVELOPMENT OF CONUS BILIOSUS (RODING, 1798) AND C. CORONATUS GMELIN, 1791, FROM PAKISTAN. Itrat ZEHRA, University of Karachi, Pakistan. (p. 49)

3:40 INTRASPECIFIC MORPHOMETRIC VARIATION IN FOUR SPECIES OF ROCKY INTERTIDAL SNAILS FROM DIFFERENT EXPOSURE REGIMES IN HONG KONG. Carrie L. BRAVENAC, Freese & Nichols, Inc., and Joseph C. BRITTON, Texas Christian University, Fort Worth, Texas. (p. 29)

4:00 SESSILE SLIT-SHELLS -- A FIRST LOOK AT SILIQUARIA ANATOMY AND BIOLOGY (CERITHIOIDEA: SILIQUARIIDAE). Rudiger BIELER, Delaware Museum of Natural History, Wilmington, Delaware. (p. 29)

* Student paper competition

Wednesday Evening, June 28

Museum Auditorium

SLIDE PRESENTATIONS OF GENERAL INTEREST

WELCOME: Lindsey GROVES, Los Angeles County Museum of Natural History, and President, Conchological Club of Southern California.

7:30 ADAPTIVE SIGNIFICANCE OF COLOR IN MARINE GASTROPODS. Terrence M. GOSLINER, California Academy of Sciences, San Francisco, California.

8:20 Intermission -- Refreshments provided by Conchological Club of Southern California.

8:40 ARCHAEOGASTROPOD LIMPETS AT DEEP-SEA HYDROTHERMAL VENTS: A 12-YEAR OVERVIEW OF DISCOVERIES. James H. MCLEAN, Los Angeles County Museum of Natural History. (p. 40)

Thursday Morning, June 29

Davidson Conference Center, Room 1

SYMPOSIUM: SYSTEMATICS, ANATOMY AND EVOLUTION OF WESTERN NORTH AMERICAN LAND MOLLUSKS IN HONOR OF WALTER B. MILLER. Organized by F. G. HOCHBERG and Barry ROTH. Session III. Chair: Richard L. REEDER, University of Tulsa, Tulsa, Oklahoma.

8:30 A REVIEW OF REPRODUCTIVE SYSTEM ANATOMY IN OREOHELIX: A PROPOSAL FOR FUTURE RESEARCH. H. Lee FAIRBANKS, Pennsylvania State University (Beaver Campus), Monaca, Pennsylvania. (p. 34)

9:00 ANATOMICAL OBSERVATIONS OF THE GENUS HOLOSPIRA IN ARIZONA AND SONORA, MEXICO. Lance H. GILBERTSON, Orange Coast College, Costa Mesa, California. (p. 35)

9:30 PHYLOGENETIC ANALYSIS OF THE NORTH AMERICAN HAPLOTREMATIDAE (GASTROPODA: PULMONATA). Barry ROTH, Associate, Santa Barbara Museum of Natural History, Santa Barbara, California. (p. 44)

10:00 BREAK

10:30 * EVOLUTIONARY RELATIONSHIPS OF MICRARIONTA ON SAN NICOLAS ISLAND, CALIFORNIA. Timothy A. PEARCE, Museum of Zoology, University of Michigan, Ann Arbor, Michigan. (p. 42)

10:50 LAND SNAILS OF NEW MEXICO, COMPARED WITH THE ARIZONA LIST OF BEQUAERT AND MILLER (1973). Artie L. METCALF, University of Texas, El Paso, Texas. (p. 40)

11:10 PRESENT STATUS OF THE MICROMOLLUSKS OF NORTHERN SONORA, MEXICO. Edna NARANJO-GARCIA, Universidad Nacional Autonoma de Mexico, Mexico, D.F. (p. 41)

11:30 THE NEXT CHALLENGE: LIFE STYLES AND EVOLUTION. Alan SOLEM, Field Museum of Natural History, Chicago, Illinois. (p. 46)

* Student paper competition

Thursday Morning, June 29

Davidson Conference Center, Room 221

CONTRIBUTED PAPERS: MARINE BIVALVES AND CEPHALOPODS. Chair: Eugene V. COAN, Associate, California Academy of Sciences, San Francisco.

8:40 RECRUITMENT OF HARD CLAMS, MERCENARIA SPP., IN FLORIDA: WHEN IS REPEATED FAILURE A SUCCESSFUL STRATEGY? Dan C. MARELLI, William S. ARNOLD, and Paige A. GILL. Florida Marine Research Institute, St. Petersburg, Florida. (p. 41)

9:00 LARVAL AND POSTLARVAL SHELL MORPHOLOGY OF TAGELUS PLEBEIUS (BIVALVIA: TELLINACEA). S. Cynthia FULLER, Rutgers University, New Brunswick, New Jersey, Joy G. GOODSELL, Clemson University, Clemson, South Carolina, and Richard A. LUTZ, Rutgers University. (p. 34)

9:20 * USE OF GENERAL PROTEIN ELECTROPHORESIS FOR DIFFERENTIATING LARVAL BIVALVES: PRELIMINARY STUDIES OF CRASSOSTREA VIRGINICA AND OSTREA EDULIS. Ya-ping HU, Rutgers University, New Brunswick, New Jersey. (p. 38)

9:40 THE RECENT EASTERN PACIFIC SPECIES OF THE BIVALVE FAMILY THRACIIDAE. Eugene V. COAN, Associate, California Academy of Sciences, San Francisco, California. (p. 31)

10:00 BREAK

10:20 CEPHALOPODS COLLECTED BY THE R/V "DR FRIDTJOF NANSEN" IN VENEZUELAN WATERS. Roberto CIPRIANI, Universidad Simon Bolivar, Caracas, Venezuela, Luis MARCANO, and Freddy AROCHA, Ministerio de Agricultura y Cria, Cumana, Venezuela. (p. 30)

10:40 FIRST REPORT OF CALCIUM MINERALIZATION IN THE STYLETS (SHELL VESTIGES) OF AN OCTOPUS. Ronald B. TOLL, The University of the South, Sewanee, Tennessee. (p. 48)

11:00 QUALITATIVE AND QUANTITATIVE ASSESSMENTS OF CONCEALMENT TACTICS USED BY OCTOPUS BIMACULATUS IN A KELP HABITAT. Roger T. HANLON and John W. FORSYTHE, University of Texas Medical Branch, Galveston, Texas. (p. 36)

11:20 * MORPHOLOGICAL STUDIES OF PRESERVED OCTOPUSES: A NEW TOOL FOR OCTOPOD TAXONOMY AND SYSTEMATICS. Janet R. VOIGHT, University of Arizona, Tucson, Arizona. (p. 49)

11:40 NOMENCLATURAL INDEX OF RECENT CEPHALOPOD TAXA. Michael J. SWEENEY, and Clyde F. E. ROPER. National Museum of Natural History, Washington, D.C. (p. 47)

* Student paper competition

Thursday Afternoon, June 29

Davidson Conference Center, Room 1

CONTRIBUTED PAPERS: MARINE GASTROPODS AND MISCELLANEOUS TOPICS. Chair: Roy HOUSTON, Loyola Marymount University, Los Angeles, California.

1:40 ANATOMY, REPRODUCTIVE BIOLOGY AND SYSTEMATIC POSITION OF FOSSARUS AMBIGUUS (LINNE) (FOSSARIDAE: PROSOBRANCHIA). Richard S. HOUBRICK, National Museum of Natural History, Washington, D.C. (p. 38)

2:00 THE SEGUENZIIFORMES, BASILISSOPSIS AND GUTTULA: WHERE ARE THEY? James F. QUINN, Jr., Florida Marine Research Institute, St. Petersburg, Florida. (p. 43)

2:20 REPRODUCTIVE SYSTEMS OF NERITIMORPH PROSOBRANCH MOLLUSKS FROM THE EASTERN PACIFIC. Roy HOUSTON, Loyola Marymount University, Los Angeles, California. (p. 37)

2:40 PHYLOGENY AND ADAPTATION OF THE PATELLOGASTROPOD RADULA. David R. LINDBERG, University of California, Berkeley, California. (p. 39)

3:00 BREAK

3:20 THE RELATIONSHIP OF ASC'S WORKSHOP ON SYSTEMATIC COLLECTIONS RESOURCES TO NEW NSF INITIATIVES: FUTURE FUNDING OPPORTUNITIES FOR MALACOLOGY. K. Elaine HOAGLAND, The Association of Systematics Collections, Washington, D.C. (p. 38)

3:40 THE DICHOTOMOUS KEY AS AN IMPORTANT TOOL IN SYSTEMATIC MALACOLOGY. Gary A. COOVERT, Dayton Museum of Natural History, Dayton, Ohio. (p. 32)

Thursday Afternoon, June 29

Davidson Conference Center, Room 1

4:00 ANNUAL BUSINESS MEETING, AMERICAN MALACOLOGICAL UNION.

5:00 ANNUAL BUSINESS MEETING, WESTERN SOCIETY OF MALACOLOGISTS.

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Thursday Evening, June 29

Town and Gown Banquet Hall

7:00 SOCIAL HOUR, outdoor patio (cash bar).

8:00 BANQUET (purchase tickets by Tuesday afternoon).

Banquet speaker: Robert R. Hessler, Scripps Institution of Oceanography: THE HYDROTHERMAL VENTS OF THE MARIANA BACK ARC BASIN.

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Friday, June 20

8:00 - 5:00 Field trips (see bulletin board for departure times).

9:00 - 5:00 Open house at LACM Malacology and Invertebrate Paleontology Collections.

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Saturday, July 1

9:00 - 5:00 Open house at LACM Malacology and Invertebrate Paleontology Collections.

CYTOGENETIC STUDIES ON TWENTY TWO SPECIES/SUBSPECIES POPULATIONS OF ASHMUNELLA (MOLLUSCA: PULMONATA POLYGYRIDAE)

BABRAKZAI, Noorullah, Department of Biology, Central Missouri State University, Warrensburg, MO 64093.

Studies involving a combination of cytological research tools on species/subspecies of Ashmunella revealed that: (1) the subspecies of A. proxima are conspecific; (2) A. angulata, A. chiricahuana, A. ferrissi and A. esuritor are cytologically monophyletic and hence be named the A. chiricahuana species group; (3) A. rhyssa rhyssa, A. r. altissima and the morphologically intermediate populations are conspecific; (4) the A. chiricahuana species group and A. rhyssa complex probably share some cytological markers while A. levettei, A. varicifera, A. mendax and A. binneyi do not. Cytogenetic studies on A. proxima X A. lenticula F1 hybrids and A. proxima X A. angulata F1 & F2 hybrids indicated that these are genetically distinct species with incomplete reproductive isolation. Meiotic studies of A. levettei X A. varicifera F1 hybrids and embryonic survivability of their F2 hybrids point to the conspecific nature of these snails. Therefore levettei and varicifera should be consideres as subspecies of A. levettei (Bland).

CONSERVATION SURVEY: INVERTEBRATE PALEONTOLOGY TYPE COLLECTION, ACADEMY OF NATURAL SCIENCES, PHILA.

BENAMY, Elana, Academy of Natural Sciences, Phila. 19th and the Parkway, Philadelphia, PA 19103

The Invertebrate Paleontology Type Collection at the Academy of Natural Sciences consists of nearly 3500 lots, roughly 85% of which are mollusks. Holdings span the Phanerozoic, however the great majority of specimens are from the Cenozoic. Because of the great historical significance of this collection, it was imperative that degradation due to improper storage, handling and environmental control be documented, analyzed and halted. A grant from the Institute for Museum Services (IMS) was obtained in order to have a professional conservator survey the collection, report on current conditions, make recommendations and help formulate a practical conservation plan. The Type Collection was singled out because of its great intrinsic value and because it represents a good sampling of the entire collection in an approachable size. Results of the survey can easily be extrapolated.

Every drawer of the collection was examined and lots representing particular problems pulled for closer study. Problems encountered include: fragmentation, exfoliation, efflourescence, chipping, peeling, coatings, glues, dyes, cracking and contact with archivally unstable housing and labeling materials and mounting media.

Preliminary survey results demonstrate that rehousing the entire collection using archivally stable materials would probably stabilize it. Specimens with serious problems will have to be evaluated and treated on a case-by-case basis.

THE SIGNIFICANCE OF ADDITIONAL CHROMODORID NUDIBRANCHS FROM CENTRAL PACIFIC ISLANDS

BERTSCH, Hans, Los Angeles County Museum Natural History, Los Angeles, CA 90007, and Terrence M. GOSLINER, California Academy of Sciences, San Francisco, CA 94118.

During the last 20 years our understanding of the molluscan fauna of the Hawaiian Islands has increased significantly. However, our knowledge of both the number and identity of opisthbranch species present is not as complete. Recently we reported an additional 17 species of opisthobranchs occurring in Hawaii. All of these were previously described from elsewhere in the Indo-Pacific faunal region.

This presentation describes the taxonomy, anatomy, ecology, and zoogeography of 5 species of Chromodorididae (including 4 currently unnamed species). Two of these species are widely distributed on other Indo-Pacific islands. As more species of nudibranchs are discovered in Hawaii, the trend toward reduced numbers of endemics (and a higher proportion of wide-spread indigenous species) continues. These are important data for theories of island biogeography.

