PROGRAM AND ABSTRACTS

58th ANNUAL MEETING

Hyatt Sarasota **2-7 August 1992**

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AMERICAN MALACOLOGICAL UNION

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1991-1992

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Local Information	Gladys McCallum, Sue Vaughan, Mary Mansfield
Registration	Liz Petit, Anne Joffe, Janice Bullock
Bourse and Exhibits	Anne Joffe
Logo and T-Shirts	Sue Stephens
Symposia	Rudiger Bieler, Terry Gosliner
Fieldtrips	Warren Allmon, Kurt Auffenberg, Fred Thompson, Peggy Williams
Hyatt Sarasota	Minna Franzek, Rhonda Holliday
Sarasota Shell Club	Peggy Williams
Mote Marine Laboratory	Gail Brown

PROGRAM SUMMARY

Note: Please check the bulletin board at the registration table for additional information, program changes, and messages.

Sunday, August 2

Monday, August 3

Tuesday, August 4

Wednesday, August 5

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Friday, August 7

The Sarasota Meeting Logo

A special "Thank you!" is extended to Sue Stephens of Sanibel Island for her assistance with the design of the logo and for overseeing the production of the T-shirts. The centrally located snail, *Latirus stephensae*, is a fossil from Florida that was named in honor of Sue by former AMU president Bill Lyons. The snail represents the focal point of the two symposia held during the meeting: one on gastropod phylogeny, the other on Caribbean mollusks. The circle of the common East Coast chiton, *Chaetopleura apiculata* (Say), reflects the research interests of the current AMU president.

REGISTRATION

The registration table will be open for those wishing to register or to purchase tickets for fieldtrips or the banquet, the Sarasota meeting T-shirt or AMU publications. Registration will take place in the Gallery on Sunday from 1:00-5:00, Monday and Tuesday from 8:30-12:00 and 1:30-5:00, and Wednesday morning from 8:30-12:00.

COPY AND FAX MACHINES

A copy machine is available in the Catering Office of the Hyatt during office hours (the cheaper alternative) and at the Front Desk (the more expensive alternative). The Front Desk also has a FAX machine [Telephone (813) 952-1987].

SMOKING POLICY

Smoking is not permitted in the meeting rooms. Smoking will be allowed in the Gallery throughout the week. At the banquet specific tables for smokers will be identified.

ACTIVITIES

President's Reception

All registrants are invited to this reception on Sunday evening from 8:00-10:00 PM. Join old friends and meet new people. Mixed drinks, soft drinks, coffee, and snacks will be available.

Bourse and Exhibits

Anne Joffe, chairperson of the Dealers and Sales Committee has made arrangements for well-known dealers to display and sell specimen shells and other malacological items. Several noted Florida collectors have brought special exhibits of shells that are sure to please. Don't miss this opportunity to see beautiful examples of Recent and fossil mollusks from Florida and the Caribbean. Meeting participants will find that the bourse and exhibit area is a great location to socialize during the early part of the meeting. The bourse will be open Sunday afternoon in the Sara DeSoto Room from 1:00-5:00 and Monday and Tuesday from 9:00-5:00.

Collectors' Evening

This Monday evening event will feature presentations that will please both amateurs and professions. Join Peggy Williams, President of the Sarasota Shell Club, for a delightful evening of brief talks by Terry Gosliner, Gary Rosenberg, Tucker Abbott, and Peggy Williams.

Mote Aquarium Openhouse

Visit with old and new friends among the sharks, turtles, mollusks, and other inhabitants of the Mote Aquarium. Snacks and a cash bar will will be provided. This is a great opportunity to visit a noted research laboratory and aquarium that is one of the area's most popular tourist attractions.

Fieldtrips

The traditional AMU fieldtrips will take participants to productive freshwater, terrestrial, and marine sites. A special feature this year will be the visit to a local fossil shell pit. All trips will be ably led by knowledgeable volunteers. For those wishing to do some sightseeing, we have made arrangements for meeting participants to travel on a scheduled cruise of Le Barge, a local sightseeing boat that visits different areas of Sarasota Bay.

Auction

Dick Petit will run the annual AMU auction. Many participants of previous meetings have considered the auction to be one of the most delightful aspects of the annual meeting. Don't miss Dick in action as attendees vie for choice specimen shells and malacological publications.

Roundtable Discussion on Funding of Molluscan Systematic Research

Some malacologists question whether their profession as a whole fares well when contrasted to other areas of science. As part of the symposium on phylogeny and classification of gastropods, Janice Voltzow will lead a roundtable discussion on "Funding of Molluscan Systematic Research: How Our Science Affects Our Funding."

Annual Business Meeting

Members should not miss this opportunity to help shape important decisions of the AMU. This is <u>your</u> chance to become better informed about the society.

Social Hour, Banquet, and Dance

As the meeting ends, joins friends in the Gallery for a social hour (with cash bar) followed by a sit-down banquet in the Hernando DeSoto Ballroom that features:

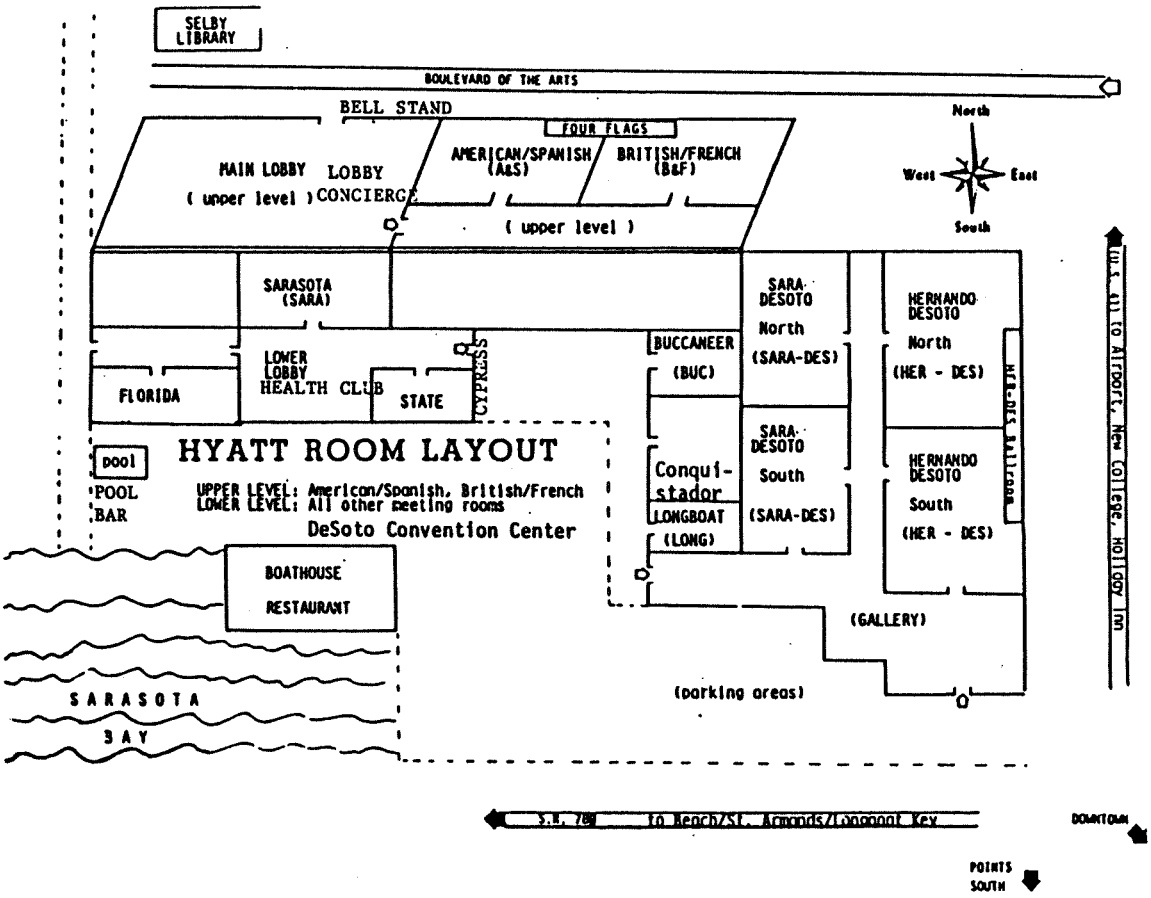
CAESAR SALAD
Romaine Lettuce with Croutons
Parmesan Cheese
Anchovy Vinaigrette Dressing

CHICKEN AND SHRIMP
Boneless Breast of Chicken
with Supreme Sauce
Stuffed Baked Shrimp
Tri-Color Pasta Alfredo
Broccoli Polonaise
Honey Glazed Carrots
Sour Dough Rolls and Butter

KEY LIME PIE
A Traditional Florida Favorite

Coffee Tea Decaffeinated

After the banquet, participants may remain in the Ballroom for an evening of socializing and, for the young at heart, dancing to music provided by a local D.J.



Notations in the program:

* - indicates author who will present paper
** - indicates candidate for best student paper award

Monday Morning, August 3

8:30-12:00 **Registration** Location: Gallery

8:45 **OPENING SESSION AND WELCOME** Location: Hernando DeSoto South

Robert C. Bullock, President of AMU
Kumar Mahadevan, Executive Director of the Mote Marine Laboratory
Peggy Williams, President of the Sarasota Shell Club

9:00-12:00 **Bourse and Exhibits** Location: Sara Desoto North and South

Symposium: BIOLOGY OF CARIBBEAN MOLLUSKS
Location: Hernando DeSoto South
Convener: Rüdiger Bieler, Department of Zoology, Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, IL 60605

9:15 **OPENING REMARKS AND WELCOME.** Rüdiger Bieler.

Local Faunas and Zoogeography of Smaller Taxonomic Groups

Chairperson: José Leal, University of Miami, Miami, FL

9:30 **UROCOPTID LAND SNAILS AND THE FAMILY HOLOSPIRIDAE.**
Fred G. THOMPSON, Florida Museum of Natural History, University of Florida, Gainesville, FL 32611.

10:00 **NEW RECORDS OF CARIBBEAN MOLLUSKS IN THE SOUTHERN PART OF THE GULF OF MEXICO.**
Flor Marina CRUZ-ABREGO*, Felipe FLORES-ANDOLAIS, and Arturo TOLEDANO-GRANADOS, ICMyL-UNAM, Estación Puerto Morelos, A.P. 1152 Cancun, 77500 Quintana Roo, MEXICO.

10:30 **BREAK**

11:00 **THE ZOOGEOGRAPHY OF THE WESTERN ATLANTIC TROCHIDAE, WITH SPECIAL REFERENCE TO THE CALLIOSTOMATINAE.**
James F. QUINN, Florida Marine Research Institute, 100 8th Avenue SE, St. Petersburg, FL 33701.

11:30 **THE EVOLUTION OF "*CHLAMYS*" (BIVALVIA: PECTINIDAE) IN THE TROPICAL WESTERN ATLANTIC SINCE THE RISE OF THE ISTHMUS OF PANAMA.**
Thomas R. WALLER, Department of Paleobiology, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560.

12:00 **GROUP PHOTOGRAPH** Location: Front of Hyatt

12:15 **LUNCH**

Monday Afternoon, August 3

1:30-5:00 **Registration** Location: Gallery

1:30-5:00 **Bourse and Exhibits** Location: Sara Desoto North and South

Symposium: BIOLOGY OF CARIBBEAN MOLLUSKS (continued)
Location: Hernando DeSoto South
Convener: Rüdiger Bieler, Field Museum of Natural History, Chicago, IL

Local Faunas and Zoogeography of Smaller Taxonomic Groups (continued)

Chairperson: José Leal, University of Miami, Miami, FL

1:30 **CUBAN MARINE MOLLUSKS AND THEIR BIOGEOGRAPHIC RELATIONSHIPS IN THE WESTERN ATLANTIC.**
José ESPINOSA, Instituto de Zoología, Academia de Ciencias de Cuba, Havana, CUBA.

Reproductive Strategies and Dispersal

Chairperson: M.G. Harasewych, Smithsonian Institution, Washington, D.C.

2:00 **REPRODUCTIVE STRATEGIES IN SOUTHERN CARIBBEAN GASTROPODS.**
Pablo PENCHASZADEH*, Roberto CIPRIANI, and Patricia MILOSLAVICH, Universidad Simon Bolivar, Apartado 89000, Caracas 1080, VENEZUELA.

2:30 **PASSIVE DISPERSAL OF LARVAE: RELEVANCE FOR THE BIOGEOGRAPHY OF CARIBBEAN MOLLUSKS.**
Rudolf S. SCHELTEMA, Woods Hole Oceanographic Institution, Woods Hole, MA 02543.

3:00 **BREAK**

3:30 **OF GIVING AND RECEIVING: THE CARIBBEAN AS A SOURCE AND SINK FOR INVADING SPECIES.**
Geerat VERMEIJ, Department of Geology, University of California, Davis, CA 95616.

5:00-6:00 **Editorial Board** (closed) Location: Longboat Room

Monday Afternoon, August 3

CONTRIBUTED PAPERS: GENERAL AND MARINE
Location: Hernando DeSoto North
Chairperson: William H. Heard, Florida State University, Tallahassee, FL

1:30 **SIPUNCULA, A SISTER TAXON OF MOLLUSCA.**
Amelie H. SCHELTEMA, Woods Hole Oceanographic Institution, Woods Hole, MA 02543.

1:50 **AN INORDINATE FONDNESS FOR MOLLUSK NAMES.**
Philippe BOUCHET* and Jean-Paul ROCROI, Muséum national d'Histoire naturelle, Paris, FRANCE.

2:20 **WHY YOU SHOULD NOT PUBLISH IN MALACOLOGICAL JOURNALS.**
David R. LINDBERG, Museum of Paleontology, 3 Earth Sciences Bldg., University of California, Berkeley, CA 94720.

2:40 **MARTIN LISTER (1638-1712) VS. LEEUWENHOEK'S "NEW THEORY OF GENERATION."**
William H. HEARD*, Department of Biological Science, Florida State University, Tallahassee, FL 32306, and L. Judith WAGNER, St. Johns River Community College, Palatka, FL 32217.

3:00 **BREAK**

3:30 **A MULTI-MEDIA DATA BASE ON DEEPSEA CEPHALOPODS.**
Michael VECCHIONE, Clyde F.E. ROPER*, Department of Invertebrate Zoology NHB-118, Smithsonian Institution, Washington, D.C. 20560, and James D. FELLEY, Office of Information Resource Management, Smithsonian Institution, Washington, D.C. 20560.

