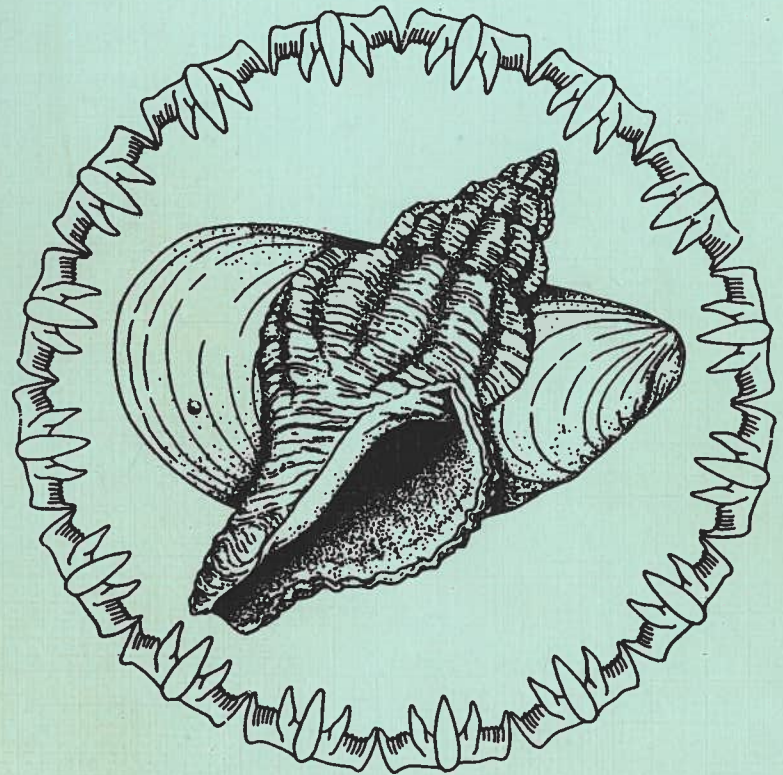


R. Bullard

**The American
Malacological Union
51st Annual Meeting**



**University of Rhode Island
Kingston, Rhode Island
July 28 - August 2, 1985**

Printed Program
by
Melbourne R. Carriker
University of Delaware
College of Marine Studies
Lewes, DE 19958

PROGRAM FOR
THE FIFTY-FIRST ANNUAL MEETING
OF THE
AMERICAN MALACOLOGICAL UNION, INC.
WITH THE
BOSTON MALACOLOGICAL CLUB

In Commemoration of the
75th Anniversary of the
Boston Malacological Club

and

In Honor of
Dr. William J. Clench
Fourth President of AMU

University of Rhode Island, Kingston, Rhode Island
July 28-August 2, 1985

Cover Illustration: Donna M. DeCarlo
Department of Zoology
University of Rhode Island

Typesetting: Pamela L. Donnelly



Dr. William J. Clench

William James Clench
October 24, 1897-February 22, 1984
BS (Michigan State), MS (Harvard U.),
PhD (U. of Michigan), DSc (Hon) (Michigan State)
Curator of Mollusks, Museum of Comparative Zoology, Harvard
1926-1966

William J. Clench was a founding member of the American Malacological Union, its fourth President and its ardent supporter throughout his long life. He never missed a meeting unless he was out of the country or on a field trip. Bill loved people and the meetings gave him an opportunity, not only to "catch up" with his colleagues scientifically, but to see and chat with all those (amateurs, professionals, young and old) with whom he had corresponded throughout the year. He was a strong supporter of amateur malacologists and constantly stressed their role in the building of museum collections, the importance of their field observations and data collection on which he, as well as other research workers, depended so heavily. Bill always invited amateur malacologists to visit the museum, and after his retirement his home where he would talk shells, help with their problems, urge them to join their local shell club and to attend the AMU meetings.

Dr. Clench was one of the last of those broadly based Malacologists whose field and museum research resulted in extensive publications in the areas of land, freshwater and marine mollusks. He founded two journals, *Johnsonia (Monographs of Western Atlantic Marine Mollusks)* and *Occasional Papers on Mollusks*, both of which are published by the Department of Mollusks. It was this breadth of knowledge, interest in publishing and teaching that led Joe Rosewater, who was one of his students, to say at the time of Bill's death "He will live forever through his scientific communications and those of the students he nurtured."

The development and success of the AMU from its beginning through the 60's and early 70's owe much to Bill Clench. We are honored to dedicate this meeting to him.

Ruth D. Turner and Melbourne R. Carriker

AMERICAN MALACOLOGICAL UNION, INC.