SEM AND ENERGY-DISPERSIVE X-RAY MICROANALYSIS OF MURICID PROSOBRANCH RADULAE

BAIRRINGTON, Philip K., Moss Landing Marine Laboratories, Moss Landing, CA 95039

Within the family Muricidae, the gastropod typically perforates the shell of its prey in order to eat its flesh. Therefore, relatively small morphological differences in the feeding mechanism might significantly affect the capability of the gastropod to utilize certain species of bivalves as prey. Thus, a comparison of the radular morphology with the feeding habits and prey preferences of muricid species presumably would show correlations which reflect the fundamental role of the radula.

The radulae of six locally occurring snails (Acanthina spirata, Nucella emarginata, Ceratostoma foliatum, Ocenebra lurida, O. atropurpurea, O. interfossa) were analyzed for elemental composition along the rachidian and lateral teeth.

A NOTE ON THE FECAL ANALYSIS OF PLEUROBRANCHAEA CALIFORNICA MacFARLAND, 1966 (OPISTHOBRANCHIA, NOTASPIDEA)

BAIRRINGTON, Philip K., Moss Landing Marine Laboratories, Moss Landing, CA 95039

The feces of thirteen Pleurobranchaea californica collected by otter trawl at the sixty meter station in Monterey Bay were analyzed. Eight phyla of prey (protozoa, nemerteans, aschelminths, mollusks, annelids, crustaceans, echinoderms, and fish) were identified in the remains.

SESSILE SLIT-SHELLS -- A FIRST LOOK AT SILIQUARIA ANATOMY AND BIOLOGY (CERITHIOIDEA: SILIQUARIIDAE).

BIELER, Rüdiger, Delaware Museum of Natural History, Wilmington, DE 19807

Among the non-parasitic gastropod groups that have adopted a sessile mode of life is the poorly known family Siliquariidae, variously linked to either the Vermetidae or Turritellidae.

Clusters of two western Atlantic Siliquaria species, S. modesta and S. squamata, were found embedded within sponges collected by submersibles in 50-200 m depths off Florida and in the Bahamas.

The anatomy of members of this genus is described for the first time and compared to available data on turritellids, vermetids, and other siliquariid genera. Gross anatomy is found to be very similar to that of turritellids. A number of autapomorphies, such as a large, specialized operculum and a shortened rectum (with the anus in the posterior part of the mantle cavity) can be explained as adaptations in connection with the sessile and embedded mode of life. Siliquaria differs in a number of protoconch, opercular, radular and anatomical characters from the previously studied siliquariids Pyxipoma and Stephopoma (J.E. Morton, 1951).

INTRASPECIFIC MORPHOMETRIC VARIATION IN FOUR SPECIES OF ROCKY INTERTIDAL SNAILS FROM DIFFERENT EXPOSURE REGIMES IN HONG KONG.

BRAVENEC, Carrie L., Environmental Science Dept., Freese and Nichols, Inc., 811 Lamar Street, Fort Worth, TX 76102
BRITTON, Joseph C., Dept. of Biology, Texas Christian University, Fort Worth, TX 76129

The correlation between environmental exposure and intraspecific morphometric variation was studied in four species of rocky intertidal snails from the Hong Kong area. Specimens of Nodilittorina trochoides (Gray 1839) fide Reid (1988), Nodilittorina radiata (Eydoux & Souleyet 1852) fide Reid (1988), Planaxis sulcatus (Born 1780), and Monodonta labio (Linnaeus 1758) were collected from 12 localities which comprised three exposure regimes (High, Moderate, and Shelter) based on coastal morphology and wave action. Each specimen was measured for nine morphological characters with the aid of a Bausch and Lomb digitizing tablet, a WILD M4 compound microscope fitted with a camera lucida, and vernier calipers.

One-way multivariate analysis of variance, performed for each species, demonstrated that the differences in shell morphology were statistically significant (P less than 0.00001) between populations from the three exposure regimes. Stepwise discriminant analyses confirmed that the populations were distinctly different and that the majority (greater than 70%) of specimens were correctly classified into exposure groups. One-way analyses of variance were used to demonstrate possible relationships between exposure and each of the nine morphological characters. The differences in shell morphology are considered to be due at least in part to environmental exposure.

ON THE RETENTION OF THE EMBRYONIC SHELL OF FISSIDENTALIUM PHANEUM DALL FROM HAWAII

BURCH, Beatrice L. and Thomas A. BURCH, B. P. Bishop Museum, Honolulu, HI 96817

Four specimens of the scaphopod Fissidentalium phaneum Dall, 1895 that had retained their embryonic shells were dredged in depths of 90 to 180 meters off Oahu, Hawaii. The translucent embryonic shells are approximately 1 mm long with a 0.2 mm long tip formed as a slightly inflated nipple with a small transverse slit in the distal end. Proximal to the inflated tip are several transverse annulations.

Approximately 700 F. phaneum specimens without the embryonic shell were obtained in 70 out of 359 sorted dredge hauls taken between 36 and 550 meters off Hawaii, Maui, Molokai, and Oahu Islands, Hawaii, with the greatest number between 90 and 180 meters.

RECENT RECORDS OF PHYLLIROE BUCEPHALA (GASTROPODA, OPISTHOBRANCHIA) IN THE SUBTROPICAL CENTRAL NORTH PACIFIC

BURCH, Beatrice L. and Thomas A. BURCH, B. P. Bishop Museum, Honolulu, HI 96817.

Phylliroe bucephala were examined from cruises between 1985 and 1988 utilizing the National Oceanographic and Atmospheric Administration sponsored National Marine Fisheries Service R/V Townsend Cromwell from the island of Hawaii and the Hancock Sea Mount and from the University of Hawaii R/V Moana Wave from around Oahu. Gear included dip nets, drift meter nets, Bongo nets, neuston nets, Isaacs and Kidd midwater trawls and modified Manta nets. Phylliroe were absent or scarce except at Hancock Sea Mount where a swarming population was encountered during an eleven day period in January 1988. Eighteen of 73 stations at that location had 404 Phylliroe. Preserved specimens ranged in size from 7 to 28 mm, with a mean of 18.1 mm. They were most abundant between 1830 and 0630 hours.

ON THE DISTRIBUTION AND MORPHOMETRY OF SOME SPECIES OF CHICOREUS (PHYLLONOTUS) IN VENEZUELA

CIPRIANI, Roberto, INTECMAR, Universidad Simon Bolivar, Apartado Postal 89,000, Caracas 1080, Venezuela.

In Venezuela, Chicoreus margaritensis, Chicoreus cf. globosus and Chicoreus cf. pomum live on sandy bottoms and Thalassia beds, localities that show high densities of Arca zebra, and other species of mollusks.

C. margaritensis has been found living around Cubagua Island, Mochima Bay, Cariaco Gulf and Triste Gulf. Empty shells were recorded at Isla Fernando, Archipelago Los Roques.

C. cf. globosus has been sampled in Caribe Island, and empty shells were found in some northern Margarita Island beaches and Amuay Bay, Paraguana Peninsula.

C. cf. pomum lives around Margarita Island, Coche Island and Paraguana Peninsula. Empty shells are known from Chirimena beach, Venezuela Gulf and some localities of Cariaco Gulf.

Some individuals of Chicoreus oculatus were collected near Puerto Frances and Chirimena beaches and shells were found in dos Mosquices Sur, Archipelago Los Roques.

Due to some individuals of Chicoreus (Phyllonotus) species showing highly variable shell characters in different localities, analysis of shell meristic characters and Raupian coiling parameters has been applied to discriminate all their shell forms.

CEPHALOPODS COLLECTED BY THE R/V "DR FRIDTJOF NANSEN" IN VENEZUELAN WATERS.

CIPRIANI,Roberto; L. MARCANO & F. AROCHA. INTECMAR-Caracas. FONAIAP-Cumana.

The cephalopod fauna of Venezuela is poorly known. Most of the species described are from the northeastern coast and very little is known of the deep sea cephalopod fauna off the Venezuelan coast.

The results of two cruises held during the first two quarters in 1988, revealed the distribution of neritic squids along the coast and of several oceanic species. Specimens were obtained with a bottom trawl of 40 m of sweep area, trawled at depths of 10-650 m. Five epipelagic species, four mesopelagic, two bentholittoral and three mesobenthic were collected.

The epipelagic were represented by Loligo plei, Loligo pealei, Lolliguncula brevis, Illex coindetti and Ornithoteuthis antillarum; the mesopelagic by Abralia redfeldi, A. veranyi, Lycoteuthis diadema and Pholidoteuthis adami; the bentholittoral by Octopus vulgaris and O. burryi; finally the mesobenthic by Rossia antillensis, Semirossia tenera and Nectoteuthis pourtalesi.

L. plei and L. pealei were present in 73% of the stations, where the highest yields were obtained in the northeastern continental shelf ($\bar{x}$=26.1 k/h), at depths beyond 60 m in the northwest coast ($\bar{x}$=13.6 k/h) and off the Gulf of Venezuela ($\bar{x}$=17.7 k/h).

O. antillarum, A. redfeldi, A. veranyi, L. diadema, P. adami, R. antillensis and N. pourtalesi are new records for Venezuela.

POPULATION BIOLOGY OF FLORIDA ASCOGLOSSA (GASTROPODA: OPISTHOBRANCHIA).

CLARK, Kerry B., Department of Biological Sciences, Florida Institute of Technology, Melbourne, FL 32901

Populations of four species were sampled at approximately monthly intervals over multi-year periods, including biomass-specific egg production and alga-specific population density. Three of the species live within a mangrove lagoon in the upper Florida Keys. Elysia tuca Marcus was sampled on Halimeda incrassata, where the population was non-reproductive and apparently recruited from allochthonous larvae (populations outside the lagoon exhibit an autumnal peak in egg production). Costasiella n. sp. lives on Avrainvillea, and reproduces all year, with highly variable egg production (no seasonal pattern). Oxynoe azuropunctata Jensen exhibits a strong seasonal peak (winter) in egg production, though population density is nearly constant. The reproductive peak may anticipate vernal regrowth of the sole food, Caulerpa paspaloides.

The fourth species, Elysia n. sp., eats Caulerpa prolifera and occurs in the Indian River Lagoon, east central Florida. This species exhibits an irruptive population cycle, reaching very high densities in early summer, followed by precipitous collapse of the population as its food supply disappears.

MICROCOMPUTER-BASED VIDEO MACROPHOTOGRAPHY SYSTEM.

CLARK, Kerry B., Genda Systems, Inc., and Florida Institute of Technology, Melbourne, FL 32901

A table-top system for biological recording of high-resolution color images can be assembled entirely from commercially-available, "off-the-shelf" components. The system permits real-time image recording, display, and storage. Components include a charge-coupled device (CCD) camera, video recorder, image capture circuit board, a widely-available microcomputer. The system uses a variety of commercially-available software, and can be assembled with minimal technical skill.

Use of the system will be demonstrated, including "METAZOA" (an image-intensive tutorial for invertebrate zoology), "SLUG-SPEAK" (a pictorial key to ascoglossan molluscs), and various programs for image processing, display, and storage.

THE RECENT EASTERN PACIFIC SPECIES OF THE BIVALVE FAMILY THRACIIDAE

COAN, Eugene V., Dept. Invert. Zool., California Academy of Sciences, Golden Gate Park, San Francisco, CA 94118

Twenty-two Recent species of thraciids are recognized in the area from the arctic coast of Alaska to Ecuador. Thracia myopsis and T. devexa remain in Thracia, s.l.; T. trapezoides and T. challisiana are assigned to subgenus Homoeodesma; T. septentrionalis to subgenus Crassithracia; T. condoni, tentatively recognized from the Recent fauna, to subgenus Cetothrax; T. curta and T. anconensis to subgenus Ixartia; T. squamosa to subgenus Odoncineta; and a new species to a new subgenus.

Asthenothaerus villosior and A. diegensis are separable species. "Thracia" colpoica is placed in a new genus. The genus Bushia contains B. panamensis, B. galapagana, and a new species. Lampeia is accorded full generic status, with L. adamsi its only species. The following taxa are recognised in Cyathodonta: C. undulata, C. dubiosa, C. pedroana, and C. tumbeziana. One new genus and species is proposed with a shell shaped like that of a Cyathodonta, but with a very different hinge.

NOTES ON CALCIFICATION IN MOLLUSKS: THE PRIMARY FORMATION OF THE NACREOUS SHELL LAYER IN Anodonta nuttalliana Lea, 1838 (BIVALVIA: UNIONIDAE)

CONEY, C. Clifton, Malacology Section, Los Angeles County Museum of Natural History, 900 Exposition Blvd., Los Angeles, CA 90007.

Reported here are data revealing the morphology and chemical composition of micro-spherules discovered in the mantle tissue of the glochidia of Anodonta nuttalliana Lea, 1838. These Glochidia begin life with only the prismatic layer forming the glochidial shell. Mantle tissue lying against the prismatic layer was found to be charged with numerous micro-spherules. Micro-probe analysis using a LINK Energy Despersive Spectrometer with a Cambridge 360 SEM at 20 kv revealed the presence of hydrocarbons and calcium in both the prismatic layer of the glochidial shell and the micro-spherules lodged throughout the mantle. While the amount of calcium present in the dense prismatic layer was found to be substantially greater than that amount detected in the micro-spherules of the mantle, this is to be expected of the initial stage of crystal formation. The micro-spherules found in the mantle tissue apparently act as "seeds" which will eventually coalesce with growth and form the nacreous inner shell layer.