3:50 **A DAY IN THE LIFE OF IVAN SQUIDOVICH: BEHAVIORAL ECOLOGY OF A CORAL REEF SQUID.**
Roger T. HANLON*, J.F. FORSYTHE, F.P. DIMARCO, and G.C. HUMMELKE, Marine Biomedical Institute, University of Texas Medical Branch, Galveston, TX 77550.

4:10 **DOES OCTOPODID CLASSIFICATION REFLECT DISTRIBUTION OR PHYLOGENY?**
Janet VOIGHT, Department of Zoology, Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, IL 60605

4:30 **EVIDENCE FOR HYBRIDIZATION BETWEEN AN AQUACULTURE STOCK AND THE NATURAL POPULATION OF *MERCENARIA MERCENARIA* INHABITING THE FOLLY RIVER NEAR CHARLESTON, SOUTH CAROLINA.**
Katharine L. METZNER-ROOP**, Department of Biology, College of Charleston, Charleston, SC 29424.

Monday Evening, August 3

8:00-10:00 **Institute of Malacology** (closed) Location: Longboat Room

8:00-10:00 **COLLECTORS' EVENING** Location: Hernando DeSoto North
Chairperson: Peggy Williams, President of the Sarasota Shell Club

Take a break from the daytime professional papers and join others interested in shells and the study of living mollusks as some malacologists briefly speak on topics of general interest to amateurs and professionals.

Topics: **HOW SCIENTISTS STUDY BIOLOGICAL RELATIONSHIPS: A BRIEF INTRODUCTION TO CLADISTIC METHODOLOGY.**
Terry GOSLINER, California Academy of Sciences.
[This information will provide shell collectors and meeting participants greater understanding of the methodology employed in a variety of investigations being reported at this year's meeting].

THE SANIBEL SHELL MUSEUM.
R. Tucker ABBOTT, Founding Director of the Bailey-Matthews Shell Museum, Sanibel Island, Florida.

A CLOSE-UP VIEW OF GASTROPOD SHELLS.
Gary ROSENBERG, Academy of Natural Sciences of Philadelphia.

LIVING CARIBBEAN MOLLUSKS.
Peggy WILLIAMS, Sarasota Shell Club.

Tuesday Morning, August 4

9:00-12:00 **Bourse and Exhibits** Location: Sara Desoto North and South

Symposium: BIOLOGY OF CARIBBEAN MOLLUSKS (continued)
Location: Hernando DeSoto South
Convener: Rüdiger Bieler, Field Museum of Natural History, Chicago, IL

Distribution and Faunal Relationships

Chairperson: James F. Quinn, Florida Marine Research Institute, St. Petersburg

9:00 **EXTENT OF THE WESTERN ATLANTIC TROPICAL PROSOBRANCH FAUNA IN THE SOUTHERN HEMISPHERE: THE PERSPECTIVE FROM OCEANIC ISLANDS.**
José LEAL, Rosenstiel School of Marine and Atmospheric Science, University of Miami, 4600 Rickenbacker Causeway, Miami, FL 33149.

9:30 **THE ZOOGEOGRAPHIC IMPLICATIONS OF THE PROSOBRANCH GASTROPODS OF THE MOIN FORMATION OF COSTA RICA.**
David G. ROBINSON, Academy of Natural Sciences of Philadelphia, 1900 Benjamin Franklin Parkway, Philadelphia, PA 19103.

10:00 **PATTERNS OF MOLECULAR DIVERGENCE IN CARIBBEAN AND EAST PACIFIC FAUNAS.**
Timothy COLLINS, Department of Biology, University of Michigan, Ann Arbor, MI 48109.

10:30 **BREAK**

11:00 **ZOOGEOGRAPHY OF THE BATHYL AND ABYSSAL MOLLUSCAN FAUNA OF THE CARIBBEAN.**
M.G. HARASEWYCH*, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560, and Rüdiger BIELER, Department of Zoology, Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, IL 60605.

11:20 **A DATABASE OF WESTERN ATLANTIC GASTROPODS.**
Gary ROSENBERG, Academy of Natural Sciences of Philadelphia, 1900 Benjamin Franklin Parkway, Philadelphia, PA 19103.

11:50 **CLOSING REMARKS.**
Rüdiger BIELER, Field Museum of Natural History, Chicago, IL

12:00 **LUNCH**

Tuesday Afternoon, August 4

1:30-5:00 **Bourse and Exhibits** Location: Sara Desoto North and South

Symposium: BIOLOGY OF CARIBBEAN MOLLUSKS (conclusion)
Location: Hernando DeSoto South
Convener: Rüdiger Bieler, Field Museum of Natural History, Chicago, IL

1:30-3:10 ***ROUNDTABLE DISCUSSION.*** Thomas R. WALLER (Chairperson), Smithsonian Institution, Washington, D.C.

3:10 **BREAK**

Tuesday Afternoon, August 4

CONTRIBUTED PAPERS: GENERAL AND MARINE
Location: Hernando DeSoto North
Chairperson: Robert Hershler, Smithsonian Institution, Washington, D.C.

1:30 **FRESHWATER MITES (*UNIONICOLA*) AS MOLLUSCAN TAXONOMISTS AND BIOGEOGRAPHERS.**
Malcolm F. VIDRINE, Department of Science, Louisiana State University at Eunice, P.O. Box 1129, Eunice, LA 70535.

1:50 **UNDESCRIBED HETEROPHYID (TREMATODA) IN *MELANOIDES TUBERCULATA* (GASTROPODA: THIARIDAE) AND YELLOW-CROWNED NIGHT HERONS, *NYTICORAX VIOLACEUS* (CICONIIFORMES: AREIDAE).**
Pulin KOTHARI and Harold D. MURRAY*, Biology Department, Trinity University, San Antonio, TX 78212.

2:10 **EFFECTS OF COMMERCIAL NAVIGATION ON UNIONID MOLLUSKS: MISSISSIPPI RIVER, EAST CHANNEL, CITY DOCK, PRAIRIE DU CHIEN, WI, OCTOBER 1990.**
Marian E. HAVLIK*, Malacological Consultants, 1603 Mississippi St., La Crosse, WI 54601, and Carol B. STEIN, The Ohio State University Museum of Zoology, Columbus, OH 43210.

2:30 **AMAZING ANATOMICAL INNOVATION IN A CHINESE TRICULINE SNAIL SPECIES AND THE UTILITY OF QUANTITATIVE DATA.**
George M. DAVIS, Academy of Natural Sciences, 1900 Benjamin Franklin Parkway, Philadelphia, PA 19103.

2:50 **BIOGEOGRAPHY OF GREAT BASIN SPRINGSNAILS: STUDY RATIONALE AND PRELIMINARY RESULTS.**
Robert HERSHLER, Department of Invertebrate Zoology, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560.

3:10 **BREAK**

Tuesday Afternoon, August 4 (continued)

CONTRIBUTED PAPERS: GENERAL AND MARINE (continued)

3:30 **THE EVOLUTION OF SIMULTANEOUS HERMAPHRODITISM IN THE FRESHWATER MUSSEL GENUS *UTTERBACKIA* (BIVALVIA: UNIONIDAE): PHYLOGENETIC SYSTEMATICS OF *UTTERBACKIA*.**
Walter R. HOEH, Center for Theoretical Applied Genetics, Cook College, Rutgers University, New Brunswick, NJ 08903.

3:50 ***ELLIPTIO* SPECIES IN THE STREAMS OF THE UPPER COASTAL PLAIN IN SOUTH CAROLINA WITH EMPHASIS ON *E. HEPATICA*.**
Debra L. PYER*, Margaret MULVEY, Savannah River Ecology Lab, Drawer E, Aiken, SC 29802, and George M. Davis, Academy of Natural Sciences of Philadelphia, Philadelphia, PA 19103.

4:10 **REPRODUCTIVE DEVELOPMENT IN THE HERMAPHRODITIC FRESHWATER SNAIL, *PHYSA*, MONITORED WITH COMPLEMENTING ALBINO LINES.**
Amy R. WETHINGTON and Robert T. DILLON, Jr.*, Department of Biology, College of Charleston, 66 George St., Charleston, SC 29424.

4:30 **GENDER CHOICE IN A SIMULTANEOUS HERMAPHRODITE, THE FRESHWATER SNAIL *PHYSA*.**
Amy R. WETHINGTON**, Department of Biology, College of Charleston, 66 George St., Charleston, SC 29424.

Tuesday Evening, August 4

7:30-9:30 **OPEN HOUSE AT MOTE MARINE AQUARIUM**

Relax, join old friends, and make new acquaintances in a social setting at the beautiful Mote Marine Aquarium. A cash bar will be available. The aquarium features numerous tanks and exhibits that display a variety of marine life, including mollusks, crustaceans, sharks, skates, and sea turtles.

TRANSPORTATION: Vans will begin leaving from the front of the Hyatt at 7:10. All persons who need a ride should be at this location by 7:30. Vans will begin returning to the Hyatt at 9:10.

TRAVEL DIRECTIONS: (for those who will be driving their own cars): The Mote Marine Laboratory and Aquarium is located on City Island opposite the Hyatt Sarasota on the other side of Sarasota Bay. As you leave the Hyatt, turn right on North Tamiami Trail (U.S. 41), go 0.4 mi and turn right on SR 789 (Gulfstream Ave and John Ringling Causeway. The causeway drawbridge sometimes causes slight delays. Go 2.2 mi, turn right on North Blvd of the Presidents at traffic circle (follow signs to Longboat Key; you are still on SR 789). Go 1.1 mi and turn right at Mote Marine Aquarium sign. Aquarium is 0.2 mi on right.

Wednesday Morning, August 5

CONTRIBUTED PAPERS: PALEONTOLOGY Location: Hernando DeSoto North
Chairperson: Debra K. Krumm, University of Colorado, Boulder, CO

9:10 **PLIO-PLEISTOCENE CHITONS (MOLLUSCA: POLYPLACOPHORA) OF SOUTHERN FLORIDA.**
William G. LYONS, Florida Marine Research Institute, 100 8th Avenue SE, St. Petersburg, FL 33701.

9:30 **MARINE PLIOCENE AND EARLY PLEISTOCENE PATTERNS OF MOLLUSCAN EXTINCTION AND SURVIVORSHIP FROM THE ATLANTIC COASTAL PLAIN, EASTERN NORTH AMERICA.**
Lyle D. CAMPBELL, Science Division, University of South Carolina at Spartansburg, Spartansburg, SC 29303.

9:50 **A NEW VOLUTID GENUS FROM THE EOCENE OF SOUTH CAROLINA.**
David C. CAMPBELL*‡Department of Geology, The University of North Carolina at Chapel Hill, CB# 3315 Mitchell Hall, Chapel Hill, NC 27599.

10:10 **MORPHOLOGIC VARIATION IN *NODIPECTEN COLLIERENSIS* (MANSFIELD) AND *N. PEEDEENSIS* (TUOMEY AND HOLMES) FROM THE GOOSE CREEK LIMESTONE OF SOUTH CAROLINA.**
Matthew R. CAMPBELL*‡ Department of Geology, College of William and Mary, Williamsburg, VA 23187.

10:30 **BREAK**

10:50 **MORPHOLOGICAL TRENDS IN CENOZOIC MURICINAE.**
Daniel J. MILLER, Department of Geophysical Sciences, University of Chicago, 5734 S. Ellis Ave., Chicago, IL 60637.

11:10 **ENDOLITHIC BIVALVES FROM THE LARES FORMATION (OLIGOCENE) OF NW PUERTO RICO.**
Debra K. KRUMM, Department of Geological Sciences, University of Colorado, Boulder, CO 80309.

11:30 **EVOLUTIONARY TRENDS IN EARLY PALEOZOIC MOLLUSCA.**
Donald R. MOORE, School of Marine Science, University of Miami, Miami, FL 33149.

11:50 **LUNCH**

Wednesday Afternoon, August 5

1:00-5:00 **FIELDTRIPS** [times vary slightly]

MARINE ENVIRONMENT. Peggy Williams of the Sarasota Shell Club will lead a fieldtrip to a nearby locality that should provide a variety of local mollusks. Any person who plans to collect specimens must purchase a State of Florida collecting permit (information will be available at the registration desk). Fieldtrip cost $10.00. Participants will leave in vans from the front of the Hyatt at 1:00 PM sharp.

FRESHWATER AND TERRESTRIAL HABITATS. Fred Thompson and Kurt Auffenberg of the Florida Museum of Natural History will lead a group that will visit some local freshwater and terrestrial habitats. No collecting permit necessary. Cost $10.00. Van will leave from the front of the Hyatt at 1:00 PM.

FOSSIL SHELL PIT. Warren Allmon of the University of South Florida will lead a trip to a local fossil pit. No collecting permit required. Cost $15.00. Vans will leave from in the front of the Hyatt at 1:00 PM. More information about the fossil shell pit trip will be available at the registration desk.

LE BARGE CRUISE. The Le Barge, a local tour boat, provides two-hour sightseeing cruises around the quiet waters of Sarasota Bay. Collecting specimens will not be possible. Persons wishing to participate on this trip should purchase tickets from the registration desk by 5:00 PM on Monday, August 3. Cost, including transportation to the downtown dock area, is $10.00. Participants will leave from the area in front of the Hyatt at 1:30 PM and return to the hotel around 4:15.

Wednesday Evening, August 5

8:00-10:00 **AMU AUCTION** Location: Hernando DeSoto South

This year Dick Petit will again entertain AMU members and guests as he ably plays the role of auctioneer. Don't miss this occasion when amateurs and professionals seek to enlarge their libraries and shell collections. All proceeds go to the AMU Symposium Fund that supports symposia sponsored by the American Malacological Union.

Thursday Morning, August 6

Symposium: PHYLOGENY AND CLASSIFICATION OF GASTROPODS
Location: Hernando DeSoto South
Convener: Terrence M. Gosliner, Department of Invertebrate Biology and Paleontology, California Academy of Sciences, Golden Gate Park, San Francisco, CA 94118.

Chairperson: Terrence M. Gosliner, California Academy of Sciences

9:00 **PHYLOGENETICS OF THE EARLIEST ARCHAEOGASTROPODS.**
Peter J. WAGNER**, Department of Geophysical Sciences, University of Chicago, 5734 S. Ellis Ave., Chicago, IL 60637.