Officers, 1984-1985

President	Melbourne R. Carriker
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Council of Systematic Malacologists	Richard S. Houbrick
Conservation	Arthur H. Clarke

Organizing Committee for 1985 Meeting

Melbourne R. Carriker, Robert Bullock,
Ed and Gayle Nieburger, Ruth Turner, Gary Rosenberg

Committee Chairpersons for 1985 Meeting

Local Representative	Robert Bullock
Registration	Evelyne Henderson Liz Petit
Goodie Bags	Ed Nieburger
Welcoming	Happy Robertson
T-shirts	Anne Joffe
AMU Literature Display	Connie Boone
Exhibits and Sales	Ed Nieburger
Posters	Douglas G. Smith
Auction	Richard E. Petit
Student Talk Award	Clement Counts III
Freshwater Field Trip	Eileen Jokinen
Marine Field Trip	James Carlton
Newport Outing	Ed Nieburger
Lobster-Clam Bake	Gayle Nieburger
President's Reception	Gary Rosenberg
Transportation	Robert Bullock
Assistant to President	J. Evan Ward

Symposium Organizers for 1985 Meeting

Perspectives in Malacology, Melbourne R. Carriker
Ecology of Freshwater Molluscs, Eileen H. Jokinen
Encapsulation of Embryos by Molluscs, Jan A. Pechenik
Molluscan Radula, Robert C. Bullock and Carole S. Hickman

Official Shell Club Representatives

Names will be posted on bulletin board in main lobby of Chafee during the meeting.

Name Tag Ribbon Colors

Red: American Malacological Union Officers
Green: Members of Organizing Committee for the meeting.

American Malacological Union Past Presidents

Henry A. Pilsbry	1931-32	Katherine V. W. Palmer	1960
Paul Bartsch	1933	Thomas E. Pulley	1961
Junius Henderson	1934	William K. Emersen	1962
William J. Clench	1935	Albert R. Mead	1963
Calvin Goodrich	1936	John Q. Burch	1964
Joshua L. Baily, Jr.	1937	Juan Jose Parodiz	1965
Carlos de la Torre	1938	Ralph W. Dexter	1966
Maxwell Smith	1939	Leo G. Hertlein	1967
Horace B. Baker	1940	Arthur H. Clarke, Jr.	1968
Harald A. Rehder	1941	Joseph Rosewater	1969
Frank C. Baker	1942	Alan Solem	1970
Louise M. Perry	1943-45	David H. Stansbery	1971
Henry van der Schalie	1946-47	Arthur S. Merrill	1972
A. Myra Keen	1948	Dolores S. Dundee	1973
Elmer G. Berry	1949	Harold D. Murray	1974
Fritz Haas	1950	Donald R. Moore	1975
Joseph P. E. Morrison	1951	Dorothea S. Franzen	1976
Jeanne S. Schwengel	1952	George M. Davis	1977
A. Bryon Leonard	1953	Carol B. Stein	1978
Joseph C. Bequaert	1954	William E. Old, Jr.	1979
Morris K. Jacobson	1955	Clyde F. E. Roper	1980
Allyn G. Smith	1956	Richard S. Houbrick	1981
Ruth D. Turner	1957	Louise Russert Kraemer	1982
Aurele LaRocque	1958	Robert Robertson	1983
R. Tucker Abbott	1959		

PROGRAM SUMMARY

Note: Posters will be located in Chafee Lobby, and authors will be present to discuss them at times indicated on posters. Please check bulletin board in Lobby daily for changes in program.

	Page
Sunday, July 28	
9:00-12:00 am	AMU Executive Council Meeting (closed). Chafee 275
12:00-8:00 pm	Registration. University Club 1
1:00-3:00 pm	Conservation Committee Meeting (open). Chafee 275 1
3:00-5:00 pm	Council of Systematic Malacologists Meeting (open). Chafee 275 1
8:00 pm	President's Reception. University Club 1
Monday, July 29	
8:00-12:00 am	Registration. Chafee Lobby
9:00-12:00 am	Introductions, welcome, group photograph, and Symposium: Perspectives in Malacology. Chafee 271 1
2:00-5:00 pm	Symposium: Ecology of Freshwater Molluscs I. Chafee 271 2
2:00-5:00 pm	Contributed Talks I: Marine Molluscs. Chafee 277 . . . 4
8:00 pm	Boston Malacological Club Anniversary Party. University Club 6
Tuesday, July 30	
9:00-12:00 am	Symposium: Ecology of Freshwater Molluscs II. Chafee 277 6
9:00-12:00 am	Contributed Talks II: Marine Molluscs. Chafee 275 . . . 7
9:00-12:00 am	Contributed Talks III: Marine Molluscs. Chafee 273 . . 9
2:00-5:00 pm	Symposium: Ecology of Freshwater Molluscs III. Chafee 277 11
2:00-5:00 pm	Shell Club Program I. Chafee 275 12
8:00 pm	Institute of Malacology Meeting (closed). Conference Room, Biological Sciences
8:00 pm	Preview: Marine Field Trip. Chafee 275 12
8:00 pm	Preview: Freshwater Field Trip. Chafee 277 13
8:00 pm	Slides: Past AMU Meetings and Other Topics. Chafee 273 13