COMPARATIVE ANATOMY OF STERKIA AND NEARCTULA (PULMONATA: VERTIGINIDAE)

CONEY, C. Clifton, Malacology Section, Los Angeles County Museum of Natural History, 900 Exposition Blvd., Los Angeles, CA 90007 and HOCHBERG, F.G. Department of Invertebrate Zoology, Santa Barbara Museum of Natural History, 2559 Puesta del Sol Rd., Santa Barbara, CA 93105

Details of internal anatomy and radulae were analyzed for two relatively unstudied micromollusks in the family Vertiginidae. Sterkia clementina (Sterki, 1890) and Nearctula californica longa Pilsbry, 1920 were collected from San Clemente Island, CA, the type locality. The radula and reproductive anatomy of Nearctula are highly similar to that of Vertigo, confirming Pilsbry's assignment of Nearctula as a subgenus of Vertigo. Sterkia has no appendix associated with the penis, therefore we are unable to confirm its previous allocation to the Nesopupinae. Sterkia exhibits an affinity for Opuntia habitat, whereas Nearctula may be found in a wider range of habitats. The distribution of Nearctula is restricted to California, Baja California and the California Islands. The distribution of Sterkia is distinctly disjunct. A clade of four closely related eastern neotropical species is widely remote from the three western species which mirror the distribution of Nearctula.

COMPARATIVE SHELL MORPHOMETRICS IN SOME RELATED SPECIES OF FOSSIL AND RECENT GASTROCOPTA (PULMONATA: PUPILLIDAE)

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Attempts to identify an unnamed fossil species of Gastrocopta from the late Wisconsinan, Pleistocene, of Nebraska, using traditional methodology, proved inconclusive. Specimens were compared with Recent Gastrocopta holzingeri holzingeri (Sterki, 1889), and G. holzingeri agna (Pilsbry & Vanatta, 1948), and the holotype and paratypes of G. falcis Leonard, 1946, known only as a Pleistocene fossil from Kansas.

A suite of 32 measurable characters, 20 for the aperture and apertural lamellae and 12 measures of whorl heights and widths, provides a robust data set that completely describes the morphometrics of the pupillid shell. Twenty-two specimens of the four taxa were measured and the data was subjected to principal component analysis with principal components being extracted from the correlation matrix. Three of the four taxa are separated almost completely in multivariate space defined by the first two principal components.

This analysis suggests that Gastrocopta falcis is synonymous with G. holzingeri, that G. agna is a valid taxon, and that the unnamed fossil species is new.

THE DICHOTOMOUS KEY AS AN IMPORTANT TOOL IN SYSTEMATIC MALACOLOGY

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Dichotomous keys are a very important tool used in many groups of plants and animals. The usage of keys in malacology is not very extensive, especially in most marine groups. The primary goal of constructing a dichotomous key is to end up with a highly efficient identification tool, but the process of constructing keys is here viewed as an extremely important exercise for the practicing taxonomist. Keys summarize diagnostic characters, and they are a good tool for assessing the composition of taxa. The process of constructing keys forces the taxonomist to critically examine taxonomic characters. Often phylogenetic relationships, parallelisms, and convergences are made obvious during this process. A most important aspect of keys is that they lend themselves to subsequent improvement, and new taxa can easily be added. Additionally, keys can easily be modified for a local fauna. Again, it is the process of constructing keys that is here viewed as of greatest benefit to the taxonomist, with a superior identification tool as a by-product. The construction of a key initially begins with a table of taxonomic characters, from which key characters are carefully chosen. The group is broken down into smaller units by choices of opposing sets of characters: each smaller group is, in turn, further broken down. Key characters of phylogenetic importance are best if they also lend themselves to easy recognition. Once the draft key is completed, testing and subsequent modification follows.

MORPHOLOGICAL AND MOLECULAR GENETIC COMPARISON OF U.S. HYDROBIA TRUNCATA AND EUROPEAN HYDROBIA VENTROSA.

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It has long been suggested that Hydrobia truncata (= H. totteni) from northeastern U.S.A. and European H. ventrosa were conspecific (Muus, 1967; Bishop 1976). This contention was strengthened when Oskarsson et al. (1977) found what they identified as H. ventrosa on the west coast of Iceland. There is also a strong resemblance between the species in life history and ecology (Davis et al., 1989). Are they conspecific?

Living specimens of H. ventrosa from Denmark were studied using tools of detailed comparative anatomy and allozyme molecular genetics. Small but significant morphological differences were found. Twenty-eight presumptive loci and 52 alleles were scored. Nei's (1978) D was 0.259 to 0.289 when H. ventrosa was compared with six populations of H. truncata. The Cavalli-Sforza and Edwards (1967) arc distance was 0.449-0.473. I conclude that sister species are involved; they are not synonymous.

DISTRIBUTION AND ANNUAL CYCLE OF Limacina retroversa Fleming, 1823 IN PATAGONIAN WATERS.

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An annual cycle (April, 1978 - April, 1979) of L. retroversa on the Patagonian shelf (40°-52°S) is analyzed. A stationary distribution pattern is shown in autumn and winter. The shelf population concentrates chiefly in a dense core (max.: 67,800 ind./1,000 m^3) or swarm located to the NW of Malvinas (Falkland) Islands. Individual expatriated northward connect this core with slope waters and merge with other swarms carried by the eastern branch of the Malvinas Current. In October, the core gradually begins to disintegrate and proceeds slowly northward and off the shelf. The summer distribution pattern consists in scattered individuals on the shelf and some swarms moving along the slope.

Despite the stability of the autumn-winter pattern, the abundance of L. retroversa in the area decreases regularly according to the expresion:

$$A = e^{33.7667-0.395006\,m} \qquad r = 0.90$$

where A: monthly abundance (ind.); m: month (April 1978 = 1; April 1979 = 13).

These results are discussed in relation with local hydrology, migration and reproductive events.

FEEDING ECOLOGY AND SIZE DISTRIBUTION OF OLIVELLA BAETICA (NEOGASTROPODA)

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Olivella baetica were collected in Monterey Bay, CA between September and November of 1988 to investigate distribution and feeding preferences. Shell lengths had a bimodal distribution, the two modes being 3.0 and 8.5 mm. This suggested growth of new recruits. Variation was high in the density estimates, ranging from 2 to 17 individuals per 0.1m . O. baetica consumed a wider variety of both foraminiferans and other prey items (ostracods, crustaceans, and bivalves) than the larger size classes. Live animals were observed feeding in an aquarium. When food (chopped shrimp) was placed nearby they quickly emerged from the sand, engulfed a chunk of food, and descended beneath the substrate again. Out of forty three snails examined for sex, 91% proved to be male and 9% female. This may reflect differences in distribution or size between the sexes.

ECOLOGY AND TAPHONOMY OF ENVIRONMENTALLY STRESSED NON-MARINE MOLLUSCAN POPULATIONS, GRAND PRAIRIE PROVINCE, EAST-CENTRAL TEXAS

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Mollusks of two valleys (with permanent streams) and the intervening divide were studied for two years. The region is underlain by limestone; soil cover is thin or absent, ranging from black calcareous clay of the divides and upper valley sides to fossiliferous, tan, calcareous loams of lower valley side terraces. Divides are covered by grasses, scattered shrubs, and trees, whereas valleys support a dense cover of trees, shrubs and grasses.

Low species diversity is closely correlated with annual distribution of rainfall. Torrential spring rains and rapid run-off produce sheetwash, gulley erosion, and valley flooding which devastate local snail populations. Summer and occasionally longer droughts lead to critical loss of soil moisture and further population stresses.

Terrestrial snails of the divide and valleys are consistently active only in the spring and late fall. With cessation of valley flooding in early June and prior to onset of summer drought, a period of 4 to 5 weeks, environmental factors appear uniquely favorable for breeding and reproduction among terrestrial snails. These factors include: 1) rapid plant growth, 2) high soil moisture, 3) daily minimum air and soil temperatures above 60°F, and 4) probable enrichment of near-surface waters in nutrients important to snail development.

Time-averaged death assemblages, living snails, and fossils are transported downstream and deposited together on the valley floor. Such mixed assemblages of aquatic and terrestrial snails, if preserved, would convey a confusing picture of the present environmental complex.

SHELL GROWTH RATES AND ARAGONITE PRODUCTION OF PTEROPOD AND HETEROPOD MOLLUSCS.

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Shell calcification rates of four species of euthecosomatous pteropods and two species of shelled heteropods were measured in short-term ^{45}Ca uptake experiments. In subtropical, temperate and subarctic waters of the North Pacific Ocean and Atlantic Ocean, animals were hand-collected by Scuba divers, captured with the use of a submersible, and caught in plankton nets. Shell growth rates of pteropods and heteropods ranged from 1.1 to 7.8 μg Ca deposited (mg Ca shell)$^{-1}$ h^{-1}.

Aragonite production of shelled pteropods and heteropods at three oceanic stations was estimated using the instantaneous growth rate method. Estimates of aragonite production ranged from 2.1 to 6.9 mg $CaCO_3$ m^{-2} d^{-1}. Using weighted averages based on two broad divisions of oceanic productivity, aragonite production was compared to reported calcite fluxes of foraminiferans and coccolithophorids. Because the production of calcite exceeds the flux measured with sediment traps, pteropod and heteropod aragonite probably constitutes a smaller percentage of total biogenic $CaCO_3$ than the 21% estimated here.

OLIGOCENE LAND SNAILS OF THE ROCKY MOUNTAINS AND ADJACENT AREAS.

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Oligocene land snails occur in over 300 localities in the intermontane basins of Colorado, Montana, Wyoming, and the Great Plains of Nebraska and South Dakota. The fauna is poorly known, but includes taxa from at least 13 land snail families. Most of the taxa occur in the earliest Oligocene (Chadronian) rocks, but snails occur throughout the Oligocene sequence.

The Oligocene land snails are largely distinct from their Eocene predecessors, but most are closely related to land snails now living in the western United States and northern Mexico. The most characteristic Oligocene group is the helminthoglyptids that have been lumped in the species "Helix leidyi." These include relatives of Humboldtiana, Xerarionta, and Helminthoglypta. Other widespread and locally abundant macrosnails include Polygyrella, Radiocentrum, and Ashmunella-like polygyrids. Rare snails include members of the Ceresidae, Limacidae, Oleacinidae, Urocoptidae, and the last of the Grangerellidae. Oligocene microsnails are very similar to those of the modern Rocky Mountains, and include Pupoides, Gastrocopta, Vallonia, and Discus.

In local areas, Oligocene land snails can provide detailed biostratigraphies. Over a wide area, land snail faunas of similar ages can be quite different, probably reflecting regional differences in climates during the Oligocene.

POLYGYRID ORIGINS: WEST OR EAST?

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Two conflicting hypotheses have been proposed for the origin and biogeographical history of the North American land-snail family Polygyridae. One postulates the Camaenidae as sister group, with the Ashmunellinae as the most plesiomorphic polygyrid subfamily; the other hypothesizes a non-camaenid holopod as sister group, with the Triodopsinae most plesiomorphic. Based on present distributions, the former hypothesis puts the origin of the polygyrids in the West, and the latter puts it in the East. An attempt will be made to resolve this question, based on anatomical phylogenetics of the Polygyridae and the eight families that have been suggested by various authors as polygyrid close relatives.

A REVIEW OF REPRODUCTIVE-SYSTEM ANATOMY IN OREOHELIX: A PROPOSAL FOR FUTURE RESEARCH

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Because of the apparent "plasticity" of the shell, the environment seems to play an unusually strong role in determining the shell morphology of Oreohelix. This plasticity makes identification of specimens not collected at type localities difficult, if not impossible. For these "cryptic" species, the terminal genitalia have not been particularly useful. Despite many studies, no species specific characters involving the terminal genitalia have been found. The more recent species descriptions have included a variety of characteristics (e.g. penis anatomy, epiphallus length, insertion of vas deferens into the epiphallus, length of retractor muscle, shape and orientation of the lobes of the ovotestis, plus shell characteristics and locality) which, taken together, usually make species identification possible, although it is a lengthy process. One usually hopes to find a relatively simple process by which to identify species of landsnails. To date, the only sure way to identify the "cryptic" species of Oreohelix is to include the use of electrophoresis.

MORPHOLOGY OF THE VELUM IN LARVAE OF ARCHIDORIS PSEUDOARGUS VON RAPP 1827 (MOLLUSCA/OPISTHOBRANCHIA)

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The larvae of Archidoris pseudoargus is a typical opisthobranch veliger with short planctonic development. It has a relatively simple bilobed velum.

Using a combination of SEM and TEM several types of cells in front and rear epithelium and in the area of the ciliary bands and the food groove can be distinguished. Cells of the two last-mentioned areas contain yolk and pigment granules. The cells of the front and rear surface contain many vacuoles and form a pillow-like epithelium on each external side with a brushborder of microvilli. These are connected by "discoidal reticulate lamellae" (Bonar and Maugel 1982. J. Ultrastruct. Res. 81, 88-103).