9:30 **ARCHAEOGASTROPODA: A CLADE, A GRADE OR WHAT ELSE?**
Gerhard HASZPRUNAR, Institut für Zoologie der Universität Technikerstrasse 25, A-6020 Innsbruck, AUSTRIA.

10:00 **TROCHID GASTROPOD PHYLOGENY: EFFECTS OF NINE CHARACTER SETS ON PHYLOGENETIC HYPOTHESES AND CLASSIFICATION.**
Carole S. HICKMAN, Department of Integrative Biology and Museum of Paleontology, University of California, Berkeley, CA 94720.

10:30 **BREAK**

11:00 **NEW PERSPECTIVES IN CERITHIOIDEAN PHYLOGENY.**
Richard S. HOUBRICK, Department of Invertebrate Zoology, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560.

11:30 **CLADISTIC ANALYSIS OF MURICID GROUPS: AN UPDATE (VERSION 5.3).**
Silvard KOOL, Museum of Comparative Zoology, Harvard University, Cambridge, MA 02138.

12:00 **LUNCH**

Thursday Morning, August 6

CONTRIBUTED PAPERS: TERRESTRIAL AND MARINE
Location: Hernando DeSoto North
Chairperson: Alan J. Kohn, University of Washington, Seattle, WA

9:10 **A PRELIMINARY REPORT OF UTERUS-EMBRYO RELATIONSHIPS IN *OREOHELIX* (GASTROPODA: OREOHELICIDAE).**
H. Lee FAIRBANKS*, Pennsylvania State University, Monaca, PA 15061, and Richard L. REEDER, Faculty of Biological Science, University of Tulsa, Tulsa, OK 74104.

9:30 **THE ZOOGEOGRAPHY OF THE LAND SNAILS OF PAKISTAN.**
Kurt AUFFENBERG, Florida Museum of Natural History, University of Florida, Gainesville, FL 32611.

9:50 **MORPHOLOGY OF LARVAE AND POSTLARVAE OF *BANKIA GOULDI* (BARTSCH) (BIVALVIA: TEREDINIDAE).**
Antonieto TAN-TIU*, Ya-Ping HU, Richard A. LUTZ, Fisheries and Aquaculture TEX Center, Institute of Marine and Coastal Sciences, Rutgers University, New Brunswick, NJ 08903, and Michael CASTAGNA, Virginia Institute of Marine Science, College of William and Mary, Wachapreague, VA 23480.

10:10 **SHELL MORPHOLOGY AND IDENTIFICATION OF EARLY LIFE HISTORY STAGES OF CONGENERIC SPECIES OF *CRASSOSTREA* AND *OSTREA*.**
Ya-Ping HU*, Richard A. LUTZ, R.C. VRIJENHOEK, S.C. FULLER, Institute of Marine and Coastal Sciences, Rutgers University, New Brunswick, NJ 08903, and Michael CASTAGNA, Virginia Institute of Marine Science, College of William and Mary, Wachapreague, VA 23480.

10:30 **BREAK**

11:00 **ANNUAL CYCLES OF TEMPERATURE AND GROWTH IN SHELLS OF *MERCENARIA*: INVERSE PATTERNS IN NORTHERN VERSUS SOUTHERN POPULATIONS.**
Douglas S. JONES, Florida Museum of Natural History, University of Florida, Gainesville, FL 32611.

11:20 **GENETIC DIFFERENTIATION AMONG SAMPLES OF THE BEACH CLAM *DONAX DENTICULATUS* FROM JAMAICA.**
Laura ADAMKEWICZ, George Mason University, Fairfax, VA 22030, and John SLAPCINSKY*, Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, IL 60605.

11:40 **DEVELOPMENT, DISPERSAL AND DISTRIBUTION IN INDO-PACIFIC AND TEMPERATE AUSTRALIAN *CONUS*.**
Alan J. KOHN, Department of Zoology, University of Washington, Seattle, WA 98195.

Thursday Afternoon, August 6

Symposium: PHYLOGENY AND CLASSIFICATION OF GASTROPODS
(continued) Location: Hernando DeSoto South
Convener: Terrence M. Gosliner, Department of Invertebrate Biology and Paleontology, California Academy of Sciences, Golden Gate Park, San Francisco, CA 94118.

Chairperson: Terrence M. Gosliner, California Academy of Sciences

1:30 **PYRAMIDELLIDS: ARE THEY PROSOBRANCHS OR HETEROBRANCHS?**
John WISE, George Washington University, Washington, D.C. 20052.

2:00 **CLASSIFICATION OF THE SACOGLOSSA (OPISTHOBRANCHIA), WITH A DISCUSSION OF PHYLOGENY.**
Kathe R. JENSEN, Zoological Museum, DK-2100 Copenhagen, DENMARK

2:30 **IMPLICATIONS OF A POLYGYRID GENERA PHYLOGENY.**
Kenneth C. EMBERTON, Academy of Natural Sciences of Philadelphia, 1900 Benjamin Franklin Parkway, Philadelphia, PA 19103.

3:00 **BREAK**

3:30 **MOLECULAR DYNAMICS OF MITOCHONDRIAL CYTOCHROME B IN PROSOBRANCH GASTROPODS.**
Timothy M. COLLINS*, Kenneth S. FRAZER, Wesley M. BROWN, Department of Biology, University of Michigan, Ann Arbor, MI 48109.

4:00 **GASTROPOD PHYLOGENY - A CLADISTIC EVALUATION.**
Winston F. PONDER*, Australian Museum, Sydney, NSW 2000, AUSTRALIA, and David R. LINDBERG, Museum of Paleontology, University of California, Berkeley, CA 94720.

4:30 **RECENT DEVELOPMENTS IN GASTROPOD SYSTEMATICS: MAJOR INCREASE OF KNOWLEDGE - OR MAJOR INCREASE OF NAMES?**
Rüdiger Bieler, Department of Zoology, Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, IL 60605.

Thursday Evening, August 6

Symposium: PHYLOGENY AND CLASSIFICATION OF GASTROPODS
(continued) Location: Hernando DeSoto South
Convener: Terrence M. Gosliner, California Academy of Sciences

8:00-9:30 **ROUNDTABLE DISCUSSION: FUNDING OF MOLLUSCAN SYSTEMATIC RESEARCH: HOW OUR SCIENCE AFFECTS OUR FUNDING.** A discussion led by Janice VOLTZOW, Department of Biology, University of Puerto Rico, P.O. Box 23360, Rio Piedras, PR 00931.

Friday Morning, August 7

Symposium: PHYLOGENY AND CLASSIFICATION OF GASTROPODS
(conclusion) Location: Hernando DeSoto South
Convener: Terrence M. Gosliner, California Academy of Sciences

Chairperson: Terrence M. Gosliner, California Academy of Sciences.

9:00 **ORDERED CHARACTERS IN GASTROPOD PHYLOGENY.**
Gary ROSENBERG* and Kenneth C. EMBERTON, Academy of Natural Sciences, 1900 Benjamin Franklin Parkway, Philadelphia, PA 19103.

9:30 **DISCOVERING KEY INNOVATIONS IN THE PHYLOGENY OF GASTROPOD MOLLUSCS.**
David R. LINDBERG*, Museum of Paleontology, University of California, Berkeley, CA 94720, and Winston F. PONDER, Australian Museum, Sydney, NSW 2000, AUSTRALIA.

10:00 **THE CONCEPT OF MONOPHYLY AND ITS APPLICATION TO GASTROPOD PHYLOGENY AND CLASSIFICATION.**
Terrence M. GOSLINER, Department of Invertebrate Biology and Paleontology, California Academy of Sciences, Golden Gate Park, San Francisco, CA 94118.

10:30 **BREAK**

11:00 **PRODUCING A COHERENT CLASSIFICATION OF THE GASTROPODA: A PANEL DISCUSSION.**
Panel: Rüdiger BIELER, Field Museum of Natural History; Gerhard HASZPRUNAR, University of Innsbruck; David R. LINDBERG, University of California, Berkeley; and Winston F. PONDER, Australian Museum.

12:00 **LUNCH**

Friday Morning, August 7

CONTRIBUTED PAPERS: MARINE Location: Hernando DeSoto North
Chairperson: M. Bowie Kotrla, Florida State University, Tallahassee, FL

9:10 **THE MORPHOLOGY AND ULTRASTRUCTURE OF THE FEEDING APPARATUS OF *SAYELLA FUSCA* (C.B. ADAMS, 1839) (GASTROPODA: PYRAMIDELLIDAE).**
Bradley J. PETERSON**, Department of Zoology, University of Rhode Island, Kingston, RI 02881.

9:30 **ENCAPSULATED DEVELOPMENT OF BUCCINIDAE (*BUCCINUM UNDATUM, B.* CF. *CYANEUM*) AND FASCIOLARIIDAE (*FUSINUS CLOSTER*).**
Patricia MILOSLAVICH**, Dep. d'océanographie, Université du Québec à Rimouski, Québec, CANADA G5L3A1.

9:50 **THE ROLE OF OLFACTORY AND TACTILE STIMULI IN THE FEEDING BEHAVIOR OF *MELIBE LEONINA* (GOULD, 1852) (MOLLUSCA, OPISTHOBRANCHIA).**
Charles M. CHESTER*† and Winsor H. WATSON, Department of Zoology, University of New Hampshire, Durham, NH 03824.

10:10 **MORPHOMETRIC AND GENOTYPIC RELATIONSHIPS AMONG FLORIDA GULF COAST BAY SCALLOP POPULATIONS (*ARGOPECTEN IRRADIANS CONCENTRICUS* (SAY, 1822)).**
Dan C. MARELLI*[1], Maureen K. KRAUSE[2], William S. ARNOLD[1], and William G. LYONS[1], [1]Florida Marine Research Institute, 100 8th Avenue SE, St. Petersburg, FL 33701, and [2]State University of New York at Stony Brook, Stony Brook, NY 11794.

10:30 **BREAK**

11:00 **MICROSTRUCTURE OF *BANKIA GOULDI* (BARTSCH) (BIVALVIA: TEREDINIDAE) SHELL DENTICLES.**
M. Bowie KOTRLA*, and Shannon SMALLEY, Department of Biological Science, B-142, Florida State University, Tallahassee, FL 32306.

11:20 **LIFE HISTORY AND REPRODUCTION OF THE OVOVIVIPAROUS CRASSATELLID *GONIOCUNA DALLI*.**
Carol M. CLEVELAND, Marine Sciences Research Center, SUNY Stony Brook, Stony Brook, NY 11794.

12:00 **LUNCH**

Friday Afternoon, August 7

CONTRIBUTED PAPERS: MARINE Location: Hernando DeSoto North
Chairperson: Dan C. Marelli, Florida Marine Research Institute, St. Petersburg

1:30 **PHYLOGENETIC RELATIONSHIPS AND PATTERNS OF HETEROCHRONY IN ADVANCED CARDIID BIVALVES.**
Jay A. SCHNEIDER, Department of Geophysical Sciences, University of Chicago, Chicago, IL 60637.

1:50 **MOLLUSKS FROM A LAGOON AT PUERTO MORELOS, QUINTANA ROO, MEXICO.**
Felipe FLORES-ANDOLAIS*, F. ESCOBAR, and F. CRUZ-ABREGO, ICMyL-UNAM, Estación Puerto Morelos, A.P. 1152 Cancun, 77500 Quintana Roo, MÉXICO.

2:10 **MOLLUSKS FROM CAMPECHE SOUND, MEXICO.**
Arturo G. TOLEDANO-GRANADOS*, V. SOLIS-WEISS, F. CRUZ-ABREGO, and F. FLORES-ANDOLAIS, ICMyL-UNAM, Estación Puerto Morelos, A.P. 1152 Cancun, 77500 Quintana Roo, MÉXICO.

2:30 **DEEP-SEA WOOD BORERS AND ANCIENT WRECKS.**
Ruth D. TURNER, Museum of Comparative Zoology, Harvard University, Cambridge, MA 02138.

3:00 **BREAK**

3:30 - 4:30 **ANNUAL BUSINESS MEETING** Location: Hernando DeSoto North

Take an active part in the affairs of your society and attend the annual business meeting. Each year a variety of important issues are brought before the membership. Your participation in this way contributes to the well-being of the AMU.

Friday Evening, August 7

7:00 **SOCIAL HOUR** Location: Gallery

8:00 **BANQUET** Location: Hernando DeSoto Ballroom

9:00 **SOCIAL TIME AND DANCE** Location: Hernando DeSoto Ballroom

GENETIC DIFFERENTIATION AMONG SAMPLES OF THE BEACH CLAM *DONAX DENTICULATUS* FROM JAMAICA.

ADAMKEWICZ, Laura, George Mason University, Fairfax, VA 22030, and SLAPCINSKY, John, Field Museum of Natural History, Chicago, IL 60605

Populations of *Donax denticulatus* were sampled periodically over a year's time at three different sites in Jamaica: Port Maria, a brown sand beach on the northern coast; Negril, a white sand beach on the western coast; and Black River, a brown beach on the southern coast. The three populations were at all times strongly differentiated from one another both in mean shell length and in the frequencies of various shell colors.

DNA extracted from these clams was subjected to RAPD amplification with six different primers. This technique yielded 18 genetic markers. At the same time, DNA from three samples of *Donax variabilis*, and one sample each of *D. parvula* and *D. texasianus*, all from the United States, were examined with the same six primers. The samples from Port Maria and Negril were uniform for the genetic markers, but both were strongly differentiated from Black River. The three samples of *D. variabilis* showed no such differences. Black River was also more differentiated from the other Jamaican samples than the two species, *D. parvula* and *D. variabilis*, were from each other. Clearly, the RAPD genetic markers suggest different relationships among the samples than the morphological markers do.

THE ZOOGEOGRAPHY OF THE LAND SNAILS OF PAKISTAN

AUFFENBERG, Kurt, Florida Museum of Natural History, University of Florida, Gainesville, 32611.

Preliminary studies on the zoogeographic patterns of the land snails of Pakistan have yielded interesting results. Pakistan represents a large void in our knowledge of the taxonomy and distribution of land snails in southern Asia. Only 53 species have been previously recorded from Pakistan. Based on collections from about 300 localities throughout the country, the fauna now embraces almost 100 species, including at least 20 undescribed taxa. The Enidae and Pupillidae dominate the fauna.

Six major zoogeographic provinces are present in Pakistan, 1) the Palearctic Province dominated by pupillids and valloniids conspecific or closely related to wide-ranging northern species, 2) the Himalayan Province is dominated by endemic ariophantids possibly related to more eastern or Tibetan species, 3) the Southern Foothills Province is dominated by about 30 endemic species of the enid genus, Subzebrinus, 4) the Northwestern Highland Province is also dominated by enids, but by different genera well-known in more western and northern localities, 5) the Western Highland Province dominated by dry mountain pupillids and enids, and 6) the Desert Province dominated by subulinids, particularly Zootecus. These faunal distributions are usually correlated to altitude and/or rainfall patterns. The limited distributions of the Northern and Western Highland faunas in Pakistan are enigmatic.

RECENT DEVELOPMENTS IN GASTROPOD SYSTEMATICS: MAJOR INCREASE OF KNOWLEDGE - OR MAJOR INCREASE OF NAMES?

BIELER, Rüdiger, Field Museum of Natural History, Chicago, IL 60605

In addition to the standard sources of nomenclatural change (discovery of "new" taxa and taxonomic revisions), gastropod systematics in recent years has had to deal with names derived from the systematizations of numerous hypotheses of phylogenetic relationship at "higher" taxonomic levels. These names, frequently the result of more-or-less orthodox applications of analytical methods of phylogenetic systematics, are subject to personal preferences (they are not regulated by the International Code of Zoological Nomenclature). Their large number and inconsistent application are defeating the main purpose of taxonomic classification, namely to act as an information storage and retrieval system.

An overview and analysis of various major classificatory schemes of Gastropoda are presented, and the question is addressed whether the major differences are based on content or labelling. Several uncoordinated and frequently contradictory attempts were made to introduce unified systems of name derivation and/or rank-indicating endings; history and reasoning of these efforts are examined.

AN INORDINATE FONDNESS FOR MOLLUSK NAMES.

BOUCHET, Philippe, and ROCROI, Jean-Paul, Muséum national d'Histoire naturelle, Paris, France

Routine taxonomical and nomenclatural work is facilitated by a number of nomenclators and treatises. As other zoologists, malacologists rely on Sherborn's Index Animalium and Neave's Nomenclator Zoologicus, plus a number of nomenclators specific to their discipline, such as the Ruhoff Index, Vokes' bivalve catalogues, and Wenz-Zilch's Handbuch der Paläozoologie. However, every source covers a limited field of our phylum, and a complete, up-to-date, and comprehensive nomenclator of molluscan names simply does not exist.

As a result of this frustration, we have started in 1987 to compile a Nomenclator of supraspecific names of Mollusca. This nomenclator is based on personal examination of all original descriptions, through library facilities in Europe (Paris, Leningrad, London, Stockholm, Frankfurt) and correspondence with colleagues and librarians in many other countries.

Our results indicate that there are 25,000 to 28,000 genus-group names of mollusks, with a current yearly increment of 224 names. Gastropods account for 12,700 names, cephalopods for 6,000, and bivalves for 5,100. Family-group names in Mollusca amount to more than 5,000 names.

In the last 30 years, scientists from the former USSR were responsable for 21.6% of the new genus-group names, and USSR, USA and China altogether account for half the total output. Omission of new generic names by Zoological Record stands at an alarming 23%. Omission mainly affects books and series, rather than regular journals, and by no means it is restricted to obscure publications.

Our ambition is to complete our nomenclator back to 1758, complete with references to type species designations. This will require another 6-8 years.

A NEW VOLUTID GENUS FROM THE EOCENE OF SOUTH CAROLINA

CAMPBELL, David C., Department of Geology, The University of North Carolina at Chapel Hill, CB# 3315 Mitchell Hall, Chapel Hill, NC 27599

Three years of field work in the Eocene Santee Limestone of South Carolina have yielded fragmentary molds of large gastropods. These included molds of a Strombus-like flaring lip as well as body whorl molds of Vasum wilmingtonense Brown and Pilsbry, 1912. However, the thin shell and prominent columellar folds suggested that the latter species was a volutid. Eventually, a combination of internal and external molds showed that the flaring lip belonged to the same species as the volutid body and columella.

The protoconch and early postnuclear whorls resemble those of Caricella, an Eocene genus previously reported from the Santee Limestone. Yet the multispiral protoconch and the unusual, centrally constricted body whorl, extremely large size and stromboid lip of the adult are distinctive. Some volutids, such as the Australian Pterospira (especially P. hannafordi), have an expanded, projecting lip, but no other volutid has the extremely flaring, recurved lip shown by these molds. I am therefore proposing a new genus with Vasum wilmingtonese as the type species.

MARINE PLIOCENE AND EARLY PLEISTOCENE PATTERNS OF MOLLUSCAN EXTINCTION AND SURVIVORSHIP FROM THE ATLANTIC COASTAL PLAIN, EASTERN NORTH AMERICA.

Lyle D. Campbell, USCS, Spartanburg, SC, 29303

Oxygen isotope data demonstrate a Pliocene history of at least 13 glacio-eustatic coastal onlap sequences, 11 of which can be correlated with Atlantic Coastal Plain deposits. Distribution of 1914 species (33.5 % bivalve species, 65.0 % gastropods, and about 1.5 % scaphopods and chitons) demonstrate several important trends and patterns. South Florida faunas were fully tropical, Carolinian and West Florida faunas were subtropical, and faunas from Virginia and northern North Carolina were warm temperate with greater numbers of arctic and boreal genera. Bivalves show greater cold water affinity and gastropods show higher tropical affinities. Gastropods show higher endemism, evolution, and extinction: bivalves typically show higher suvivorship between sequences and a greater percentage of extant taxa. The trends may be a function of diversity, as bivalves show the greater extinction in the units in which they predominate. Through the Pliocene, survivorship appears to be of greater importance than colonization in the make up of a given assemblage. Background extinction rates are 5-10 % per onlap interval, with greater extinction occurring coincident with more extensive regressions and especially catastrophic extinction occurring with the major regression at the Plio-Pleistocene boundary, 1.7 to 1.6 my BP.

MORPHOLOGIC VARIATION IN NODIPECTEN COLLIERENSIS (MANSFIELD) AND N. PEEDEENSIS (TUOMEY AND HOLMES) FROM THE GOOSE CREEK LIMESTONE OF SOUTH CAROLINA.

CAMPBELL, Matthew R., Department of Geology, College of William and Mary, Williamsburg, VA 23187

Published stratigraphy and provenance of South Carolina Nodipecten species were not definitive. However, expanded collections from Pliocene limestones in coastal South Carolina now provide Nodipecten populations of two distinct species. Both are found in the Goose Creek Limestone, an Early Pliocene calcarenite with two members separated by an unconformity. This lithologic break is also a biostratigraphic boundary for nodipectens. In South Carolina the older species, N. collierensis, occurs only in the lower member, outcropping around Charleston. These specimens exhibit low, rounded ribs with fine secondary sculpture, varying only in node development. By contrast, N. collierensis from South Florida are quite variable in ribbing and sculpture.

Nodipecten peedeensis, a probable descendent species, exhibits greater variation in all traits. N. peedeensis reaches 16 cm in diameter, is more inflated, has higher ribs, coarser secondary sculpture, and larger nodes. The major paired ribs of the right valve become fused in 30 of 109 specimens. N. peedeensis is restricted to the upper member of the Goose Creek Limestone. The type came from Henry Davis' estate, just east of Giles Bluff on the Pee Dee River.

THE ROLE OF OLFACTORY AND TACTILE STIMULI IN THE FEEDING BEHAVIOR OF MELIBE LEONINA (GOULD, 1852) (MOLLUSCA, OPISTHOBRANCHIA).

CHESTER, Charles M. and WATSON, Winsor H., Department of Zoology, University of New Hampshire, Durham, NH 03824

The dendronotacean opisthobranch, Melibe leonina, feeds by sieving small planktonic organisms using a specialized oral hood. Previous work has shown that feeding is a fixed action pattern which is modified by the external environment. Melibe exhibits feeding movements at 0.2 cycles per minute (cpm) in the absence of prey. This frequency increases in direct proportion to prey concentrations. The purpose of this study was to determine what qualities of prey caused a change in feeding frequency. Animals were exposed to 6 treatments: 1) filtered seawater, 2) Artemia-conditioned water (odor), 3) small inert particles in filtered seawater, 4) particles soaked in Artemia-conditioned water, 5) frozen Artemia, and 6) live Artemia.

Both the addition of odor and of particles resulted in a significantly higher feeding rate (0.4-0.5 cpm) than control conditions. Soaked particles and frozen Artemia resulted in a higher rate of feeding (0.7 cpm) than either stimulus by itself. When both stimuli were present but not combined the rate was the same as if both stimuli were added separately. However, no combination of stimuli were as effective as live Artemia, suggesting that vibration of prey is important. Particles were also required to illicit a complete feeding cycle. This suggests that Melibe uses two mechanisms to locate prey. Distance chemoreception using olfactory cues and contact chemoreception. Tactile reception of prey vibrations also appears to be important.

LIFE HISTORY AND REPRODUCTION OF THE OVOVIVIPAROUS CRASSATELLID GONIOCUNA DALLI.

CLEVELAND, Carol M., Marine Sciences Research Center, SUNY Stony Brook, Stony Brook, NY 11794

The geographical distribution of the crassatellid, Goniocuna dalli, is limited due in part to its relatively small reproductive output and low dispersal ability. It occurs in the shallow waters of the northeastern Gulf of Mexico where it can reach population densities of 8000 / m^2. Length, sex, brood size and developmental stage were determined for clams collected from West Ship Island, MS.

Males (mean length = 1.6mm) appear to mature at smaller sizes than females (mean length = 2.0mm) and represent a smaller proportion (20%) of the population above 2.0mm. Females are ovoviviparous and retain their young within the suprabranchial chamber in a single layer attached to the outer demibranch. Young are released as well developed juveniles (350 microns). Brood size ranges from 4 in the smallest (1.4mm) females to 60 in the largest (2.8mm) females and increases exonentially with female length. Females produce sequential broods but no overlap occurs between broods in a single individual. The late shelled embryos retain a small yolk deposit and have a large prodissoconch I. No prodissoconch II develops. Late shelled embryos are present throughout the year although a large release occurs in mid- to late summer.

MOLECULAR DIVERGENCE IN CARIBBEAN AND EASTERN PACIFIC GEMINATE SPECIES

COLLINS, Timothy M. , Department of Biology, University of Michigan, Ann Arbor, Michigan 48109-1048, U.S.A.

Questions concerning comparative rates of molecular evolution among higher taxonomic categories (phyla, classes,etc) are perennially interesting, but difficult to approach. Calculated rates of evolution among groups may be misleading if calibrations are made on very different time-scales (temporal scaling problem), or if calibrated on a time scale so great that the molecules being compared have suffered multiple substitutions at many sites (saturation problem). The Pliocene isolation of the Caribbean and Eastern Pacific marine faunas by the emergence of the Central American Isthmus is a situation in which both of these potential problems are eliminated. Geminate (twin) species from diverse taxonomic groups may be compared on the same short time scale. An homologous portion of the mitochondrial cytochrome b has been sequenced from over 20 species representing 10 geminate pairs of snails, urchins, and fishes. Results indicate that rates of molecular evolution vary over an order of magnitude among all geminates sampled, but that variation is reduced within taxonomic categories. Different taxonomic categories appear to have characteristic rates of evolution. Results from other studies supporting the idea of taxon-specific rates of molecular evolution are reviewed. Mitochondrial cytochrome b in snail geminates sampled to date is evolving at rates similar to those in urchins and approximately five times the rate found in fish geminates. [Based in part on joint research with Haris Lessios and Eldredge Bermingham, Smithsonian Tropical Research Institute]

MOLECULAR DYNAMICS OF MITOCHONDRIAL CYTOCHROME B IN PROSOBRANCH GASTROPODS.

COLLINS, Timothy M. , FRAZER, Kenneth S. , BROWN, Wesley M. Department of Biology, University of Michigan, Ann Arbor, Michigan 48109-1048, U.S.A.

A prerequisite to the proper application of sequence data to phylogenetic questions is an understanding of the molecular dynamics (the tempo and pattern of molecular change) in the group under investigation for the molecule being examined. In this study we describe the molecular dynamics of a portion of cytochrome b, a conserved protein-coding gene in the mitochondrial genome, for the prosobranch gastropods. A 731 base pair portion of the cytochrome b gene from a variety of prosobranch taxa has been amplified by the Polymerase Chain Reaction (PCR) and directly sequenced. Methods for this technique are discussed. Comparisons span a broad taxonomic scale from co-occurring conspecifics and conspecifics over a broad geographic area, through variation among congeneric species, to families, superfamilies, and orders. The patterns of nucleotide substitution and amino acid replacement are documented over these varying temporal/phylogenetic scales and approximate range of rates for the various types of change are inferred. The molecular dynamics of gastropod cytochrome b are compared to other groups of animals in which this gene has been analyzed. Recommendations concerning the phylogenetic levels over which various types of change are most likely to be useful are made.

NEW RECORDS OF CARIBBEAN MOLLUSKS IN THE SOUTHERN PART OF THE GULF OF MEXICO.

CRUZ-ABREGO, F.M., FLORES-ANDOLAIS, F. and TOLEDANO-GRANADOS, A., ICMyL-UNAM, Estación Puerto Morelos, A.P. 1152, Cancun, 77500 Quintana Roo, México

An analysis of molluscan distribution in the southern part of the Gulf of Mexico was performed. Data were obtained from four oceanographic cruises on board O/V "Justo Sierra" during March and September of 1985 and 1986, using a Van Veen dredge.

A total of 83 live-collected species were identified, of which 50 are new records of Caribbean species. Three distributional groups were found; they include eurytropic species, mainly from the Caribbean. Distributional patterns are explained by marine currents and by a Campeche Bay model circulation.

Molluscan distribution is affected by different environmental factors like marine currents, malacological provinces, marine climates and by physical barriers produced by river plume oceanic fronts.

AMAZING ANATOMICAL INNOVATIONS IN A CHINESE TRICULINE SNAIL AND THE UTILITY OF QUANTITATIVE DATA.

DAVIS, George M., The Academy of Natural Sciences of Philadelphia

A new species of snail classified as Pomatiopsidae: Triculinae has several unique and amazing anatomical innovations of the female reproductive system. Unusual for Triculinae species, there were several populations located throughout one county in Zhejiang Province thus permitting a multivariate analysis of variation within and between populations. One can now answer the question, on the average, how much species-wide quantitative variation will one encompass by measuring shell, and male and female reproductive structures from a number of individuals of a single population? Also, do emergent informative patterns result from such analysis?