Across the velar lumen, which is filled with hemolymph-fluid, fibre-like structures connect front and rear epithelia. They form a web, where they are attached to the epithelia. Pressure of the hemolymph-fluid and muscles together with fibre-like structures act as antagonists.

MORPHOLOGY OF THE WINGS OF EUTHECOSOMATOUS PTEROPODS

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Using TEM and SEM the structure of the wings of different euthecosomatous pteropods was investigated (Limacina inflata, Creseis acicula, Clio pyramidata, Cavolinia inflexa).

The lumen of the wings, which is filled with hemolymph-fluid, is characterized by a framework of muscle cells, formed as pylons standing in regular intervals perpendicular to the wing plane. Their dorsal and ventral tips divide into branches (mostly two) before they penetrate the subepithelial muscle layers and insert at the epithelia. Their nuclei are situated in the median wing plane. From the level of the nuclear regions connections between neighbouring muscle cells are found, thus forming a row of pylons parallel to the long axis of the wing.

These rows are sometimes connected to each other by horizontal branches of the pylons also originating from their nuclear region, sometimes forming a perforated sheath in the median wing plane. This horizontal part, whether it may be a sheath or a framework of muscle cells, acts as support for nerves and muscle fibres originating from the columellar muscle.

A quite similar muscle-framework can also be found in the lobes of the foot giving further evidence for a common origin of foot and wings.

LARVAL AND POSTLARVAL SHELL MORPHOLOGY OF TAGELUS PLEBEIUS (BIVALVIA: TELLINACEA).

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Several distinct shell morphological features characterize early ontogenetic stages of Tagelus plebeius and enable their identification in the plankton and benthos. Adult specimens were collected from mudflats in Delaware Bay, New Jersey, and placed in baywater with 2 x 10^6 cells/ml of microalgae to induce spawning. Disarticulated larval and postlarval shells were examined using scanning electron microscopy.

Larval specimens 110 µm long have small, indistinct provincular teeth. Taxodont dentition is recognizable in shells 115-120 µm long, when 5-7 rectangular teeth are formed in the anterior and posterior regions of the hinge. Provinculum length increases gradually as teeth enlarge with larval development. At a shell length of 166-184 µm, a change in microstructure, marked on the exterior shell surface by a distinct prodissoconch-dissoconch boundary, coincides with settlement and formation of the ligament pit. Postlarval shells 215 µm long have a prominent umbo and an anterior cardinal tooth in both right and left valves. A posterior cardinal tooth forms in the right valve at a shell length of approximately 300 µm and in the left valve at a shell length of approximately 700 µm.

Larvae of Tagelus plebeius are distinguished from larvae of several sympatric tellinacean species by their taxodont hinge structure and continuously elongating provinculum; postlarvae are differentiated by the low umbo and absence of cardinal teeth in early stages and finally by the increasingly symmetrical shape of anterior and posterior shell margins.

BIPOLAR VARIATION IN CLIONE, A GYMNOSOMATOUS PTEROPOD.

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It has long been known that the gymnosome, Clione limacina, and its thecosome prey, Limacina helicina and L. retroversa, exhibit bipolarity. Clione limacina and L.helicina are found in arctic and subarctic waters as well as in antarctic and subantarctic seas, whereas L. retroversa co-exits with Clione in temperate waters of both hemispheres. None of these pteropods have been found in intervening equatorial areas.

A re-examination of bipolarity in Clione has been undertaken, utilizing new techniques and observations of living animals. Although Clione acts as a food specialist in all areas of its range, feeding only on Limacina, new in situ observations are presented that demonstrate behavioral differences between subarctic and antarctic specimens and their respective thecosome prey. Differences in external morphology are readily apparent in both larval and adult Clione from northern and southern areas, and differences in maximum adult size can be related to the size of available prey, and ultimately to productivity of the water. Scanning electron microscopy has been utilized to examine the radulae of Clione collected from different areas, confirming differences in the development of the median radular teeth.

FIELD BEHAVIOR OF THECOSOMATOUS PTEROPODS: ARE THEY MORE LIKE CLAMS OR SPIDERS?

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Recent in situ observations of feeding behavior by thecosome pteropods have revealed that members of all twelve genera of the four major families use a large, spherical or sheet-like external mucous web to collect a variety of food types. The dynamics of the web for the four families suggest it is used primarily as a trapping device for large, fast moving zooplanktonic prey. Preliminary analysis of diver-made collections of Limacina helicina from subarctic waters reveal that large metazoans account for 50 to 90% by volume of the food ingested in the webs. In contrast, virtually no intact metazoans occur in fecal pellets or in gut contents of specimens not fixed immediately upon capture. Intact phytoplankton cells can be identified in webs, guts and fecal pellets. It is concluded that carnivory by thecosome pteropods is much more important than previously thought. Studies where only the gut contents or fecal pellets are examined do not accurately represent the prey items, and will lead to the conclusion that phytoplankton is a more important constitutent of their diet than it actually is.

ANATOMICAL OBSERVATIONS OF THE GENUS HOLOSPIRA IN ARIZONA AND SONORA, MEXICO

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Preliminary studies of the reproductive anatomies of several Holospira species inhabiting Arizona and adjacent Sonora, Mexico indicate the presence of at least four lineages. These lineages correspond only in part to the presently described subgenera from this region which are based on shell characters.

The Sonoran species which have been investigated thus far are separable into three distinct lineages based on variations of the structure of the penial complex. One is represented by H. minima, the type species of the primary Sonoran subgenus Allocoryphe. However, a presently undescribed form whose shell clearly resembles that of H. (A.) remondi laevior differs significantly with regard to the arrangement of the male anatomy and, thus, represents a second lineage (=subgenus?). Another undescribed form which resembles H. (A.) dentaxis exhibits a similar arrangement. The third lineage is represented by H. (H.) milleri.

By comparison, the Arizonan species in subgenera Eudistemma and Holospira s.s. (H. sherbrookei, in press) are similar to each other with regard to the shape and arrangement of their anatomies and, hence, appear to be a monophyletic group. They differ from the Sonoran species by exhibiting a long, slender epiphallus, a comparatively large, elongate penis and a spermathecal diverticulum.

MARINE GASTROPODA COLLECTED BY THE STEAMER ALBATROSS FROM THE PHILIPPINES IN 1908.

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During the first year of the 1907-1910 Philippine Expedition of the U.S. Steamer Albatross, Paul Bartsch collected numerous molluscan specimens. Included in these were approximately forty species of Velutinacea, Onchidiacea and Opisthobranchia that were richly illustrated by Japanese artist, Kumataro Ito. Unfortunately, attempts to find specimens of this material in the collections of the National Museum of Natural History have been unsuccessful. However, many of these taxa are readily identifiable. Included in these taxa are 2 species of Scutum, 3 species of Velutinidae, 1 Onchidiidae, 1 Cephalaspidea, 3 Sacoglossa, 3 Anaspidea, 3 Notaspidea, 26 doridacean nudibranchs, 2 dendronotacean nudibranchs, 3 arminacean nudibranchs, and 1 aeolidacean nudibranch. Included in this collection are drawings of several undescribed taxa, which have now been collected from elsewhere in the western Pacific Ocean.

ADDITIONS TO THE AEOLIDACEAN NUDIBRANCH FAUNA OF THE TROPICAL EASTERN PACIFIC.

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The opisthobranch gastropod fauna of the tropical eastern Pacific has been reasonably well studied, particularly from the Gulf of California, Mexico. Included in the species known to occur within the Gulf of California are 16 species of aeolidacean nudibranchs. Recent investigations along the Pacific and Gulf of California coasts of Baja California have provided material of 11 additional species of aeolids, not previously recorded from the region. Four of these constitute new records of described Indo-Pacific species. Embletonia gracilis Risbec, 1928, has been recorded from the western Pacific as far east as the Hawaiian Islands. Phestilla lugubris (Bergh, 1870) has been recorded from the tropical Indo-Pacific from the east coast of Africa to the Hawaiian Islands. Specimens described from Panama and the Galapagos Islands as Phestilla panamica Rudman, 1982 are probably conspecific and represent a junior synonym of P. lugubris. The present material constitutes the first record of this species from Baja California. Eubranchus mandapamensis (Rao, 1968) has been reported only from the type locality, India and from Tanzania though it has also been recently collected from Papua New Guinea and Madagascar as well as the Gulf of California. Favorinus mirabilis Baba, 1955, has been recorded from Japan and Australia and has recently been collected from Baja California and the Pacific coast of Central America.

ACCESSORY BORING ORGAN (ABO) OF CHILIAN "LOCO", Concholepas concholepas (MURICIDAE, GASTROPODA).

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The "loco" looks like an abalone, and is the last surviving species of the genus whose other species are recorded only in the fossil record. At least the young bore through the shell of prey (DiSalvo, Biota 1: 14). Arias (Thesis, Univ. of Concepcion, 1983) noted the ABO in the "loco" and urged its study.

Each of three adult snails (kindly shipped by Izador Barrett, Santiago) examined by us possessed a large ABO in the midventral part of the fleshy foot. Histologically, the secretory disc of the mushroom-shaped organ consisted of elongated secretory cells, each with a large ovoid nucleus and an extension to the microvillar border on the free surface of the ABO. The slender ABO stalk contained longitudinal muscle fibers, nerves, and blood vessels in a hemocoel. Histochemically, secretion of the microvillar border was an acidic, non-sulfated mucosubstance with traces of protein.

The ABO of C. concholepas morphologically, histologically, and histochemically resembles that of other boring gastropods so far studied (Carriker, Malacologia 20: 403), supporting observations of DiSalvo that it can perforate the shell of prey. Boring is probably a chemical-mechanical process similar to that described for other shell-boring Muricaceans and Naticaceans.

A REVIEW OF NORTH AMERICAN CRETACEOUS CYPRAEIDAE AND THREE NEW SPECIES FROM SAN DIEGO AND YOLO COUNTIES, CALIFORNIA.

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Cypraeid mollusks are rare in Cretaceous deposits of North America and are represented by six species within the genus Paleocypraea s. s., two within the genus Bernaya s. s., and six within Bernaya (Protocypraea). Described species have been found in California, Oregon, Washington, Montana, Texas, Alabama, Delaware, and New Jersey. Paleocypraea (Paleocypraea) fontana (Anderson, 1958) from the Lower Cretaceous (uppermost Lower Albian) Budden Canyon Formation, Shasta County, California represents the earliest cypraeid found in North American strata.

Three new species of Cypraeidae were determined during the course of this study. Two are from the Upper Cretaceous (Campanian/Maastrichtian) Point Loma Formation near Carlsbad, northern San Diego County, and one is from the Upper Cretaceous (Turonian) Yolo Formation, Thompson Canyon, southern Yolo County, California. All three are assigned to the genus Bernaya and subgenus Protocypraea based upon shell characteristics.

QUALITATIVE AND QUANTITATIVE ASSESSMENTS OF CONCEALMENT TACTICS USED BY OCTOPUS BIMACULATUS IN A KELP HABITAT.

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Octopuses were observed and photographed during the day in their natural kelp habitat off the Channel Islands, California. We assembled an ethogram of body patterns used for concealment, which is their primary defense against predation. We illustrate their tactics of general color resemblance, deceptive resemblance, and disruptive coloration and we then assess pattern and brightness matching to representative backgrounds with a computerized image analyzer. This species is capable of diverse body patterns that provide superb concealment against a multitude of backgrounds; neural control of chromatophores and papillae allow octopuses to conceal themselves instantly as they move onto different substrates. Furthermore, O. bimaculatus climbs kelp stalks and remains motionless in a pattern resembling the color, brightness and texture of kelp; this 3-dimensional concealment and foraging tactic has not been observed in other shallow-water, benthic octopods.

ANATOMY OF ARCTOMELON STEARNSII AND A. BENTHALIS (PROSOBRANCHIA: VOLUTIDAE): SYSTEMATIC AND ZOOGEOGRAPHIC IMPLICATIONS.

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Like most bathyal and abyssal gastropods, both eastern Pacific species of the genus Arctomelon Dall, 1915 were described on the basis of empty shells. The genus has been assigned either to the predominantly Japonic and western Pacific subfamily Fulgorarinae, or to the Austral and Magellanic subfamily Zidoninae, as both have superficially similar shell and radular morphologies. Anatomical studies of Arctomelon stearnsii (Dall, 1872) and A. benthalis (Dall, 1896) serve as the basis of a reassessment of the phylogenetic affinities of this genus. The zoogeography of the bathyal and abyssal volutid fauna of the eastern Pacific is discussed.

GENUS FONTIGENS PILSBRY (GASTROPODA: HYDROBIIDAE).

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The genus Fontigens is a small-sized (8-9 spp.), group widely distributed among aquatic habitats in eastern North America. The genus belongs to the subfamily Emmericiinae Brusina. Congeners are not readily separable by shell alone in some cases, and distinguishing features are also from radula, penis, and pallial oviduct complex. Species may be cave endemic or present in both groundwater and epigean habitat; and include narrowly localized as well as widely distributed forms. The genus is disjunct in distribution, with suites of species largely restricted to either Ozark Plateau/Central Lowland or Appalachian regions. The relationship between snail zoogeography and modern drainage/physiography is complex.

DISTRIBUTION OF THE BULIMULINAE WITH RELATION TO MICROPLATE TECTONICS

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The Bulimulinae is a subfamily of land snails with a Gondwanaland distribution. They inhabit southwestern and central Australia, the northern tip of New Zealand, the Solomons, the New Hebrides, Fiji, and most of South America. The only exception to this Southern Hemisphere distribution is their occurance in Central America, the West Indies, and the southern part of North America. One bulimulid genus, Naesiotus has a North American-South American disjunct distribution. I propose a model to explain this disjunct distribution in which Naesiotus and other bulimulid genera may have been transported on terranes from an origin in what was formerly the South Pacific Ocean or from a continental land mass in what was formerly the Tethys Sea.

EVOLUTIONARY HISTORY OF CANTHARIDINE GASTROPODS IN SEAGRASS BEDS

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Evolutionary radiation of taxa comprising the Tribe Cantharidini (Trochidae: Trochinae) has been closely tied to marine plants. A major component of the radiation is in Australian seagrass systems. Seagrass beds have provided a unique set of trophic resources as well as a unique topographic and hydraulic enviromental setting for the evolution of peculiar morphological and behavioral innovations.

An initial phylogenetic analysis of relationships of an Australian complex of genera and species is based on a special set of relationships among the axis of shell coiling, the axis of the cephalopedal mass of the animal, and the plane of the substratum. The initial cladistic hypothesis, in which the clines in geometric relationships were directed through outgroup comparison, is subsequently tested by the overlay of four independent sets of data. The hypothesis is supported by (1) the early (Cretaceous) appearance of the plesiomorphic set of conditions and late (Neogene) appearance of the derived conditions, (2) parallel trends in the geometric relationships during ontogeny of the most derived taxa, (3) the correspondence between derived conditions and functional morphological paradigms, and (4) the results of an independent cladistic analysis of a set of 15 anatomical characters directed by separate outgroup comparisons.

LAND SNAILS OF THE CALIFORNIA ISLANDS

HOCHBERG, F.G. Santa Barbara Museum of Natural History, Santa Barbara, CA 93105

The islands off California provide a breathtaking natural laboratory setting for studies on the biology and evolution of land mollusks. Although most species were described in the late 1800's they have not been studied in detail until recently. Nineteen species are endemic to the islands. The diversity and density of native snails on several islands is much higher than adjacent mainland areas. Complex distribution patterns often mirror the intrusion of plants and animals from north and south.

REPRODUCTIVE SYSTEMS OF NERITIMORPH PROSOBRANCH MOLLUSKS FROM THE EASTERN PACIFIC

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Differences occur in the reproductive anatomy among the eastern Pacific neritimorphan gastropod genera. These differences are based on the location of the accessory sperm sacs in the female, and the nature of the penis in males. Also, there appears to be a direct relationship between the spermatophoric filament and the length of the duct to the receptaculum seminis. In addition, a sorting mechanism has been demonstrated within the crystal sac of Nerita funiculata.

THE RELATIONSHIP OF ASC'S WORKSHOP ON SYSTEMATICS COLLECTIONS RESOURCES TO NEW NSF INITIATIVES: FUTURE FUNDING OPPORTUNITIES FOR MALACOLOGY.

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Last October, the Association of Systematics Collections held a workshop on "Systematics Collections Resources for the 1990's." The workshop covered the status and needs of collections and institutions. It also focussed on needs in the areas of computerization and networking. The report was submitted to NSF and was considered by the National Science Board's Committee on Biological Diversity.

The ASC Workshop, the National Science Board Committee's deliberations, and actions of Congress on Biological Diversity have all led to expanded opportunities at NSF for systematics and related activities. New funds are available for computerization projects and conservation biology in the context of a major initiative in Biological Diversity. A new student training program is also being developed. The details of these opportunities and other Federal programs in biodiversity will be reviewed.

RECORD OF PLEISTOCENE MARINE MOLLUSKS IN THE LOS ANGELES BASIN, SOUTHERN CALIFORNIA, DURING THE LAST MILLION YEARS: AN OVERVIEW

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The Los Angeles Basin, a 50 by 80 km area bounded on the N by the Santa Monica Mtns, on the E by the Elysian, Repetto and Puente Hills, and on the SE and S by the Santa Ana Mtns and San Joaquin Hills, has been the site of continuous subsidence and deposition since the Late Miocene. Quaternary marine and non-marine sediments in parts of the basin may reach a thickness of 1,300 m. These have yielded the richest and most diverse assemblages of marine mollusks and other invertebrates of any sedimentary basin in western North America. Late Pleistocene mollusks, from the Palos Verdes Sand and equivalents, are best known from exposures along the fringes of the basin (e.g., from Potrero Cyn on the NW, Upper Newport Bay on the S, and Signal Hill and Palos Verdes Hills on the SW). These date to the peak of the last interglacial period (125,000 yrs BP), and are characterized by their warm-water faunal elements. Thirteen marine terraces are present on the Palos Verdes Hills. Faunas from successively higher (older) terraces correlate with successively deeper parts of the surrounding basin deposits. In San Pedro these are represented in part by the highly fossiliferous middle Pleistocene San Pedro Sand (300-350,000 yrs old) and underlying Timms Point Silt (400-500,000 yrs old) and Lomita Marl (500-600,000 yrs old).

ANATOMY, REPRODUCTIVE BIOLOGY AND SYSTEMATIC POSITION OF FOSSARUS AMBIGUUS (LINNÉ) (FOSSARIDAE: PROSOBRANCHIA).

HOUBRICK, Richard S., Department of Invertebrate Zoology, National Museum of Natural History, Smithsonian Institution.

The anatomy of Fossarus ambiguus (Linné, 1758), the type species of Fossarus Philippi, 1841, was examined for characters diagnostic of the family Fossaridae Troschel, 1861. The family is defined by several apomorphic characters: 1) a heavily ciliated cephalic rostrum; 2) a ciliated strip on the dorsal surface of each tentacle; 3) numerous fine denticles on the cutting edge of the lateral radular tooth; 4) a tightly organized nervous system with a very short supraesophageal connective; 5) protandry. The Fossaridae is herein placed in Cerithioidea. Within the Cerithioidea, fossarids are most closely related to members of the Planaxidae. Fossarus ambiguus is a protandric hermaphrodite, and constitutes the only known example of this phenomenon among Cerithioidea. Fossarus ambiguus has a brood pouch of ectodermal origin from which embryos are released at the veliger stage.

USE OF GENERAL PROTEIN ELECTROPHORESIS FOR DIFFERENTIATING LARVAL BIVALVES: PRELIMINARY STUDIES OF CRASSOSTREA VIRGINICA AND OSTREA EDULIS

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Preliminary studies indicate that the electrophoretic profiles of general proteins may be useful as a protein "fingerprint" for identifying larval bivalve mollusks. In this preliminary study, the general protein patterns of larval specimens of Crassostrea virginica and Ostrea edulis with shell lengths of approximately 200 um were individually analysed on thin (0.25 - 0.5 mm) SDS - polyacrylamide slab gels. Three to four electrophoretic bands of single larvae of Crassostrea virginica and six to seven bands of single larvae of Ostrea edulis were observed after staining with Coomassie blue and/or silver stains. The differentiation of the number and migration patterns of bands provides a potentially powerful tool for the identification of individual specimens of bivalve larvae.

THE NEW WHITE MICE: *HERMISSENDA* AND OTHER OPISTHOBRANCHS AS BIOMEDICAL MODELS.

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The use of marine organisms including molluscs as model systems for biomedical research has a long and important history. More recently, their usefulness has expanded greatly in the area of neurobiology. The basic advantage inherent to all these animals is their relative simplicity. Their reduced number of neurons which are easily accessible exhibit a high degree of anatomical constancy and homology of function with vertebrates.

Another advantage of marine invertebrates as biomedical research models is their ability to be kept in laboratory culture. Of the molluscs being used, two of the more important species are *Hermissenda* and *Aplysia*. Both these animals have a record of greater than 20 years of published neurobiological research including behavior, biochemistry, electrophysiology, functional morphology and anatomy of many neural pathways, and laboratory culture. As with the many strains of laboratory mice, rats, etc., laboratory cultures of *Hermissenda*, *Aplysia* and other opisthobranchs are needed to overcome problems with widely variable performances of field collected animals. Seasonal and other naturally occurring population fluctuations and overcollection pressures also make the natural supply of animals unpredictable. Laboratory reared animals in general have the distinct advantage of being raised healthy and disease free, well adapted for laboratory maintenance, research use, and being continued in specified genetic strains.

PRINCE SNAIL: A TSIMSHIAN MYTH

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The study of zoogeography and systematics is colored by one's assumptions. We have been trained to address organisms with the question, "What are you?" When we ask, "Why are you here?", we evaluate the ecological microcosm where the creature lives to learn what led it to reside in such a place. Eventually, we will ask it, "How did you get here?"

For Native Americans, the last question is the only one which needs answering, and the myth of *Prince Snail* provides an eye-opening explanation.

Some might find the Tsimshian view of molluscan distribution funny, even absurd. The evolution of marine snails and chitons from terrestrial ancestors seems implausible to modern scientists. But, such a notion is completely reasonable to a people who employ mythology to explain abstract concepts such as origination.

MOLLUSKS OF THE IRVINGTONIAN (MIDDLE PLEISTOCENE) SHUTT RANCH LOCAL FAUNA, RIVERSIDE COUNTY, CALIFORNIA.

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The Irvingtonian Shutt Ranch Local Fauna, recovered from the Plio-Pleistocene San Timoteo Formation, yielded a malacofauna of 16 taxa, including 2 clams (*Pisidium casertanum* and *P. insigne*), 8 aquatic snails (*Valvata* sp., *Pyrgulopsis* sp., *Fossaria cubensis*, *F. dalli*, *Physella concolor*, *Gyraulus circumstriatus*, *G. parvus*, and *Menetus opercularis*), and 6 land snails (*Vertigo berryi*, 1 species of Succineidae, *Euconulus fulvus*, *Pristoloma* sp., *Striatura pugetensis*, and *Deroceras* sp.). The aquatic environment consisted of a spring-fed stream flanked by seasonally varying ponds, all with vegetation rooted in mud beds and banks. The terrestrial environment included a riparian woodland bordered by upland woodland and scrub. The climate was moister, milder, and slightly cooler than today. Dated at 1.3 Ma, the fauna produced the oldest known records for *Striatura pugetensis* and *Vertigo berryi* and the oldest California records for *Fossaria cubensis*, *F. dalli*, *Gyraulus circumstriatus*, and *Euconulus fulvus*.

PHYLOGENY AND ADAPTATION OF THE PATELLOGASTROPOD RADULA.

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In the Patellogastropoda the radular teeth are variable in size and shape in the inner and outer lateral fields. Modification of teeth in the marginal field is not known except in the Lepetidae. A hypothesis of the relationships within the Patellogastropoda was constructed based on an analysis of a data set of over 50 characters. The distribution of radular modifications was then overlain on the resulting cladogram. Based on the hypothesized relationships the following large scale evolutionary trends in the Patellogastropoda are present: (1) loss of the medially fused inner lateral teeth, (2) reduction in the number of teeth in all three tooth fields, and (3) increasing complexity of the ventral support plates. Morphological adaptations for particular food types are remarkably similar between taxa. Radular adaptations for the following food types; (1) calcareous substrates (e.g., coralline algae), (2) high intertidal diatom flora, (3) marine plants including kelps and angiosperms, and (4) waterlogged wood are illustrated and discussed. When available the fossil record is used to document the paleo-geography and -ecology of specific taxa as well as setting minimum ages for their origin or association with a specific substrates.

SEASONAL VARIATION OF REPRODUCTIVE ORGANS FROM TWO POPULATIONS OF CARACOLUS CARACOLLA (PULMONATA: CAMAENIDAE) IN PUERTO RICO.

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Previous studies of the morphology of camaenid pulmonates have indicated that there is a seasonal variation in the reproductive organs of fully mature adult snails. To determine if environmental conditions influence reproductive seasonality, the histology of the reproductive system of two populations of Caracolus caracolla were compared. Both populations had different environmental conditions such as temperature and relative humidity, one population of snails was from a rain forest and the other from a dry coastal plain. Four reproductive organs were studied, ovotestis, hermaphroditic duct, spermatheca, and albumen gland. These organs were dissected, measured (size and weight) and sectioned monthly. A seasonal pattern of activity was seen in three reproductive organs of the rain forest population. The activity of the albumen gland was at a maximum during the month of May and the ovotestis was at the spawning stage in August. Since mating is related to the ripe stage of the ovotestis, the snails from both populations were mating from April to June. The mating season was correlated with an increase in temperature and precipitation. (Supported in part by NIH-MBRS RR08102).

LAND SNAILS OF NEW MEXICO, COMPARED WITH THE ARIZONA LIST OF BEQUAERT AND MILLER (1973).