IMPLICATIONS OF A POLYGYRID GENERA PHYLOGENY

EMBERTON, Kenneth C., Academy of Natural Sciences, 1900 Benjamin Franklin Parkway, Philadelphia, PA 19103-1195

A fresh assessment of reproductive behavior and anatomy, combined with new allozyme data, results in a robust phylogeny for the 23 polygyrid genera implying (a) evolution from internal to external sperm-trading occurred just once in polygyrids, with functional intermediates still extant; (b) polygyrid biogeographic history paralleled that of plethodontid salamanders, with vicariance events at about 145, 120, 65, and 40 MA, and dispersal events at about 55 and 40 MA; and (c) the iterative shell evolution of the Triodopsini and Mesodontini occurred despite a phylogenetic constraint on whorl expansion rate. Paraphyletic taxa include the Ashmunellinae and Daedalochila. Conservation efforts should target (a) radiating, endemic clades (e.g. Fumonelix and Mesodon (Akromesodon) in the Southern Blue Ridge), (b) extremely autapomorphic endemics (e.g. the ovoviviparous Giffordius on Islas de Providencia, and the conchologically and genitally aberrant Inflectarius ferrissi in the high Smoky Mountains and Triodopsis platysayoides on the New River Gorge), and (c) high-diversity sites with convergences in sympatry (e.g. Pine Mountain, Kentucky, with eleven polygyrid species, including four sympatric shell convergences).

CUBAN MARINE MOLLUSKS AND THEIR BIOGEOGRAPHIC RELATIONSHIPS IN THE WESTERN ATLANTIC.

ESPINOSA, José, Instituto de Zoología, Academia de Ciencias de Cuba, Havana, CUBA

[Abstract not available]

A PRELIMINARY REPORT OF UTERUS-EMBRYO RELATIONSHIPS IN OREOHELIX (GASTROPODA: OREOHELICIDAE)

FAIRBANKS, H. Lee, Pennsylvania State University, Monaca, PA 15061, and REEDER, Richard L., University of Tulsa, Tulsa, OK 74104

Oreohelicids are thought to be ovoviviparous,i.e. they form an egg and retain it inside the uterus until it "hatches". The young are then born live.

The goals of this study were to compare uterine cell and tissue structure in Oreohelix with those of an oviparous snail, i.e. an egg layer, and characterize those differences that might explain the difference in reproductive strategy.

Beginning with the uterus, we utilized standard histological and histochemical techniques to examine cells and tissues at various stages of embryonic development in Oreohelix concentrata.

The results indicated (1) that the typical egg is not formed; (2) that during embryonic growth both the uterus and embryo have tissue specializations that suggest the transfer of materials between the embryo and the uterus.

MOLLUSKS FROM A LAGOON REEF AT PUERTO MORELOS, QUINTANA ROO, MEXICO.

FLORES-ANDOLAIS, Felipe, ESCOBAR, F., and CRUZ-ABREGO, F., ICmyL-UNAM, Estación Puerto Morelos, Apartado Postal #1152, Cancun 77500, Quintana Roo, México

An analysis was done of the composition and community structure of the mollusks of a lagoon reef at Puerto Morelos. The data were derived from five transects using a Van Veen dredge.

The fauna included 90 gastropod species, 35 bivalve species, and two species of Scaphopoda.

The most abundant species were: the gastropods Tricolia affinis, Tricolia bella, and Acmaea pustulata, and the bivalves Chione pygmaea, Codakia orbicularis and Pleuromeris tridentata.

Diversity values fluctuated between H' = 1.8 to H' = 3.0 for the different zones of the lagoon.

THE CONCEPT OF MONOPHYLY AND ITS APPLICATION TO GASTROPOD PHYLOGENY AND CLASSIFICATION.

GOSLINER, Terrence M., California Academy of Sciences, Golden Gate Park, San Francisco, CA 94118

The concept of monophyly is well established in contemporary phylogenetics. Many of the molluscan taxa that we all know and love are based on a long standing tradition of their use, with little other than tradition to support their retention. Some taxa are diagnosed presently only by ancestral rather than derived features. Taxa such as Prosobranchia, Streptoneura, Archaeogastropda, Cephalaspidea are clearly not monophyletic. These are clearly paraphyletic, as not all descendants of that group are included within the taxon. This problem has serious implications to gastropod classification. It requires a major overhaul of the classification of all gastropod groups to make them compatible with our current knowledge of gastropod phylogeny. Several gastropod taxa, such as Euthyneura, Patellacea, Nudibranchia are likely monophyletic and require little modification of higher classification. Some suggestions as to how reclassification might be achieved are presented.

A DAY IN THE LIFE OF IVAN SQUIDOVICH: BEHAVIORAL ECOLOGY OF A CORAL REEF SQUID.

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We documented quantitatively the intra- and interspecific behavioral interactions of single schools of *Sepioteuthis sepioidea* between dawn and dusk during three different weeks at Little Cayman Island. School sizes ranged from 5-88 individuals (mean ≈30) and squid sizes ranged from ≈1.5-18.0cmML. Squids have an average of 5 interactions/hr (max. 16 observed) with predators throughout the daytime period; their responses are varied and sophisticated because they seem to assess the species, its size and its approach before reacting. Predator avoidance was highly successful (0 mortalities in 623 interactions). Sentinels may alert the "resting" school to primary predators: yellow jacks, bar jacks, houndfish, barracuda. In some habitats, squids camouflaged themselves well in gorgonians. Courtship is complex and was analyzed by video analyses. The typical courtship group comprises one female and two competing males. Males perform visually dramatic Zebra Spread Displays to gain dominance over rival males for preferred access to females for mating. Mating was observed 40 times and is also described and illustrated. Courtship and mating occur occasionally throughout the day but peak activity is one hour before dark. At sunset, squids begin to disperse and hunt, and three feeding methods are described: in one novel method, squids mimic fishes to allow closer approach to prey; in another, they stir the sand with their arms to help find buried mantis shrimp. Squids feed all night before reconvening at dawn, often with the same school. Some comments are made on the overall daily energy budget for squids on a Caribbean coral reef.

ZOOGEOGRAPHY OF THE BATHYAL AND ABYSSAL MOLLUSCAN FAUNA OF THE CARIBBEAN.

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Based on a survey of the literature, a data base containing over 2,000 records, representing 200+ species of bathyal and abyssal mollusks from 400+ stations in the Caribbean and adjacent regions was produced. Phenetic techniques were used to determine patterns in the geographic and bathymetric distributions of this fauna.

The resulting patterns are compared with those of adjacent shallow water (continental shelf) molluscan faunas, and the possible origins of the bathyal and abyssal Caribbean molluscan fauna are discussed.

THE ARCHAEOGASTROPODA: A CLADE, A GRADE, OR WHAT ELSE ?

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The classic concept of Thiele's Archaeogastropoda includes the Patellogastropoda (Docoglossa), Neritimorpha, Cocculiniformia, and Vetigastropoda (zeugobranchs and Trochoidea). The recent discovery of many new archaeogastropod groups mainly from deep waters and in particular from the hydrothermal vent habitat causes a re-evaluation of the taxon. Archaeogastropoda can still be clearly defined by the symplesiomorphic hypoathroid nervous system (close association of pleural and pedal ganglia). This definition also includes the Neritimorpha and the architaenioglossate groups. The amount of convergence is very high among archaeogastropods, most characters of advanced gastropods occurred several times independently and parallelly in evolution.

Despite of their low number, archaeogastropods show a high rate of anatomical diversity and adaptive capacity. As in Thiele's time, the taxon *Archaeogastropoda* is regarded as the basic gastropod grade (paraphyletic stem group). Whether this basic grade gave rise to a single or two or several lines of higher gastropods is still a matter of debate.

EFFECTS OF COMMERCIAL NAVIGATION ON UNIONID MOLLUSKS: MISSISSIPPI RIVER, EAST CHANNEL, CITY DOCK, PRAIRIE DU CHIEN, WI, OCTOBER, 1990.

HAVLIK, Marian E., Malacological Consultants, La Crosse, WI 54601, and STEIN, Carol B., The Ohio State University Museum of Zoology, Columbus, OH.

Ninety-four - 0.25 m^2 quadrats were sampled for unionids on 7 - 90 meter transects, including one extended across the navigated East Channel, Mississippi River Mile 634.7 - 635.2. Divers also collected qualitatively. A total of 3308 unionids (34 sp.) were collected; 1240 living unionids (28 sp.) were measured, aged, and inspected for damage. Maximum density = 116/m^2; mean density = 39.4/m. Of the sexually-dimorphic females, 85% were gravid. Only 4 unionids were collected from a 1.5 m^2 site near the City Dock; in 1980 WI DNR collected 102 living mussels from the same area. In 1980 one site had 3 Lampsilis higginsi (Lea, 1857) within a 1.5 m^2 quadrat, & 2 more just outside the frame. A 1987 USFWS study reported 10 living L. higginsi from an area equal to our study; however, we sampled more sites, both quantitatively and qualitatively, and found only 5 living L. higginsi. Length data for Amblema plicata (Say, 1817) showed a typical bell curve, however age data showed a bimodal distribution with a decline in the 14 year age class (birth year corresponded to a 1976 channel dredging). Regression of age versus measurements of 754 A. plicata and 104 Magnonaias nervosa (Raf., 1820) showed length yielded a slightly higher R^2 than height or width. Some shells had damage which might be from barge traffic.

MARTIN LISTER (1638-1712) VS. LEEUWENHOEK'S "NEW THEORY OF GENERATION."

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In addition to being known as the father of British conchology, Martin Lister also gained a measure of fame by asking in 1699 whether the animalcules (=spermatozoa) in male semen reproduce themselves. In that brief note Lister cited his 1696 publication on bivalves, although historians seem not to have consulted it. Examination of that work provides a window to Lister, Leeuwenhoek (a spermist), science in the late 1600s, and to considerations of generation (how organisms come into being), which was the most popular subject in biology in the 17th-19th centuries.

Lister (1696) provided a brief historical review of certain views of generation (Aristotle to Malpighi, and Leeuwenhoek) and made 28 original points in expressing a qualified skepticism about the role of spermatozoa in reproduction. His questions provided for what we now treat as hypotheses, although they were buried in an obscure publication and thus went overlooked by contemporaries and successors. Nevertheless, his nearly 300 year-old thinking contains a valuable lesson for modern workers.

BIOGEOGRAPHY OF GREAT BASIN SPRINGSNAILS: STUDY RATIONALE AND PRELIMINARY RESULTS.

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A field survey of Recent Great Basin springsnails (Prosobranchia: Hydrobiidae) is underway with the primary goal of obtaining material for monographic treatment of this poorly known fauna. As many of the 115+ component drainage units will be surveyed as possible, so that a potentially robust biogeographic database also is obtained. Much of this vast region never has been surveyed by malacologists and, as western springsnails often exist as locally endemic species, discovery of many new taxa is anticipated. In addition to species distribution patterns, phylogenetic data will be obtained and analyzed to evaluate concordance between biotic patterns and hydrography. This analysis will focus on Pyrgulopsis Call & Pilsbry, 1886, which is extremely widespread and diverse in the region. A review of the described species in this genus is near completion, and will be used as a framework for evaluating phylogenetic relationships of Great Basin taxa. Collections were made in most of the basins visited during the first year of fieldwork, and a promising level of species diversity was revealed.

TROCHID GASTROPOD PHYLOGENY: EFFECTS OF NINE CHARACTER SETS ON PHYLOGENETIC HYPOTHESES AND CLASSIFICATION

HICKMAN, Carole S., Department of Integrative Biology & Museum of Paleontology, University of California, Berkeley, CA 94720

Trochid gastropods are, by any measure, one of the most diverse families within the Mollusca. Conventional morphological data underlie the definition of the major trochid clades and their recently-revised classification (Hickman & McLean, 1990) but leave many aspects of evolutionary relationships unresolved. To understand and communicate the evolutionary history of trochid diversity, there are two crucial questions: (1) how to use all available data to generate the best resolved phylogenetic hypotheses and (2) how to use the phylogenetic information in classification.

I analyzed 19 high-ranking groups (subfamilies and tribes) of trochid gastropods using 109 morphological characters in 8 character sets (25 shell, 7 operculum, 7 ctenidium, 11 epipodium, 8 snout, 5 eyes/eyestalks, 6 foot, and 40 radula) and 22 behavioral characters. Monophyly of trochaceans was established by including Pleurotomariidae in the initial unrooted analysis. Three turbinid subfamilies (Liotiinae, Colloniinae, and Turbininae) were used to polarize character transformations in the subsequent analyses.

The morphological data generate 4 trees (113 steps) with a consistency index of 0.867. The combined morphological and behavioral data generates 11 trees (143 steps) with a consistency index of 0.839. The most significant result of the addition of behavioral data to the analysis is increased resolution in two key regions of the tree. The analyses support the monophyly of all 23 trochid clades recognized by Hickman & McLean (1990). The analyses, however, produce a total of 33 clades and 9 internal hierarchical levels. There is no practical way to recognize these clades in traditional classification: the solution is to communicate using an unranked classification or to communicate using trees. Traditional ranked classification entails a loss of phylogenetic information and serves poorly in communication. Resolution is complete in the most derived, unnamed clade comprising nearly half of the trochid taxa. The major unresolved portion of the tree is the relationships of the Eucyclinae, Margaritinae, and the two unnamed clades comprising all trochids above Margaritinae.

NEW PERSPECTIVES IN CERITHIOIDEAN PHYLOGENY.

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The Cerithioidea has been put forth as the ancestral stem group of Caenogastropoda. Cladistic analysis of 15 families by Houbrick (1988) did not establish monophyly for the group. Since then, the concept of Cerithioidea has changed due to exclusion of six families (Abyssochrysidae, Triphoridae, Cerithiopsidae, Vermetidae, Campanilidae, Melanopsidae).

A new cladogram has been tested against the geolgical record with success, and monophyly is established for the group on the basis of eusperm morphology. With the exclusion of Abyssochrysos, Loxonematoidea, while still a possible stem group for the evolution of Caenogastropoda, can no longer be considered ancestral to Cerithioidea.