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The number of species of native land snails known to occur in New Mexico totals 113, as compared to 128 species recorded by Bequaert and Miller (1973) for Arizona. Nineteen families and 28 genera are common to both states. The family Philomycidae has not been reported for New Mexico nor the family Carychiidae for Arizona. The genera Chaenaxis and Eremarionta have not been reported in New Mexico nor the genera Oxyloma, Polygyra, and Humboldtiana in Arizona. Forty-nine species are common to faunas of the 2 states. The genus Sonorella is richest in number of species (57) in Arizona, but contains only 5 species in New Mexico. The genus Ashmunella comprises 25 species in New Mexico and 6 in Arizona. Some biogeographic relationships of the land snail faunas of New Mexico will be discussed and related to the innovative and comprehensive discussion on the zoogeography of southwestern land snails by Bequaert and Miller (1973). Similarities and differences in the zoogeographic patterns in Arizona and New Mexico will be stressed.

ARCHAEOGASTROPOD LIMPETS AT DEEP-SEA HYDROTHERMAL VENTS: A 12-YEAR OVERVIEW OF DISCOVERIES.

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Limpets from hydrothermal vents were first collected by using the submersible vessel Alvin at the Galapagos Rift in 1977, and in subsequent years at other sites: East Pacific Rise at 21 N, Guaymas Basin, Florida Escarpment, Juan de Fuca Ridge, Mariana Back Arc Basin, East Pacific Rise at 10-12 N, and the Gorda Ridge. French and Canadian submersibles have explored the East Pacific Rise at 13 N, the Juan de Fuca Ridge, Explorer Ridge, and the Mid-Atlantic Ridge.

Limpets in 9 superfamilies and 12 families are known. Five recently described (or currently in press) superfamilies are endemic to the hydrothermal-vent habitat. The endemic groups can not be derived from existing families. Other living archaeogastropod superfamilies diverged in the late Paleozoic to early Mesozoic; the origin of the endemic hydrothermal-vent taxa has to be of similar age. Archaeogastropods dominated the gastropod fauna in the Paleozoic; the unique radular types of the hydrothermal-vent archaeogastropods may have occurred in groups that became extinct in shallow water. They may therefore represent living fossils.

FAMILIAL RELATIONSHIPS AND BIOGEOGRAPHY OF THE WESTERN AMERICAN AND CARIBBEAN HELICOIDEA (GASTROPODA: PULMONATA)

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Nordsieck's Revision des Systems der Helicoidea, the latest published classification of the superfamily, is further revised. By showing that anatomical characters of certain Xanthonychid subfamilies are as distinctive as the ones now used to designate familial rank for other helicoid families, we reaffirm Schileyko's elevating the Humboldtianinae to familial rank and we propose raising the Helminthoglyptinae, sensu Nordsieck, to familial rank. We support the placing of Monadenia by Nordsieck into a separate subfamily and we suggest that it belongs in the Bradybaenidae.

The discrete anatomical characters of the American helicoid families and their discontinuous geographical distribution bring into question the theory of a putative continuous radiation and evolution from an Asian origin. Recent geophysical data have shown that large parts of eastern Asia and western America were formed from Gondwanian terranes that migrated tectonically from the south Pacific. We suggest that the helicoid families arrived at their separate destinations, passively, via these Pacifican terranes.

RECRUITMENT OF HARD CLAMS, MERCENARIA SPP., IN FLORIDA: WHEN IS REPEATED FAILURE A SUCCESSFUL STRATEGY?

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Commercial landings of Mercenaria spp. from the Indian River lagoon, Florida, increased dramatically in the early 1980's, instigating a research program to examine aspects of the population dynamics and ecology of these bivalves. One aspect of this research has involved studying the relationship between Mercenaria spp. recruitment and hydrographic, meteorological, and environmental parameters. Results of this work demonstrate that recruitment rates vary spatially within the lagoon (on a scale of kilometers), and that the level of recruitment observed during 1986-1989 has not been sufficient to support a fishery at the level seen in the early 1980's. The broad "failure" of Mercenaria recruitment in the lagoon may be a general feature of the Indian River population(s), and, by extension, of other Florida populations. It is probable that massive Mercenaria recruitment successes are dependent upon natural climactic events which occur at irregular intervals. Typical levels of recruitment, although considered inadequate by many fishermen, seem to be consistent enough to sustain the population. "Normal" recruitment is spatially variable and probably controlled by settlement patterns and by fluctuations in effects of localized biological disturbances.

BIOLOGY AND DISTRIBUTION OF ATLANTID HETEROPOD MOLLUSCS FROM THE GREAT BARRIER REEF, AUSTRALIA.

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Atlantid heteropods were collected from surface waters around Lizard (northern Great Barrier Reef) and Heron (southern GBR) Islands from 1985 to 1989. Atlanta gaudichaudia Souleyet, 1852 was the most common heteropod within GBR waters. Adults and veligers were found in both sampling seasons (summer and winter). Abundance and species diversity were similar between both islands. Six other species were found in low abundance.

Animals were retained in the laboratory for up to one week for feeding studies and observations on veliger metamorphosis. Atlanta gaudichaudia selectively preyed on limacinid and creseiid pteropods over other zooplankton. Cannibalism on smaller individuals of the same species was common.

Shell surface sculpturing, radula and opercula were examined for taxonomic studies by scanning electron microscopy. All heteropod species collected represented new records or extended distributional ranges for Australian waters.

PRESENT STATUS OF THE MICROMOLLUSKS OF NORTHERN SONORA, MEXICO

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The micromollusks of Mexico have received very little attention. Because of their small size they are difficult to see and to collect. Recent explorations have increased our knowledge of the malacofauna of Sonora. While searching for macromollusks several species of microsnails were found at most localities. A total of twenty species have been reported to occur in the state although few habitat accounts are available. Preliminary field work has added new locality records but no new species were discovered. Distribution maps were prepared for each species. The most widely distributed species are Chaenaxis tuba (Pilsbry and Ferriss, 1906) and Gastrocopta pellucida (Pfeiffer, 1841). A thorough search is still needed to develop more reliable conclusions.

HISTORICAL AND ECOLOGICAL ZOOGEOGRAPHY OF THE MOLLUSCS OF THE TEXAS PANHANDLE AND ADJACENT REGIONS.

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The living molluscan fauna of the Texas Panhandle includes at least 41 native species whereas Quaternary fossil assemblages from the region contain 142 species. Aquatic environments have changed more during the late Quaternary than terrestrial environments. The modern geographical pattern of increased effective moisture with increased latitude has been present for most, and probably all of the late Cenozoic. Periodic deposition and erosion of extensive riparian terrace systems throughout the Pleistocene have produced a temporally variable system of dispersal routes.

EVOLUTIONARY RELATIONSHIPS OF MICRARIONTA LAND SNAILS ON SAN NICOLAS ISLAND, CALIFORNIA.

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All eleven species of the Quaternary land snail genus Micrarionta are restricted to the Southern California Islands. A cladistic analysis of Micrarionta species and closely related genera supports the monophyly of Micrarionta and indicates that Eremarionta is the sister group to Micrarionta. Three species endemic to San Nicolas Island, M. micromphala, M. opuntia, and M. sodalis are a monophyletic group. An excellent fossil record provides clues toward understanding the evolutionary history of these snails. The three species are generally morphologically distinct, and they retained their distinct morphologies when they coexisted in the past, facts supporting their species status. Some geographically-restricted, extinct populations of snails intermediate in morphology between any two of the three species are puzzling because they do not seem to be hybrids or transition forms. Stratigraphic evidence indicates that M. sodalis occurred on San Nicolas Island before 120,000 years ago, Micrarionta opuntia originated before 18,000 years ago, and M. micromphala may have originated near the time M. opuntia did, so Micrarionta sodalis is probably the direct or indirect ancestor of the other two. An increase in island size due to lowered sea level about the time M. opuntia originated may have played a role in a founder-flush type of speciation. Micrarionta sodalis became extinct within the last 3500 years. Its extinction may have been influenced by human occupation of the island, or by a preceding period of dry climate.

ZOOGEOGRAPHY OF LAND SNAILS IN THE CENTRAL GREAT BASIN

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The central Great Basin is characterized by high, forested ranges separated by semi-arid valleys. Spring-fed wet meadows or marshes in the valleys support a fauna distinct from that found in the ranges. The dominant fault-block ranges were elevated during the Miocene from a level plain of Oligocene ignimbrites. A few large metamorphic core complexes have had considerable relief throughout the tertiary.

Sampling of the ranges began in 1976 and continues to date. The known montane fauna consists of twenty one species, counting the taxonomically difficult *Oreohelix strigosa* and *Oreohelix hemphilli* groups as single species. A minimum of six species in *Oreohelix* brings the total montane fauna to twenty six. Including the valley habitats, the total known regional land snail fauna is thirty species. Faunal relationships lie with the Rocky Mountain province.

Species-area relationships indicate that the montane faunas are non-equilibrium, undergoing extinction without replacement. This suggests that dispersal of the minute species dominating the fauna is minimal under existing conditions.

UPGMA clustering of the ranges on Jaccard's index suggests that the high ranges of eastern Nevada and adjacent Utah, and those of the western Great Basin form distinct groups. Smaller ranges cluster without regard to geographic relationships, suggesting chance similarities resulting from random loss of species.

HABITAT AFFINITIES AND SPECIES DIVERSITIES OF LAND SNAILS FROM THE RUBY MOUNTAINS, NORTHEASTERN NEVADA

PORTS, Mark A., Northern Nevada Community College, Elko, NV 89801

A total of 14 species of land snails have been identified in 6 habitat types from the Ruby Mountains of northeastern Nevada. These mountains exhibit many complex levels of vegetation and a relatively high annual precipitation. These factors contribute to a high land snail diversity for this range. Relationships between population densities, species diversities, and species assemblages are associated with habitat types and the biogeography of the region. Distribution of all species of snails throughout the range was found to be sporadic in nature, although most species were habitat generalists occurring in 3 or more habitats. Aspen and cottonwood habitats with vegetation structured in 3 distinct substrate levels were found to have the highest snail populations and species diversity. Rock mat communities on dry rocky cliff sites were found to have the smallest populations and species diversity. Geographic variation in shell morphometry was analyzed in populations of Oreohelix peripherica and Oreohelix eurekensis.

COMPARATIVE REPRODUCTIVE BEHAVIOR OF TWO PELAGIC NUDIBRANCHS, FAMILY GLAUCIDAE.

QUETIN, Langdon B. and ROSS, Robin M. Marine Science Institute, University of California, Santa Barbara, CA 93106

We observed the reproductive behavior and egg laying rates of Glaucus atlanticus and Glaucilla marginata, two species of pelagic nudibranchs from the Family Glaucidae from eastern Australian waters. Although the same sequence of behaviors occurred in both species to initiate mating and exchange of sperm, the timing of these behaviors was different. The entire process lasted about one hour for Glaucus atlanticus and only one minute for Glaucilla marginata. This difference in timing appeared to be related to both the morphology of the penis and the number and arrangement of the cerata. Eggs of both species were about the same size - 75 μm by 60 μm. They were enclosed in a membrane and released in a series of discrete strings. The larger Glaucus atlanticus had twice as many eggs per string as the smaller Glaucilla marginata. Egg laying rates in both species were directly related to food availability, but continued for up to 4 days in the laboratory with little or no food.

A REVIEW OF THE SYSTEMATICS AND BIOLOGY OF ASHMUNELLA (PULMONATA: POLYGYRIDAE).

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Species of Ashmunella demonstrate considerable overlap in their gross genital anatomy and shell morphology. Little is known of the microanatomy, ultrastructure, and functional morphology of any single species. Dissections of large numbers of individuals from different species groups (Huachuca and Chiricahua Mnts., Arizona; Black Range, New Mexico to date) indicate there may yet be anatomical features useful as systematic characters, the penial morphology and position of the right ocular retractor muscle being examples. Scanning electron microscopy of shell sculpture has proven useful in some cases, particularly among the large toothless forms such as A. chiricahuana (Dall), A. esuritor Pilsbry, and a Fly Peak population which has been referred to A. chiricahuana in the past. A complete description of the reproductive histology of A. chiricahuana and A. proxima duplicidens Pilsbry has been developed and the ultrastructure of most genital organs of the latter species has been described. Most of the transporting epithelia of the system demonstrates water reabsorption as a principal function. A complete histological picture of the digestive system of at least three species is currently in preparation. SEM preparation of the jaws and radulae of numerous species have provided a useful description but comparative differences have not been useful to date.

THE SEGUENZIIFORMES, BASILISSOPSIS AND GUTTULA: WHERE ARE THEY?

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Goryachev (1987) established the order Seguenziiformes for the superfamily Seguenziacea Verrill, 1884, and assigned it to the superorder Littorinimorpha. He also removed Basilissopsis to the Trochidae, and erected Guttulidae in the Echinospirida for Guttula. This placement and composition of the Seguenziacea conflicts with most treatments published since 1982. Goryachev's analysis of shell, radular, and anatomical characters is examined and compared with other classifications of the Seguenziacea. Basilissopsis and Guttula are seguenziacean; use of Guttulidae(inae) in Seguenziacea may be warranted.

STRUCTURE AND FUNCTION OF THE SCAPHOPOD EXCRETORY SYSTEM.

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The excretory system of the scaphopods Dentalium rectius and Cadulus aberrans has been examined with regard to haemocoel, pericardial and nephridial coelom anatomical relationships, the ultrastructural characteristics of ultrafiltrative, reabsorptive and secretory epithelia, and characterisation of secretory products. The heart is represented by a peri-anal sinus, which lies adjacent to the pericardial coelom. There is no evidence of a heart enclosed within the pericardial coelom as interpreted by earlier workers. A limited area of the pericardial epithelium, apposing the peri-anal sinus, is developed into podocytes, and may be the site of primary urine production. The ultrastructure of the scaphopod nephridial epithelium reveals two cell types. The first exhibits extensive vacuolation, within which secretory materials form granules by a process of surface accretion. The second possesses secretory vacuoles which are totally occluded by large granules, and, in addition, has a microvillous apical membrane, which may indicate a secondary reabsorptive capacity. Granules in both cell types show a concentric-ring ultrastructure, and are composed primarily of calcium phosphate with a small amount of zinc; there is an organic component of protein, glycogen, and mucopolysaccharide. Granules are extruded into the nephridial lumen by a process of merocrine secretion, prior to release into the mantle cavity via an externally ciliated, muscular, nephridiopore. While the observed functional morphology is consistent with a generalized plan of molluscan excretion, the scaphopod excretory system also exhibits unique features in circulation/excretion anatomy and secretory cell ultrastructure in comparison to other molluscan classes.

EFFECTS OF INTENSIVE FISHING EFFORT ON THE POPULATION STRUCTURE OF QUAHOGS, MERCENARIA MERCENARIA (LINNE), IN NARRAGANSETT BAY, RHODE ISLAND

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Quahogs, Mercenaria mercenaria (L.), and sediment samples were collected from three locations in Narragansett Bay: Greenwich Cove, Greenwich Bay, and West Passage. Average density in Greenwich Cove, closed to shellfishing for several decades, was 190/m^2 (range 32/m^2-500/m^2, 30 quadrats, average valve length [AVL] 62 mm). Greenwich Bay, adjacent to Greenwich Cove and heavily fished since the 1930s, had an average density of 78/m^2 (range 8/m^2- 184/m^2, 30 quadrats, AVL 31 mm). There were no significant differences in crude organic content of sediments between these two sites, whereas a slightly higher content of very fine-grained sands (<125 µm), silts and clays in the Greenwich Cove sediments was noticed. The average Mercenaria density at another closed site in West Passage was 46/m^2 with an average valve length of 61 mm. The lower density is due to higher silt and clay content of the sediments. There was a significantly higher number of juveniles (<40 mm) in the heavily fished area ($p<0.01$, ANOVA). Active fishing tends to remove adults from the population and enhance either the set or survival of juveniles. The mechanism for increases in juvenile density is not understood; possible explanations include removal of competition by adults and sediment disturbance/turnover as a result of fishing methods.

INDEPENDENT EVOLUTION OF TERRESTRIALITY IN TRUNCATELLID GASTROPODS ON CARIBBEAN ISLANDS (RISSOACEA: PROSOBRANCHIA)

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The phylogeny of the Atlantic Truncatellidae and the origins of terrestrial truncatellids on Caribbean islands were analyzed cladistically using morphology, 28S ribosomal RNA sequences, and allozymes.

Both anatomy and rRNA sequences support a subfamilial division: Geomelaniinae including the terrestrial taxa in Jamaica, and Truncatellinae including the two terrestrial species of Truncatella from Trinidad and Barbados. These terrestrial Truncatella are not sister species and so do not have a common terrestrial ancestor. Thus, terrestrial taxa evolved at least three times independently from amphibious ancestors in the Caribbean. Trinidad and Barbados became emergent at various times in the Cenozoic; terrestrial taxa then evolved on each island.

Fully terrestrial species have arisen more recently in the Truncatellidae than in other animal phyla. By the early Miocene some truncatellids had evolved an organizational grade allowing them readily to colonize land in appropriate tectonic contexts. Exaptations for terrestriality in the family include direct development, resistance to desiccation, feeding on leaf litter, and mode of locomotion. Several characters in transition allow identification of parallelisms such as ctenidial reduction, increased number of whorls, and reduced mucus production. Such transitional stages are likely to have been lost in older lineages; their presence aids phylogenetic analysis of radiations in truncatellids.

PHYLOGENETIC ANALYSIS OF THE NORTH AMERICAN HAPLOTREMATIDAE GASTROPODA: PULMONATA).

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The classification of the North American Haplotrematidae (=Haplotrematinae) is revised, based on character compatibility analysis. Two genera are recognized — Ancotrema and Haplotrema, the latter with three subgenera, Ancomena, Geomene, and Haplotrema, sensu stricto. The approximate age of the Haplotrematinae is 42.5 Ma (late middle Eocene), when the temperate Haplotrematinae and its tropical out-group, the Austroselenitidae, diverged. The phylogenetic hypothesis indicates an early dichotomy between Ancotrema and Haplotrema, with the species of Ancotrema retaining more characteristics of the common ancestor. Other trends include a tendency toward reduction of vaginal musculature, a parallel tendency toward greater penial complexity, migration of the origin of the penial retractor muscles from the columellar muscle bundle to the floor of the lung (presumably increasing mechanical efficiency), parallel instances of gigantism in the Pacific Northwest, size reduction southward along the Pacific Coast, correlating with the presence/severity of a summer dry season, and a homoplastic continuation of the loss or reduction of cusps on the teeth of the radula.

REMARKS ON ECOLOGY AND DISTRIBUTION OF SOME GASTROPOD LARVAE FROM THE TROPICAL ATLANTIC.

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Teleplanic Gastropod larvae show remarkable adaptions to the special conditions of pelagic life. In lack of a suitable substratum they can delay their metamorphosis for weeks and months - perhaps years - and so survive even transoceanic transport by relatively slow currents. Such larvae seem to stop feeding and swimming almost completely, but to float, making use of long mucus-threads, drifting in the water.

Another adaption to a prolonged pelagic state represents the cartilaginous larval shell in the genus Cymatium. This shell develops from a regular embryonic and post-embryonic aragonite shell, which is transformed into a much more resistant conchyoline one of similar size and shape.

In the tropical Atlantic the main food-source of teleplanic Gastropod larvae are Dinoflagellates. Larvae from different Gastropod families (Thaididae, Cypraeidae, Cymatiidae, Tonnidae, Coralliophilidae, Janthinidae) are able to digest the thick cellulose thecae of these algae, which means exploiting their favourite food-source more effectively. It is remarkable that the occurrence of a cellulase in these cases is restricted to the larval stages, whereas the metamorphized animals as carnivores have no need of a cellulase.

An unsolved yet very important question is that of the habitat (hatching area), where these larvae came from. The presence of quite small larvae in plankton communities of the Central Atlantic indicates that larvae may reach the area in question in an extremely short time (a few weeks).

EARLY GASTROPODS: NEW TWISTS IN THE TALE

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Recent cladistic analyses of primitive living molluscs (Wingstrand, 1985; Haszprunar, 1988) and new rRNA sequences (Ghiselin, 1988) have pointed to a somewhat segmented ("octomeric"), limpet-shaped, ancestor for all extant snails. The discovery of a variety of unusual limpets in deep-ocean, hot-spring environments has fueled this view, despite the fact that there is evidence for secondary derivation from coiled ancestors (Hickman, 1983).

The Cambrian and Ordovician fossil record provides a fundamentally different picture of the origin and early history of the Gastropoda. Most Cambrian snails are members of an ultradextral clade that disappeared during the Devonian. Late-ontogenetic development of dextral orthostrophy in a latest Cambrian member of this clade could indicate that those living gastropods with heterostrophic larval shells are descended from the Cambrian ultradextral forms. All other gastropods could be independently derived from an early dextral group whose first known member may be the early Cambrian genus Aldanella.

MOLLUSCAN SPATIAL AND TEMPORAL DISTRIBUTIONS: ASSESSING MACROEVOLUTIONARY HYPOTHESES.

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The species level properties of geographic range and geologic duration have been used to argue the case for species selection in the molluscan fossil record. Specifically, the empirical correlation between broad geographic ranges and long fossil records in molluscs has recently been given a causal macroevolutionary explanation. If broad geographic range imparts "extinction resistance", and is at least partially heritable in speciation events, then selection should act to preserve species with wide geographic ranges. The observed spatial and temporal distribution patterns of molluscs as revealed in the fossil record is consistent with this macroevolutionary scenario.

In order to critically evaluate this hypothesis it is imperative not to assess the fossil record uncritically by inferring distribution patterns at "face value". Testing the significance of a positive slope in the regression of geologic duration versus geographic range implicitly assumes that all taxa have an equal probability of being sampled. This implies that for any given time period a geographically short ranging species has the same chance of preservation and discovery as a species with a broader geographic distribution. This assumption is not valid because estimates of species duration are not independent of estimates of geographic range.

Computer simulations of various sampling regimes quantify the degree of autocorrelation between geographic range and geologic duration. The results of these simulations can be used to assess the species selection hypothesis. In addition, I have found a positive correlation between local abundance and geographic range for a sample of 180 species of Recent prosobranch gastropods from the northeastern temperate Pacific Ocean. This implies that geographically restricted species are also locally rare, thus further reducing their chances of being represented in the fossil record and compounding the problem of documenting temporal and spatial distribution patterns.

FROM TRICHOTROPIDAE TO CALYPTRAEIDAE BY WAY OF LYSIS GABB, 1864

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Gastropods resembling Trichotropis are present in Pacific Slope Cretaceous deposits at least as early as the Cenomanian (97 Ma). By Coniacian time (88 Ma), Lysis obstricta (White, 1889) had evolved a somewhat broadened and depressed inner lip. The inner lip is even broader and more depressed in the type species Lysis duplicosta Gabb, 1864, of Campanian age (80 Ma).

Lysis duplicosta was based on immature specimens and has been placed in several families, most recently in the Fossaridae, but mature specimens clearly resemble the calypteraeid Crepidula Lamarck, 1799, except that they remain more spirally coiled. Pacific Slope species of Lysis delimit more than one lineage. The very broad, depressed, spiraling inner lip of Lysis intermedia (Cooper, 1894) of Maastrichtian age (73 Ma) is, for example, more suggestive of Calyptraea Lamarck, 1799, or Crucibulum Schumacher, 1817, than of Crepidula. The internal deck or septum of calyptraeceans is homologous to the inner lip of trichotropid gastropods.

NET SAMPLING OF HETEROPODS: PROBLEMS AND RECOMMENDATIONS.

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The sampling of heteropods by nets is made especially difficult because of low population densities, high patchiness, the microscopic size of the most abundant forms (the atlantids) and potential daytime net avoidance. The design of a sampling program must take into consideration the mouth size, mesh width and filtration properties of the net, the volume of water filtered during each tow, the extent of between-sample (or replicate) variability, and an estimation of the numbers of replicate tows required to adequately sample different heteropod populations. The data for this study come from replicate tow series taken in Hawaiian waters using paired, opening-closing 70-cm Bongo nets and an open 4-m^2 ring net.

TAXONOMIC STATUS AND PHYLOGENETIC CONNECTIONS IN THE HELICOIDEA AUCT.

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Helicoidea auct. includes the taxa having primarily a dart apparatus. I assume that in an ancestral form there were many aragonite spicules in the vaginal walls; this part of the vagina was connected both spatially and functionally with some mucus tissue originating at the same time above the region. The next stage of evolution -- the oligomerization of the number of spicules (future darts) and mucus glands took place and their separation from the vaginal walls in three ways in accordance with the three Recent superfamilies: Helicoidea s. str. (American - European), Hygromioidea (Palaearctic - African) and Xanthonychoidea (Eurasian - American).

The system of American helicoids is as follows.

Helicoidea s. str.: Humboldtianidae (subfamilies: Humbotianinae, Bunnyinae, Lysinoinae, Leptariontinae, Tryonigeninae subf. nov.).

Xanthonychoidea: Xanthonychidae (subfamilies: Xanthonychinae and Monadeniinae, the former includes the tribes Trichodiscinini, Miraverelliini trib. nov., Xanthonychini, Metostracini); Helminthoglyptidae (subfamilies: Eremariontinae subf. nov., Helminthoglyptinae, Cepoliinae, Micrariontinae subf. nov., Sonorellinae); Epiphragmophoridae.

RESOURCE UTILIZATION IN A MULTI-SPECIES SCAPHOPOD ASSEMBLAGE.

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The diets of Dentalium rectius, Pulsellum salishorum, and Cadulus aberrans were determined. D. rectius was omnivorous, eating sediment, fecal pellets, foraminiferans, kinorhynchs, and invertebrate eggs. It was most abundant in a silty area that was about 10% organic material by weight, however it was found in all areas examined. It ranged in abundance from about 5 animals/sq. m., in clean sand, to about 66 animals/sq. m. in silt. Foraminiferans were rare where it was most abundant.

Cadulus aberrans was a foraminiferan predator, preying preferentially upon Cribrononion lene and Rosalina columbiana. The robust foraminiferan species Elphidiella hannai was eaten by C. aberrans about as often as they were encountered, while the fragile Florilus basispinatus, were eaten less frequently than expected. It was found most frequently in an area with sandy sediment that was about 5% organic material by weight. Foraminiferans were common in this habitat. Average densities of C. aberrans were about 10 animals/ sq. m.