Cerithioidea is thought to have its origins in late Paleozoic-early Mesozoic times, but its ancestors remain obscure. Sperm morphology has shown that this group is distinct from all other caenogastropod superfamilies. The role of Cerithioidea in relation to caenogastropod evolution must be changed.

THE EVOLUTION OF SIMULTANEOUS HERMAPHRODITISM IN THE FRESHWATER MUSSEL GENUS UTTERBACKIA (BIVALVIA: UNIONIDAE): PHYLOGENETIC SYSTEMATICS OF UTTERBACKIA.

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A comparative approach was used to investigate the evolution of simultaneous hermaphroditism in the freshwater mussel genus Utterbackia (Unionidae: Anodontini). Parsimony analysis on an allozyme data set (95 electromorphs, 25 loci) was used to estimate the phylogenetic relationships among populations of the simultaneous hermaphrodite, U. imbecillis (399 individuals, 37 populations) and the gonochoric U. peggyae (178 individuals, 15 populations). The results suggest that 1) U. "peggyae" is actually composed of two distinct lineages: U. peggyae (s.s.), from the panhandle of Florida and U. sp. from the Florida peninsula, 2) U. "imbecillis" from the Southern Atlantic Slope is a distinct clade within the U. imbecillis lineage, 3) the evolutionary relationships among U. imbecillis, U. peggyae (s.s.), and U. sp. are not resolved, and 4) the uniformly hermaphroditic condition and monophyly of U. imbecillis are consistent with the hypothesis of a single transition from gonochorism to simultaneous hermaphroditism within the genus Utterbackia.

SHELL MORPHOLOGY AND IDENTIFICATION OF EARLY LIFE HISTORY STAGES OF CONGENERIC SPECIES OF *CRASSOSTREA* AND *OSTREA*

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Sequences of SEM micrographs are presented to elucidate species-specific shell features in larval and post-larval stages of four Ostreidae species (*Crassostrea gigas* (Thunberg), *C. virginica* (Gmelin), *Ostrea edulis* L., and *O. equestris* Say). The diagnostic characters, including hinge structure, shell shape, and the dimensions of the prodissoconch, are identified and summarized in a key at both genus and species levels. In *Crassostrea*, the extremely asymmetric shells, with postero-directed umbo and two hinge teeth on each side of the provinculum, are markedly different from the more spherical shells, with dorso-directed umbo and one tooth on the left valve, of *Ostrea*. In *C. gigas*, the provinculum are longer and narrower (56 x 11 μm) than those of *C. virginica* (50 x 14 μm); the lengths of the prodissoconch-I and the provinculum are greater in *O. edulis* (180 μm and 86 μm, respectively) than in *O. equestris* (120 μm and 74 μm). The present study suggests that precise measurements are needed for differentiation of these congeneric species.

CLASSIFICATION OF THE SACOGLOSSA (OPISTHOBRANCHIA), WITH A DISCUSSION OF PHYLOGENY.

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The opisthobranch order Sacoglossa constitutes a well defined, monophyletic group. However, classification within the group is highly unstable. The present study attempts to establish a more stable classification using shared derived characters rather than overall similarity.

Evolution within the Sacoglossa has involved parallel changes in diet. This has been accompanied by parallelisms in the morphology of the feeding apparatus. These parallelisms are here reviewed.

Three families of shelled Sacoglossa exist. These share numerous plesiomorphic characters, but no synapomorphies have been identified. Thus the "Conchoidea" may be paraphyletic. The non-shelled Sacoglossa fall into two large groups, the parapodia-bearing Elysioidea and the cerata-bearing Stiligeroidea. The Elysioidea are characterized by several synapomorphies. The status of the cerata-bearing Sacoglossa is confused. The group is well separated from the Elysioidea, but most genera are poorly defined. Two to five families have been recognized. It is here attempted to identify some derived characters.

ANNUAL CYCLES OF TEMPERATURE AND GROWTH IN SHELLS OF MERCENARIA: INVERSE PATTERNS IN NORTHERN VERSUS SOUTHERN POPULATIONS.

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The seasonal cycle of shell formation in Mercenaria mercenaria from Narragansett Bay, Rhode Island exhibits an inverse pattern from that seen in M. mercenaria and M. campechiensis from Georgia and Florida. Radial sections through shells reveal alternating dark (translucent in thin section, T) and white (opaque in thin section, O) increments. The combination of one T and one O increment constitutes an annual cycle of shell growth. Stable isotopic (18O/16O, 13C/12C) analyses of shell carbonate (aragonite) across growth increments (high resolution serial sampling) reveal high amplitude cycles in the oxygen isotopic records which correspond to the annual temperature regime at each site. Carbon isotopic profiles exhibit less variation and represent a combination of environmental and vital effects. Paleotemperature calculations from the oxygen isotopic data indicate that the entire range of seasonal temperature variation is recorded in the annual cycle of shell formation through the first few years of growth. Thereafter, the annual amplitude may be truncated. The isotopic evidence also indicates that in northern populations, T increments form in winter whereas in southern populations they form in summer. These patterns were verified by field collections at monthly intervals throughout one year. Inhibition of shell growth rates during the coldest and warmest times of the year appears to occur in the northern and southern sites, respectively.

DEVELOPMENT, DISPERSAL AND DISTRIBUTION IN INDO-PACIFIC AND TEMPERATE AUSTRALIAN *CONUS*.

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Comparative study of embryonic and larval development in 61 Indo-Pacific species of *Conus* in relation to their geographic distributions supports the hypothesis that dispersal is an important determinant of biogeographic patterns in the most diverse genus of marine molluscs.

Species with greater potential for larval dispersal tend to have broader geographic ranges and to occupy oceanic island habitats. Species with non-planktonic development are more narrowly distributed and tend to occur along continuous continental coastlines. Dispersal ability, estimated from duration of the obligate planktonic larval stage, explains 40% of the variance in absolute area of geographic range. Egg size is a critical attribute of reproductive biology and life history. From it one can predict pre-hatching development time, size at hatching, developmental mode, growth rate of veliger larvae, minimum duration of the planktonic stage, and amount of parental investment, as well as geographic range.

The Indo-Pacific models also successfully predict life history traits, but not geographic ranges, of three temperate Australian species. These species occupy continuous, linear coastline, and the species having the largest eggs (*C. anemone*, 850 µm) and non-planktonic development, ranges most widely.

CLADISTIC ANALYSIS OF MURICID GROUPS: AN UPDATE (VERSION 5.3)

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Members of the muricid groups Rapaninae (+Thaidinae), Ocenebrinae and Trophoninae were analyzed on morphological characters taken from anatomy, radula, operculum, shell ultrastructure, and protoconch. Cladistic analyses reveal rampant paraphyly and polyphyly in previous taxonomic arrangements (based primarily on shell shape). A new taxonomy is proposed.

Homoplasy occurs in two-thirds of the 21 characters used in this study. Character state distribution indicates that synapomorphies, unique to a group within the Rapaninae, become homoplasies after species from other muricid groups are included in the cladistic analyses. Although the addition of relatively distantly related taxa appears to increase the occurrence of parallelism and convergence, it provides an additional test for monophyly within established groups.

UNDESCRIBED HETEROPHYID (TREMATODA) IN MELANOIDES TUBERCULATA(GASTROPODA: THIARIDAE) AND YELLOW-CROWNED NIGHT HERONS, NYCTICORAX VIOLACEUS (CICONIIFORMES: ARDEIDAE).

KOTHARI, Pulin and **MURRAY**, Harold D., Biology Department, Trinity University, San Antonio, TX 78212.

The introduced thiarid, Melanoides tuberculata, was first observed as an intermediate host to an undescribed fluke in October, 1990 in the San Antonio Zoo, San Antonio, Texas. Since 1983, Yellow-crowned Night Herons, Nycticorax violaceus, have migrated from Central Mexico to the zoo from April through October and are confirmed as the definitive hosts introducing this heterophyid to Texas.

Experimentally, cercariae from the snail entered goldfish with the respiratory currents, attached to and embeded in the gills, and were infective in 58 days. Chickens (≤ week old) were force-fed infected goldfish gills and had adult flukes (360-400μ length) in eight days. Each adult fluke had 3-7 eggs (20-22μ length) and attached to the upper small intestine which showed a slight reddening of the wall. Fluke size and infection site may differ in the Night Herons.

Populations of M. tuberculata in the zoo average 400 snails/m^2 with 80% infected. Because the numbers of infected snails do not decrease in the absence of the herons (November through March) and because heterophyids are not normally host specific, it is probable that other fish-eating animals of the zoo are infected and now maintain the parasitic cycle.

ENDOLITHIC BIVALVES FROM THE LARES FORMATION (OLIGOCENE) OF NW PUERTO RICO.

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Representatives from two genera of rock-boring bivalves, Petricola and Lithophaga, and associated organisms are described from the Lares Formation. The Lares Formation outcrops in northwestern Puerto Rico and is late Oligocene in age. Among the paleoenvironments represented in the Lares are patch reefs, fringing reefs, and deeper water carbonates.

The genus Lithophaga is well-represented, with high densities found riddling the interiors of host corals. It appears that more than one species produced the boreholes. Petricola is rare and the host substrate is not known.

Associated organisms include abundant coral, oysters, and calcareous algae. These provided substrates for the endolithic bivalves and other borers such as clionid sponges. Also found in the reef facies are numerous benthic foraminifera, arthropods (especially crabs), echinoderms, vertebrates such as sharks and manatees, and rare gastropods.

In reef ecosystems, endolithic communities are relatively conservative through time, while the framework-building and epibiont communities are highly diverse and tend to evolve rapidly. Work on the Lares Formation is contributing to a better understanding of rates of change among, and interactions between, these various communities.

MICROSTRUCTURE OF *BANKIA GOULDI* (BARTSCH) (BIVALVIA: TEREDINIDAE) SHELL DENTICLES.

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The lobes and anterior discs of teredinid shells have rows of denticles that act as saws and files as the animals maneuver their shells against the wood into which they bore. Although the superficial morphology of the denticles of several teredinid species has been described, little is known of denticular microstructure.

Bankia gouldi (Bartsch) shells, some of which were sonicated to remove the periostracum, were examined with a scanning electron microscope. The denticles on the lobe are 35-37 μm by 13-16 μm and have triangular dorsal ends and blunt ventral ends. Each of the denticles on the anterior disc consists of two triangular projections at right angles to the shell surface that are offset from one another along the dorsoventral axis. The basal regions of these denticles are 35-40 μm by 24-28 μm. On both the lobe and the anterior disc, the denticular periostracum is supported by irregular simple prismatic tufts. Tufts of lobe denticles rest on a fibrous prismatic layer the prisms of which are oriented along the dorsoventral axis. Tufts of denticles on the anterior disc are supported by bands of irregular simple prisms at right angles to the shell surface. Additional studies are required to elucidate the process of denticular formation.

EXTENT OF THE WESTERN ATLANTIC TROPICAL PROSOBRANCH FAUNA IN THE SOUTHERN HEMISPHERE: THE PERSPECTIVE FROM OCEANIC ISLANDS

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Following a taxonomic survey of hard-shelled gastropods from oceanic islands off Brazil, the limits of distribution of species occurring simultaneously on these islands and on the western Atlantic coast or shelf are examined, regardless of other geographic attributes.

Frequency distributions indicate that these non-endemic species have their northern and southern limits of distribution centered respectively around 26°N and 21°S, or the coasts and shelf off south Florida, and off Espírito Santo State, Brazil. These results coincide with boundaries previously suggested for the tropical western Atlantic fauna. The rarefaction of tropical species to the south of the Espírito Santo boundary is probably consequence of the strong and localized upwelling events occurring at about 23°S, and may be also related to water recirculation and entrapment by a large clockwise gyre recently discovered off eastern Brazil.

Analysis of faunal similarity indicates that the Brazilian islands and Bermuda in the North Atlantic are more closely related between themselves than to Ascension and Canary Islands, which supports the concept of a Mid-Atlantic Barrier impinging on the distribution of marine gastropods in both sides of the South Atlantic.

WHY YOU SHOULD NOT PUBLISH IN MALACOLOGICAL JOURNALS.

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Over the last 10 years many malacologists have voiced increasing alarm over a perceived demise of our field (i.e., loss of positions, scarcity of students, loss of funding, etc.). One measure of the fitness of any scientific discipline is its contribution to the scientific literature. To quantify this contribution I queried the 6,500 journal Current Contents© database using a listing of the professional membership of the AMU. During the last 3 years AMU members have publish about 1.1 papers/year. Over 25% of them have published exclusively in malacological journals, while 19% have published only in non-malacological journals. Over 50% of all malacologists publish in a single malacological journal, and none have published in more than three malacological journals in the past three years. These data suggest that malacology is substantially inbred and esoteric, and would be well served by diversifying both the journals we publish in and the meetings we attend. The survival of our discipline will be determined by our collective ability to rigorously address broad biological, paleontological and evolutionary questions using the ideal study organisms -- molluscs.

DISCOVERING KEY INNOVATIONS IN THE PHYLOGENY OF GASTROPOD MOLLUSCS.

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We conducted a phylogenetic analysis of 26 gastropod taxa. Monophyly of the ingroup was not assumed and initial runs were unrooted. The outgroups Poly- and Mono-placophora were used to polarize character transformations. Our analysis of character transformations within the trees revealed a heretofore unrecognized synapomorphy for the caenogastropods - the switching from exhalent control of mantle cavity water flow to inhalant control of this flow. The discovery of this character, which was not included in the data matrix, caused us to re-evaluate characters associated with external sensory organs, shell morphology, and the mantle cavity. Convergent trends in flow control were also discovered in the most derived Vetigastropoda taxa. We consider the change from exhalent control of mantle cavity flow to inhalant control to be a key innovation in the evolution of the Gastropoda. This change did not occur in morphological isolation, but was highly integrated with changes in sensory and other structures and systems as well. It is not likely that this change alone was solely responsible for the diversification seen in the Caenogastropoda, but its appearance clearly marks a significant departure from outgroup and sister taxa morphological configurations and lifestyles.