Pulsellum salishorum was a dietary specialist preying on the foraminiferan Cribrononion lene. It was distributed evenly, but uncommonly, about 6 animals/ sq. m., in all the habitats examined.

COMMENTS ON THE "CARIBBEAN ASPECT" OF FOSSIL MOLLUSKS FROM THE GULF OF CALIFORNIA

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Paleontologists have long recognized a "strong Caribbean" component in faunules from the basal Imperial Formation in the Coyote Mts., southeastern California, and from many Tertiary marine formations in west Mexico. All agree that many taxa are "almost the same as" but not conspecific with Caribbean forms. Entirely Caribbean assemblages in west Mexico could imply that the northern Gulf area is a fragment of the Caribbean plate or that a seaway now obscured by the Trans Mexican volcanic arc connected the Gulf of Mexico with the Gulf of California. Neither alternative is suggested by the known patterns of species distributions. Gulf of California assemblages are mixtures of a few conspecific forms with mostly Tertiary-Caribbean descendants and endemic taxa. Fossiliferous sediments associated with radiometrically dated volcanic rocks indicate that seawater was present in the northern Gulf of California by 12 m.y. ago; this is much more time than the 4.5 m.y. previously allowed for the evolution and dispersal of Tertiary Caribbean ancestors in the area. Many biofacies in the northern Gulf have not been recognized outside that area, although an assemblage of *Codakia, Strombus* and *Turritella* from the basal Imperial Formation, Latrania Member, is now also known from the southern Cabo Trough. A period of ca. 8 m.y. is represented near the mouth of the Gulf by an unconformity at the Tres Marias Islands, but in the northern and central Gulf by extensive sedimentary marine sections. Quantifying the Caribbean aspect of west Mexican faunas using percentages of species cannot be undertaken until these vast records are sampled and studied.

THE NEXT CHALLENGE: LIFE STYLES AND EVOLUTION

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For more than a century, we lucky few have had the fun of going into those hills and, amidst the dust, rocks, heat, spines, and unfriendly arthropods, locating scattered pockets of aestivating land snails. Often they belong to unknown species, sometimes unknown genera.

Described, illustrated, named - then stored in cabinets, accumulated knowledge tells us gross ranges, and treasured bits of collecting lore pass on "how to find" that rarest of the rare, of which Pilsbry (or now Miller) only got five "good adult shells".

How do they survive? What changes in life style and structures have occurred and how can these be correlated with the changes in climate and vegetation that have taken place.

Evidence from a far country is presented to stimulate ideas and suggest future lines of research.

OBSERVATIONS ON THE SWIMMING ACTIVITY OF THE DORIDACEAN NUDIBRANCHS HEXABRANCHUS SANGUINEUS AND SEBADORIS CROSSLANDI FROM THE NORTHWESTERN RED SEA

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Apart from pteropods, which have adopted a permanent planktonic or pelagic mode of life, there are other opisthobranchs (among almost all other orders) which are pelagic only temporarily, swimming for variable periods of time. Swimming is effected mostly by the undulations of lateral pedal extensions (parapodia, fins or wings) and/or the mantle, sometimes by the undulation or flexion of the whole body.

In the northwestern Red Sea, the large dorids Hexabranchus sanguineus and Sebadoris crosslandi are remarkable examples of temporary pelagic gastropods, each exhibiting a distinct mode of swimming. In both cases, little progress is gained. Indirectly, however, a swimming Hexabranchus can be easily carried by currents or waves away from the reef edge.

Coupled with the bright body colouration, the graceful 'dancing' of H. sanguineus can either be a means of attracting a mate, or may play a defensive role. The swimming animal may thus escape from a slow-moving benthic predator, unaware of the warning message of the colour (or at night), or the colour, revelated by the swimming undulations, may serve to alarm other predators (by day). As many dorids, H. sanguineus (and S. crosslandi) are distasteful to fishes and other predators.

The dull colour of S. crosslandi is obviously camouflaging (by day). The sudden and violent body undulation, most frequently at night, may startle and repel an enemy. A startling attitude is also a probable function of swimming in Hexabranchus.

OBSERVATIONS ON THE ANATOMY OF THE SCAPHOPOD MANTLE

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Beside Antalis, in which the anatomy of the mantle is known, five genera of the order Dentaliida and ten of the Gadilida have been investigated with histological and ultrastructural methods. The anterior mantle edge is divided into functional units: an outer gland region, a central fold, and an inner gland region. whereas in Dentaliida the outer gland region is prominent and the central fold carries a ciliary organ, the latter is lacking in Gadilida in which only some have glands. Rhabdus has a different ciliary organ. The inner gland region consists of different epithelial and subepithelial gland cells in Gadilida; in Dentaliida only the former are present.

The epidermis of the pallial cavity is low but features ciliary rings in the anal region. The posterior pallial edge or pavillon of gadilids has a powerful ciliary organ to produce water currents and ciliated ridges on the dorsal mantle process, both wanting in dentaliids. Different types of gland cells occur in both orders.

Ciliary receptors of both mantle edges are described. Functional and systematic implications are discussed.

FIRST REPORT OF THE EOCENE TETHYAN GASTROPOD VELATES PERVERSUS IN MEXICO

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Velates perversus (Gmelin) was a shoreline-dwelling neritid that spread westward during the early Eocene from its homeland in Pakistan into the Paris Basin, France, and into southern California. It has been logical to assume that this species should be found in Mexico, but previously it has not been found there or anywhere in lower Eocene strata between France and southern California.

Velates perversus can now be reported from the lower Eocene ("Capay Stage") Bateque Formation in Baja California Sur, Mexico, in an area about 75 km southwest of San Ignacio. Many specimens were found, and they range in height from 4 to 90 mm.

The presence of V. perversus in Baja confirms that the route of dispersal of this species into southern California during the early Eocene was by way of Mexico. The Baja specimens add a new data point that is 700 km farther south than the previously known early Eocene southernmost limit of Velates perversus on the West Coast; namely, the Orocopia Mountains, Riverside County, southern California.

NOMENCLATURAL INDEX OF RECENT CEPHALOPOD TAXA

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A data base has been generated of the taxonomic names from family through subspecies levels of Recent cephalopods. Data elements include the original taxonomic names, author, date, original citation, and type of the taxon (for genus and subgenus). The data base is maintained on an IBM-AT computer using dBASE programs. The system features dual files, the taxonomic data base and the literature citation data base. This enables independent or relational searches and lists to be made. For example, one can determine the author of any taxon, all taxa described by an author, all original species within a genus, all publications by an author wherein new taxa are described, etc. Now that it is established, the system can easily be maintained and updated as new taxa are described.

EVOLUTIONARY CYTOTAXONOMY IN PELAGIC GASTROPODS.

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Chromosome number and morphology were given for 6 species of pelagic gastropods: *Hyalocylis striata* (2n=28), *Pneumodermopsis paucidens* (2n=32), *Paraclione longicaudata* (2n=32), *Pterotrachea coronata* (femelle 2n=32, male 2n=32), *Pterotrachea hippocampus* (male 2n=31) and *Firoloida desmaresti* (femelle 2n=32, male 2n=31).

Comparison of known karyological data among Thecosomata shows an evolutionary trend from low to high chromosome number suggesting a polyphyletic assemblage, and the possibility of a common ancestor with metacentric chromosomes is discussed. Within the Gymnosomata, the four species studied reveal a chromosomal stability in the chromosome number and a variable proportion of metacentric-submetacentric and subtelocentric-telocentric chromosomes. The chromosome number in Heteropoda is identical to that of known Naticidae, a phylogenetically close family. The presence of sex chromosomes is discussed among the Mesogastropoda.

ALGAL HOST USE BY THE MARINE SPECIALIST HERBIVORE PLACIDA DENDRITICA.

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The patterns and consequences of algal host use by marine specialist herbivores are not known. From 1985 to 1988, I examined algal host use by the gregarious ascoglossan Placida dendritica. During the spring and summer, Placida occurred on 14.5% of the Codium setchellii and 71.5% of the C. fragile at several sites on the central coast of Oregon. In field transplant experiments, Codium density and surrounding algal diversity did not influence Placida's abundance. Thus, Codium had no low-density or associational escape from Placida. Small Codium, however, were attacked less frequently than large ones. Codium also had a partial refuge in areas affected by high sand or wave disturbance. Placida attacked disproportionately Codium stressed by desiccation or damaged by prior Placida grazing. Algal damage may be much greater than the amount consumed because Placida grazed on strategic algal parts. Thus, the high incidence of Placida's attack, coupled with Placida's targeted feeding, indicate that the sea slug may reduce survival of its algal hosts.

INTERPLAY OF THE CIRCULATORY AND EXCRETORY SYSTEMS IN BIVALVE FERTILIZATION: EVIDENCE FROM ANODONTA GRANDIS (UNIONIDAE)

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Details of the fertilization biology in freshwater mussels are largely unknown. Literature reports and our observations suggest a highly efficient fertilization system in anodontine and lampsiline mussels. To further elucidate the fertilization biology of freshwater mussels, a population of Anodonta grandis from the Cedar River, Gladwin Co., MI was intensively sampled prior to and during the fertilization period in 1985 and 1986. Paraffin cross sections of male and female mussels were stained with hematoxylin/eosin or Feulgen/fast green and subsequently examined for gonad condition and gamete location. Males released spermatozoa in spherical aggregates. In females, spermatozoa were found in the suprabranchial chambers, circulatory system, and excretory system. We hypothesize that spermatozoa are collected by the female's outer demibranchs, internalized to the circulatory system, and subsequently transferred to the excretory system for short-term storage in the distal portion of the nephridium. Eggs released from the gonopore encounter spermatozoa released from the adjacent nephridiopore. If our hypothesis is corroborated, the dependency of fertilization in A. grandis on spermatozoa transport within the female circulatory and excretory systems is an unprecedented finding.

FIRST REPORT OF CALCIUM MINERALIZATION IN THE STYLETS (SHELL VESTIGES) OF AN OCTOPUS

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Calcium mineralization of the stylets (= shell vestiges) of octopuses of the genus Scaeurgus is reported and represents the first record of a calcified internal shell from any octopod, Recent or fossil. The mineralogy of the stylets is determined to be calcite with phosphorous and magnesium. This discovery suggests that the genetic basis for shell mineralization has been conserved in the evolutionary history of the Octopoda despite a generalized reduction in size and loss of mineralization of octopod endoskeletal elements. Functionally, calcification imparts strength and rigidity to the stylets which serve as insertion sites for the paired posterior mantle retractor muscles. Further use of the term "shell vestige" for octopod stylets in general is discouraged.

MORPHOLOGICAL STUDIES OF PRESERVED OCTOPUSES: A NEW TOOL FOR OCTOPOD TAXONOMY AND SYSTEMATICS

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The soft bodies of preserved octopus specimens vary greatly in texture and consistency. Morphology has been thought to be so variable that measurements can at best only estimate shape. To test this assumption, standard measurements of 7 characters (mantle length, mantle width, head width, arm length, arm width, web depth and sucker diameter) were compiled from literature accounts and directly from specimens for the 10 described shallow water octopods of the western Atlantic.

Within each species, logrithmically transformed measurements of the 6 characters were regressed against mantle length, a measure of body size. If deformation and variation are significant, any correlations will be obscured and show the morphology of preserved specimens to be unreliable. If size-independent morphological variation is minimal, each character will be highly correlated with size, that is, mantle length.

Of the 60 correlations, 55 were significant, 47 significant at $p<.005$. Morphology is reliable despite the soft bodies and apparent deformation of octopod specimens.

The high correlations permit definition and comparison of specific growth trajectories. Further, multivariate analyses discriminate among species groups, based only on these 7 characters, and may provide ecological and phylogenetic information.

STUDIES ON EGG CAPSULE STRUCTURE, EGGS, EMBRYONIC DEVELOPMENT AND EARLY LARVAL DEVELOPMENT OF CONUS BILIOSUS (RÖDING, 1798) AND C. CORONATUS GMELIN, 1791, FROM PAKISTAN.

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Breeding season, spawn, egg capsule morphology, egg dimension and number, prehatching development, characteristics and behavior of hatched veliger larvae of Conus biliosus (Röding) and C. coronatus Gmelin from Pakistan (northern Arabian Sea) were studied. In C. biliosus the number of eggs/capsule ranges from 1100-1410 (egg diameter 160-180 µm, incubation period 10-11 days at ± 32°C, veliger shell length at hatching 210-230 µm). Conus coronatus produces 1050-1890 eggs/capsule (egg diameter 151-169 µm, incubation period 9-10 days at ±32°C, veliger shell length at hatching 210-230 µm). The capsular fluid appears to be nutritive, as the embryos failed to survive after removal from capsule. Previous studies have documented that Conus species with large eggs produce large-sized larvae with an increased prehatching developmental time. The average egg diameter of both species falls in the modal size class of Conus with smaller eggs. Both species exhibit planktotrophic development, characteristic of all Conus with a large number of small eggs. No nurse eggs were observed; all the eggs in a capsule developed into veligers. Cleavage is holoblastic, with the first two divisions equal, but the third unequal. The larvae were maintained on an algal diet of Chlamydomonas and Navicula (1:1) and the antibiotic Polymixin B (25 ppm) sea water.

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