PLIO-PLEISTOCENE CHITONS (MOLLUSCA: POLYPLACOPHORA) OF SOUTHERN FLORIDA

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More than 1,600 loose chiton valves have been examined from strata ranging in age from 3.5-3.0 m.y. (middle Pliocene) to 1.7-1.0 m.y. (early Pleistocene) in southern Florida. The specimens represent 14 species in the genera Callistochiton (1), Ischnochiton (4), Lepidochitona (1), Stenoplax (1), Chaetopleura (1), Tonicia (1), and Acanthochitona (5), as well as a single valve of a species tentatively assigned to Callochiton, a genus not previously known from North America. Representatives of all except the last genus also occur in the Recent fauna of Florida. Three of the four species that are numerically dominant in Pliocene fauna are also common in the Recent fauna, but most of the other species are undescribed, suggesting that they perished during the several extinction events near the Pliocene-Pleistocene boundary that so changed the Florida fauna.

MORPHOMETRIC AND GENOTYPIC RELATIONSHIPS AMONG FLORIDA GULF COAST BAY SCALLOP POPULATIONS (ARGOPECTEN IRRADIANS CONCENTRICUS (SAY, 1822)).

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Bay scallops, Argopecten irradians concentricus, occur along the Florida coast of the Gulf of Mexico from Pensacola to Florida Bay in often disjunct populations. Petuch (1987) introduced the subspecific name A. i. taylorae for the Florida Bay population, contending that it is isolated and morphologically divergent from other Florida Gulf coast populations. Morphometric analyses using valve character states and shape ratios and genotypic examinations using starch-gel electrophoresis were employed to compare the Florida Bay population with other populations. Results of these examinations indicate a close relationship between all Florida Gulf coast populations and do not support the contention of subspecific status for the scallop population in Florida Bay.

EVIDENCE FOR HYBRIDIZATION BETWEEN AN AQUACULTURE STOCK AND A NATURAL POPULATION OF THE HARD CLAM, MERCENARIA MERCENARIA, NEAR CHARLESTON, SOUTH CAROLINA.

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From 1980-1989, Mercenaria mercenaria seed clams were imported from Aquaculture Research Corporation (ARC) in Massachusetts by Trident Seafarms Company, on the Folly River near Charleston. The purpose of my ongoing investigation is to estimate the extent to which the ARC genome may have become established in local Mercenaria populations. Although the two stocks are quite similar genetically, ARC shows a frequency of 0.195 for a particular glucose phosphate isomerase allele ("Gpi 70") found at only a background frequency of 0.038 in South Carolina. But preliminary samples (475 clams to date, half adult, half less than 50 mm shell length) show no evidence of enrichment for Gpi 70.

MORPHOLOGICAL TRENDS IN CENOZOIC MURICINAE.

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Muricine gastropods display a wide array of morphological traits that are believed to play a role in resisting shell crushing predators. These traits include varices and intervarical nodes, pronounced spines and spiral ornamentation. Early representatives of the subfamily, however, tend to have few or no spines and have less developed axial thickenings. A study of the frequency of several traits shows that morphological trends are not simply directional but can be described as increases in variance. Although the number of strongly ornamented species increases through time, primitive morphologies persist and relatively unornamented morphologies continue to appear during the evolution of the group. Further analysis is required to determine if this trend exists at lower taxonomic levels or if it consists, instead, of a number of independent directional trends . The observed patterns suggest that predation may not be an important agent of extinction and that it was not the sole driving force in the morphological evolution of the subfamily.

ENCAPSULATED DEVELOPMENT OF BUCCINIDAE (BUCCINUM UNDATUM, B. cf. CYANEUM) AND FASCIOLARIDAE (FUSINUS CLOSTER).

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The objectives of this work are to study the developmental kinetics from egg to hatching and the reproductive effort in terms of biochemical (protein, carbohydrate and lipid) and energetic content of different species. The species chosen are the tropical Fasciolaridae Fusinus closter and the temperate Buccinidae Buccinum undatum and B. cf. cyaneum.

F. closter lays tulip shaped egg capsules containing 200-400 eggs each measuring 234-312μm. Between 10-25 develop and hatch 6 weeks later as crawling juveniles measuring 1.61$\pm$0.13mm in length. The rest of the eggs are nurse eggs which dissintegrate 2-3 days after the eggcapsule laying, once the developing eggs are at the 4 cell stage. They are totally consumed 5 days later.

B. undatum lays round concave eggcapsules containing 985$\pm$224 eggs measuring 260μm. Only 10$\pm$5 embryos develop and hatch 5 months later as crawling juveniles which measure 2.6mm in length. The eggcapsules of B. cyaneum contain 567$\pm$227 eggs measuring 240μm; between 1 to 10 embryos develop and hatch 7 months later as crawling juveniles measuring between 2.6 and 3.2mm in length. The nurse eggs are consumed intact and totally by the 3rd week and 4th month respectively for B. undatum and B. cyaneum. A direct relationship was found between female size, the size of the eggcapsules, and the number of eggs.

EVOLUTIONARY TRENDS IN EARLY PALEOZOIC MOLLUSCA.

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Early evolution of major molluscan groups was the result of drastic changes in life style, anatomy and shell form. Eventually, this led to the branching of the Bivalvia from the proto-gastropod line, while the Cephalopoda diverged before this event. Muscle scars on internal molds of molluscs are sometimes helpful, sometimes confusing. The structure of the heart and gills are probably of more importance, but have to be inferred from the shape and structure of the shell.

REPRODUCTIVE PATTERNS IN SOUTHERN CARIBBEAN GASTROPODS.

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The lack of a free swimming larvae is a widespread feature among Venezuelan prosobranchs. In Engoniophos unicinctus (Say, 1825) 3-11 eggs (380-420 μm in diameter) develop in each egg-capsule; hatching take place after 23-25 days as crawling juveniles, in some cases with velar remains. In Marginella cf. marginata (Born, 1778) a single egg (440-520 μm) in diameter develops in each egg-capsule; crawling juveniles measure 1.5 mm in shell length.

Crepidula plana Say, 1822 from eastern Venezuela incubates 15-30 egg-capsules with 5-14 eggs each (mean egg diameter of 335 μm). Hatching takes place at a crawling stage, the juvenile shell measuring 600 μm in length.

Two species of Strombina show direct development; about 5 eggs in each egg-capsule, the egg diameter around 600 μm. In both species [S. pumilio (Reeve, 1859) and S. francesae Gibson-Smith, 1974] crawling juveniles emerge from an escape hole of the egg-capsule with a shell length of about 1.0 mm.

THE MORPHOLOGY AND ULTRASTUCTURE OF THE FEEDING APPARATUS OF SAYELLA FUSCA (C. B. ADAMS, 1839) (GASTROPODA: PYRAMIDELLIDAE).

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Scanning and transmission electron microscopy in conjunction with classical histology were employed to investigate the foregut anatomy of Sayella fusca, a common New England pyramidellid snail. Certain aspects of the feeding apparatus of S. fusca depart from the characteristic pyramidellid plan. Some differences are shared with the genera Turbonilla and Eulimella. Two characteristics are unique to S. fusca: (1) the buccal pump is not divided into two pouches but exists as a single muscular bulb that possesses a non-living cuticular layer lining the entire lumen of the buccal pump; and (2) the salivary ducts never enter the muscular walls of the buccal pump. Histological studies of the salivary gland indicate that three types of secretory cells are intermittently distributed throughout the entire gland rather than characterizing distinct regions as previously described for other members of the family Pyramidellidae by Fretter and Graham (1949) and Maas (1965). The morphology of the feeding apparatus of S. fusca is compared with that of other pyramidellid species.

GASTROPOD PHYLOGENY - A CLADISTIC EVALUATION

PONDER, Winston F., Australian Museum, Sydney, NSW 2000, Australia, and LINDBERG, D. R., Museum of Paleontology, University of California, Berkeley, CA 94720.

A set of morphological characters, in large part based on those employed by Haszprunar (1988), are utilized to reassess current hypotheses of gastropod phylogeny. Cladistic procedures are used to generate the most parsimonious trees. Discussion will centre on the main branching patterns and the justification for the major monophyletic groups. The distribution of homoplastic characters not utilized in the analysis, after these are mapped on final trees, will be discussed, as will the role of heterochrony in the evolution of gastropods.

ELLIPTIO SPECIES IN THE STREAMS OF THE UPPER COASTAL PLAIN IN SOUTH CAROLINA WITH EMPHASIS ON E. HEPATICA.

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A population of Elliptio in Mill Creek previously classified as E. icterina is a morphologically and genetically distinct species. Britton and Fuller (1980),reported three species of Elliptio on the Dept. of Energy Savannah River Site (SRS) and the "Mill Creek Elliptio" was noted as a "population of special concern in South Carolina". Following up this observation, we surveyed 38 sites on SRS including 5 drainages. Using protein electrophoresis and digital imaging we found a greater species diversity than that earlier reported and have identified 7 species of Elliptio on SRS. Nomenclature is based on examination of museum specimens. The "Mill Creek Elliptio" is referred to Elliptio hepatica, a species historically described from the neighboring Salkehatchie river. Distribution and abundances of Elliptio will be discussed. E. hepatica was found to be rare in this collection. Additional surveys will clarify the legal status of Elliptio hepatica.

THE ZOOGEOGRAPHY OF WESTERN ATLANTIC TROCHIDAE, WITH SPECIAL REFERENCE TO THE CALLIOSTOMATINAE.

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Qualitative analyses of similarity were performed on, and area similarity dendrograms were generated for, the geographic distributions of 210 species of western Atlantic Trochidae. Data matrices were also analyzed for calliostomatines and non-calliostomatines separately. Based on these analyses, the western Atlantic may be divided into three realms: northern and southern cold-water realms and a central warm-water realm. The warm-water realm can be divided into Carolinian, Caribbean, and Brazilian Provinces. Depending on the analysis, the northern coast of South America aligned with either the Caribbean Province or the Brazilian Province. Distributions of warm-water, shelf calliostomatines seem to be associated principally with hard-bottom habitats and their associated organisms such as calcareous algae, bryozoans, sponges, stony corals, and octocorals.

The western Atlantic warm-water trochid fauna is most similar to that of the eastern Pacific. Relationships with other faunas are briefly discussed.

THE ZOOGEOGRAPHIC IMPLICATIONS OF THE PROSOBRANCH GASTROPODS OF THE MOIN FORMATION OF COSTA RICA.

ROBINSON, David G., Department of Malacology/ Invertebrate Paleontology, Academy of Natural Sciences of Philadelphia, PA 19103

The Moín Formation is located in and around the port of Puerto Limón, on the Caribbean coast of Costa Rica. It has been dated as being early to middle Pleistocene in age. The systematics of its constituent prosobranch gastropods were studied, and comparisons made with Recent and fossil gastropod faunas in the Caribbean area. 65% of the taxa are living species and for most, this is their first occurrence in the fossil record. These are primarily Caribbean species, but West African/Mediterranean, Panamic and Indo-Pacific components are also present. 29% of the taxa are endemic to these beds and 6% are Mio-Pliocene species occurring for the last time in the fossil record.

A number of species characteristic of the Moín Formation have a Holocene distibution in the western Caribbean, extending approximately from the Gulf of Honduras to the northern coast of Colombia. This zoogeographic pattern results from a number of factors, including the closure of the trans-Isthmian channel(s), the complex effects of the Pleistocene glacial episodes, and the conformation of the western portion of the Caribbean basin. Based on the species occurring in the Moín Formation, the existence of specific faunules or other zoogeographic entities within the western Caribbean cannot be supported.

A DATABASE OF WESTERN ATLANTIC GASTROPODS

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A database of names applied to Recent Western Atlantic gastropods has been compiled in order to ask questions about molluscan diversity and biogeography. At this writing, it contains 7374 records, including 3574 valid species, 3193 synonyms, 322 misidentifications, 158 misspellings, and 88 nomina dubia.

The database is almost complete from the Arctic Ocean through Brazil; Patagonian and Antarctic records are being added. For each species and synonym the following are entered: farthest north, south, east and west; codes for specific geographic areas; shallowest and deepest records (separating live records); maximum size; original genus, combination, and citation. Geographic and depth ranges are summed over synonyms; the database can be easily modified if synonymies change.

Of the 3574 valid species, 3263 are shelled, 2492 occur in <50 m depth, and about 2440 are >5 mm. The modal size is 10-11 mm. About 2850 shelled species occur from Cape Hatteras to Rio de Janeiro; of these about 2400 were named before 1972. Keen (1971) recorded about 2360 shelled species in the tropical Western Pacific, so diversities in the two faunal provinces are virtually identical. The Caribbean has almost 2000 species; another 500 are entirely south of the Caribbean, and almost 1100 are entirely north. Florida alone has 1177 shelled species.

ORDERED CHARACTERS IN GASTROPOD PHYLOGENY

ROSENBERG, Gary, and EMBERTON, Kenneth C., Academy of Natural Science of Philadelphia, Philadelphia, PA 19103-1195

Construction of transformation series for multistate characters (i.e. ordering characters) is a standard practice in reconstructing phylogenies. Recently, Hauser & Presch (1991, Cladistics 7:243-265) have criticized this practice for introducing unneeded or erroneous assumptions into analyses. When a transformation series conflicts with a proposed phylogeny, one or the other of them must be wrong. To the degree that transformation series conflict with the true phylogeny of a group, they constitute misinformation. Similarly, when transformation series for different character sets conflict, some of the proposed transformations must be erroneous.

What then are the consequences of using transformation series? For some polygyraceans, cladograms based on ordered characters agree with those based on unordered characters, but provide greater resolution. For some rissoaceans, use of ordered characters overweights parallel changes involving multiple steps, resulting in cladogram topologies differing from those obtained from unordered characters. Phylogenetic analyses should be run both ordered and unordered to show the effect of using transformation series with the taxa and characters under study. Transformation series must be illustrated or stated explicitly for analyses to be replicable.

SIPUNCULA, SISTER TAXON OF MOLLUSCA

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The Sipuncula are considered the sister group of the molluscs based on (1) early embryological development, (2) homologies of pelagosphera and mollusc larvae, and (3) molecular evidence. Embryos of sipunculids and molluscs share a "molluscan cross" formed from cells $1a^{12}$-$1d^{12}$ and their descendents, whereas in annelids the cross is formed from cells $1a^{112}$-$1d^{112}$. Sipunculan pelagosphera larvae have a cuticle-lined buccal organ homologous to the mollusc odontophore and radula; a lip gland homologous to the chiton larval and aplacophoran pedal gland; and a post-oral ciliated creeping lip homologous to the mollusc larval foot. Analysis of 18S rRNA has placed the sipunculids closest to the molluscs, and none are rooted with the flatworms. Thus Mollusca belong to the coelomate Eutrochozoa, in all of which coelom comes from paired mesodermal bands originating in cell 4d. Differences in expression of coelom among the Eutrochozoa are hypothesized to arise from variations in process and timing of cavitation of the mesodermal bands.

PASSIVE DISPERSAL OF LARVAE; RELEVANCE FOR THE BIOGEOGRAPHY OF CARIBBEAN MOLLUSKS.

SCHELTEMA, Rudolf S., Woods Hole Oceanographic Institution, Woods Hole, MA 02543

Occurrence of teleplanic veligers in major tropical Atlantic currents supports the hypothesis that larval dispersal contributed to colonization of the Caribbean in the geologic past. Criticisms of passive dispersal as a factor in gastropod biogeography are: (1) larvae have a fixed life span too short to account for long-distance dispersal: both laboratory and field data show this to be mistaken. (2) Larvae after a time lose the competence to metamorphose: whenever tested, teleplanic larvae are shown to retain this ability. (3) Dispersal is random and cannot explain congruent nonrandom associations among widely differing taxa; major current systems provide quasi-permanent or seasonal corridors for transport and larvae of various taxa are necessarily dispersed over similar routes leading to congruent distributions. Larval dispersal can be related to vicariant events in the Cenozoic to give a plausible hypothesis for the origin of the Caribbean molluscan fauna.

PHYLOGENETIC RELATIONSHIPS AND PATTERNS OF HETEROCHRONY IN ADVANCED CARDIID BIVALVES

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The Clinocardiinae, Lymnocardiinae, the Tridacna-group, and Fraginae constitute a monophyletic group within the bivalve family Cardiidae. The phylogenetic relationships of this group are studied cladistically. Several members of the subfamily Cardiinae are used as the outgroup. Plagiocardium and Maoricardium are the least derived members of the ingroup. Their spines are a composite of the primitive cardiine fibrous prisms and the derived mosaicostracum, previously reported only from the Fraginae. Maoricardium and the primitive clinocardiine Ciliatocardium share periostracal cilia; along with Plagiocardium they share several hinge characters. The Tridacna-group and Lymnocardiinae are sister taxa, and together constitute the sister taxon to Fraginae.

Paedomorphosis is a frequent evolutionary pattern of advanced cardiids. The common ancestor of Lymnocardiinae, Tridacna-group, and Fraginae retained the byssus into adulthood. The digestive system of the Fraginae is progenetically simplified. The gut and labial palps are reduced in more derived fragines. In most fragines, the stomach is not the typical cardiid type V (Purchon, 1960), but the presumably less derived type IV. Although progenetic evolution of the stomach from type V to type IV has been reported in many bivalves, this is the first record of the phenomenon in the Cardiidae.

MORPHOLOGY OF LARVAE AND POSTLARVAE OF BANKIA GOULDI (BARTSCH) (BIVALVIA: TEREDINIDAE)

TAN TIU, Antonieto, HU, Ya-Ping, LUTZ, Richard, Fisheries and Aquaculture TEX Center, Institute of Marine and Coastal Sciences, Rutgers University, New Brunswick, NJ 08903-0231, and CASTAGNA, Michael, Virginia Institute of Marine Science, College of William and Mary, Wachapreague, VA 23480.

Morphology and dimension of larvae and postlarvae of cultured Bankia gouldi (Bartsch) were examined using light and scanning electron microscopy. Allometric growth transformed the morphology of the prodissoconch from D-shape into subspherical shape, and then into an elliptical-oblong shape just prior to metamorphosis. A prodissoconch 75μm long possesses a well-developed provinculum and lateral flanges. The provinculum ranges from 34 to 43μm long ($\bar{x}$ = 37.8μm ± 1SD = ?.3, n = 30) and is composed of interlocking cardinal teeth. Ligament pits were observed in postlarvae 197-228μm in height. The provinculum is eventually concealed by the growth of the apophysis and dorsal condyle. Likewise, the lateral flanges are shrouded by the asymmetrical growth of the shell margin. Other dissoconch structures include the anterior and posterior slopes, disc, dorsoventral ridge, ventral condyle and denticulated ridges. The number of pallet segments increases with increase in shell length (correlation coefficient = 0.8, $p < 0.0001$, n = 41).

UROCOPTID LAND SNAILS AND THE FAMILY HOLOSPIRIDAE.

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The holospirids comprise a group of closely related genera which have been placed in the Urocoptidae. Current data on the soft anatomies of these two groups make such a relationship untenable. The family Urocoptidae is primarily found in the Greater Antilles. A few species-groups have emigrated to other West Indian islands and to the mainland. No significant secondary radiation of the Urocoptidae has occurred outside of the West Indies. The Holospiridae are endemic to arid southwestern North America where they have existed since the early Cenozoic. Close relationships to other extant families are not apparent.

MOLLUSKS FROM CAMPECHE SOUND, MEXICO.

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A distributional analysis of 185 species of benthic mollusks from Campeche Sound, México, was done. The samples were obtained with a Smith-McIntire dredge along transects made during oceanographic cruise IMCA IV on board O/V "Justo Sierra". Three species of the bivalve Corbula were the most abundant. The gastropod Diastoma varium was the most dominant. The species more broadly distributed were Corbula chittyana and Nassarius scissuratus.

The relation between molluscan distribution and sediment type was examined. Many of the bivalves are infaunal filter feeding species. The gastropods are epifaunal carnivores.

DEEP-SEA WOOD BORERS AND ANCIENT WRECKS.

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The development of small manned submersibles and remote controlled vehicles (ROV's) adapted for use in the deep-sea has enhanced our abilities for successful search and recovery in deep offshore waters. They have been efficiently used by archeologists, benthic and experimental biologists. The ROV NEMO, designed and built by Dr. T. Thompson and the Columbus-America Discovery Group, was used to locate, explore and retrieve material from the S.S. Central America, a side-wheeler which was caught in a hurricane and lost 160 miles off South Carolina in 1857. The Central America was made of wood and so little remained when she was found in the late 1980's. She was almost completely destroyed by deep-sea wood borers, the largest I have ever seen. They belong to the Xylophagainae (Family Pholadidae) and may be a new genus and species closely related to Xyloredo. However, living material is needed to prove this. New wood panels left at the site will be retrieved on our next visit. Hopefully the panels will contain an abundant supply of these borers.

A MULTI-MEDIA DATA BASE ON DEEPSEA CEPHALOPODS.

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We present a demonstration of a multi-media package, still under development, that uses a micro-computer to show data and images of deepsea cephalopods in-situ. All collection data, e.g. geographic location, depth, etc., form the data base (from which searches can be made) and are linked with images of species from videotape or 35mm slides. The taxon-based system can serve in the laboratory or as an on-board catalogue or key for observers on submersibles or using ROV's. The system was created on an IBM-type micro-computer using Base files and Asymetrix Toolbook software running under Windows.

OF GIVING AND RECEIVING: THE CARIBBEAN AS A SOURCE AND SINK FOR INVADING SPECIES.

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Many species evolving in one biogeographical region subsequently invade and become established in another. The tropical Indo-Pacific has served as a donor region to most of the biogeographical regions adjacent to it, but has itself absorbed few if any immigrants. The status of the Caribbean as donor and recipient region is much less clear. Biogeographical and paleontological evidence indicates that there has been moderate interchange between the Caribbean region and West Africa. Invasion may have been largely westward during the Miocene, but intensification of Atlantic circulation, together with episodes of extinction, made the post-Miocene pattern of invasion a two-way affair.

The Caribbean has also served as a donor region for a small number of species that became adapted to the cool conditions along the temperate east coast of North America after the Pliocene. Most of the many species that became extinct in eastern North America during the Pliocene, however, were either not replaced through subsequent evolution and invasion, or were replaced by temperate immigrants from Europe and the North Pacific. The rarity of cold adaptation and invasion to higher latitudes by warm-water species remains a major biogeographical enigma.

FRESHWATER MITES (UNIONICOLA) AS MOLLUSCAN TAXONOMISTS AND BIOGEOGRAPHERS.

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Globally, freshwater mussels (Unionoida) and snails (Cyclophoracea) are commonly hosts of parasitic water mites (Acari: Unionicolidae: Unionicola). The unravelling of phylogenetic relationships among these mites has developed interesting hypotheses regarding the phylogenetic relationships and biogeography of their hosts. Suggested hypotheses for host phylogenies generated by host preferences of these mites agree in part with existing hypotheses. Biogeographic results suggest that existing vicariant hypothesis have value. The central hypotheses is that the Anodontinae and Ambleminae sensu Davis and Fuller (1981) are distinctly different. Amblemines have similar mites and appear to have originated in Gondwana. Southeast Asian mussels and anondontines have similar mites and appear to have originated in Laurasia. The mite phylogeny remains under scrutiny, but the hypotheses generated by the current phylogeny are worthy of discussion and further testing.

DOES OCTOPODID CLASSIFICATION REFLECT DISTRIBUTION OR PHYLOGENY?

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The four octopodid subfamilies diagnosed by Voss in 1988 are based ostensibly on two anatomical characters (the presence or absence of the ink sac and the number of sucker rows) and on depth distributions. Although external octopus morphology, overtly, has had little role in octopodid classification, each of these subfamilies has a characteristic morphology associated with depth distribution. Studies of functional morphology have shown sucker sizes to be affected by depth as is the loss of the ink sac. These correlations suggest that depth distribution has implicitly affected the definition of these subfamilies.

Despite the prominent similarities that unify each of the subfamilies, the available data offer no evidence that they constitute monophyletic groups. The discovery of new morphological characters, as discussed here, that vary independent of habitat is necessary if we are to gather the information required to define evolutionary groups of octopods as a first step in understanding octopod evolution.

PHYLOGENETICS OF THE EARLIEST ARCHAEOGASTROPODS

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A phylogenetic analysis was conducted of over 100 Cambrian through Ordovician archaeogastropod species. The taxon is defined for this study as orthostrophically coiled gastropods with anal emarginations that arose in the latest Cambrian, plus their descendants. The results suggest the following:

1. Two large clades were present by the Early Ordovician that most closely correspond to traditional definitions of the Murchisonioidea and Euomphaloidea. They shared an anisostrophically coiled common ancestor and thus were not derived independently from bellerophontoids.

2. Early Paleozoic species presently considered "pleurotomarioids" are a polyphyletic assemblage, with the major families independently derived from both the murchisonioid and euomphaloid clades. Although it had been assumed that pleurotomarioids are the least-derived anisostrophically coiled gastropods, many shell features considered primitive were actually derived conditions of the Ordovician that were secondarily lost in later lineages.

3. The Subulitoidea and Loxonematoidea evolved independently from murchisonoids. The origins of the Platyceratidae are unclear; the earliest known species possess unique features and no clear synapomorphies with any other archaeogastropods. The taxon cannot be linked reliably with any taxon included in this study, and I do not discount the possibility that platyceratids evolved independently.

4. Although the general patterns of archaeogastropod evolution could be inferred from the current taxonomy, the taxon and its sub-clades were far more dynamic than previously realized.

THE EVOLUTION OF "CHLAMYS" (BIVALVIA: PECTINIDAE) IN THE TROPICAL WESTERN ATLANTIC SINCE THE RISE OF THE ISTHMUS OF PANAMA

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Previous assessments of differences in the tempo of evolution between the eastern Pacific and tropical western Atlantic since separation by Central American land masses have been based largely on censuses of gastropod taxa at the genus-group level. More detailed phylogenetic studies of the bivalve form-genus "Chlamys" at the species level are revealing that its rapid evolution in the post-closure Caribbean may result from a combination of factors, among which are time of arrival of ancestral stocks from the eastern Atlantic, habitat specialization by species, and disruption and creation of habitats by sea-level change and tectonic activity. A new genus of reef-dwelling "Chlamys" has evolved a probable lecithotrophic larva, and four species that share this derived feature have all originated in post-closure time.

Phylogenetic considerations based mainly on early ontogeny and shell microsculpture require substantial systematic revision. Six extant and two extinct Caribbean "Chlamys" species are analyzed in terms of their relationship to geminate species of the eastern Pacific, eastern Atlantic, and western Indo-Pacific. Classification of this array of species involves three tribes, two of which are new, and several genera, three of which are new.

GENDER CHOICE IN A SIMULTANEOUS HERMAPHRODITE, THE FRESH WATER SNAIL PHYSA.

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Non-complimenting albino lines of Physa heterostropha were used to assess the importance of previous reproductive history in determining sexual role assumed. A previously-published model (the "dumb snail") suggests that gender choice is solely a function of time elapsed since copulation as a male. I propose and test a second "smart snail" model, assuming optimal sex allocation and maximum outbreeding.

No line or size effect on sex preference was observed. Results suggested that previously selfing virgins were most masculine in their behavior and that previously inseminated snails (whether previously selfing or not) were most feminine. This matches the predictions of the "dumb snail" model. I could find no evidence that conflicting gender preference influenced the duration of the preliminary mating sequence or the ultimate likelihood of mating.

REPRODUCTIVE DEVELOPMENT IN THE HERMAPHRODITIC FRESHWATER SNAIL, PHYSA, MONITORED WITH COMPLEMENTING ALBINO LINES.

WETHINGTON, Amy R., and DILLON, Robert T., Jr., Department of Biology, College of Charleston, Charleston, SC 29424

Complementation tests revealed that albinism in several lab lines of Physa heterostropha resulted from two recessive, non-allelic genes, *alb1* and *alb2*. We reared experimental snails of one line from juvenile to adulthood, periodically introducing them to mature "challenge snails" of the other line. 70% of our snails developed male function first, 4% developed first as females and 6% developed both sexual functions simultaneously. We estimate 8% male sterility, 4% female sterility, and 2% double sterility, with 6% unattributed sterility remaining. Male function was obtained between 4 and 10 weeks in culture (4.35 mm to 8.65 mm), female function between 5 and 12 weeks (5.77 to 9.75 mm) and selfing (in the absence of a partner) between 14 and 33 weeks (7.00 to 11.25 mm). Neither the label "simultaneous hermaphrodite" nor any other simple label adequately describes the complexity of Physa reproductive biology.

PYRAMIDELLIDS: ARE THEY PROSOBRANCHS OR HETEROBRANCHS?

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Recent systematic/taxonomic schemes place the Pyramidellidae within the Heterobranchia (formerly the Euthyneura). Is this assignation supported by characters that resolve the 100 plus years debate over this family's subclass affinities? Characters (both old and new) were examined to determine if we have resolved this family's place in gastropod phylogeny.

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