Wednesday, July 31

8:00 am	to late afternoon: Marine and Freshwater Field Trips and Newport Bus and Boat Trip	13
8:00 am	Day also open for enjoying beaches and other local attractions	
8:00 pm	Shell Club Program II. Chafee 277	13
8:00 pm	Mollusc Discussion. Conference Room, Biological Sciences	13

Thursday, August 1

9:00-12:00 am	Symposium: Encapsulation of Embryos by Molluscs I. Chafee 275	13
9:00-12:00 am	Contributed Talks IV: Marine and Terrestrial Molluscs. Chafee 277	15
2:00-5:00 pm	Symposium: Encapsulation of Embryos by Molluscs II. Chafee 275	17
2:00-5:00 pm	Symposium: Molluscan Radula I. Chafee 277	19
9:00-4:00 pm	Exhibits and Sales of Malacological Items of Interest. Memorial Union	20
8:00 pm	Auction. Chafee 277	20

Friday, August 2

9:00-12:00 am	Contributed Talks V: Freshwater Molluscs. Chafee 271	20
9:00-12:00 am	Contributed Talks VI: Freshwater Molluscs. Chafee 277	22
2:00-4:00 pm	AMU Awards and Business Meeting. Chafee 271	24
4:00-5:00 pm	AMU Rap Session: AMU's Future. Chafee 271	24
6:00 pm	Lobster-Clam Bake. Off Campus	24

Monday-Tuesday, July 29-30

and

Thursday-Friday, August 1-2

10:00-5:00 pm	AMU Literature Display. Chafee Lobby	25
9:00-5:00 pm	Poster abstracts	25

SUNDAY MORNING, JULY 28

9:00-12:00 American Malacological Union Executive Council Meeting (closed meeting). Chafee 275.

SUNDAY AFTERNOON, JULY 28

12:00-8:00 Registration. University Club. In addition to the staff at the registration desk, a Welcoming Committee will be on hand to help newcomers. Starting Monday registration will be in the lobby of Chafee.

1:00-3:00 Conservation Committee meeting (open meeting). Chafee 275. Arthur H. Clarke, Chairperson, 325 E. Bayview, Portland, TX.

3:00-5:00 Council of Systematic Malacologists (open meeting). Chafee 275. Richard S. Houbbrick, President, Department of Invertebrate Zoology, Smithsonian Institution, Washington, DC.

SUNDAY EVENING, JULY 28

8:00 President's Reception. University Club. An evening of good fellowship, and an opportunity for AMU members to meet with AMU officers, committee members, symposia organizers, shell club representatives, past AMU presidents, and others.

MONDAY MORNING, JULY 29

9:00-9:30 President's Introduction and Welcome by Dr. Daniel T. Seymour, Assistant to the President of the University of Rhode Island. Chafee 271.

SYMPOSIUM: PERSPECTIVES IN MALACOLOGY, in honor of junior malacologists. Organizer and Moderator: Melbourne R. Carriker, College of Marine Studies, University of Delaware, Lewes, DE. Chafee 271.

9:30 Pieter W. Kat, Malacology Section, National Museums of Kenya, Nairobi, Kenya. **ORIGINS OF MOLLUSCAN FAUNAS OF THE AFRICAN GREAT LAKES: NEW EVIDENCE**. Evidence from the East African fossil record, as well as karyological and soft-part data from living species, is presented to trace origins and evolution of endemic molluscan faunas of Lakes Tanganyika, Malawi and Victoria.

- 10:00 James F. Quinn, Jr., Department of Malacology, Philadelphia Academy of Natural Sciences, 19th and the Parkway, Philadelphia, PA. **FROM CONCHOLOGY TO MALACOLOGY AND BEYOND.** New theories on species, speciation, and biogeography, use of mathematical techniques in defining species and genera and deducing phylogeny have provided a rigorous conceptual framework for malacology. Emergence of computers, scanning electron microscopes, and biochemical techniques allow use of characters unavailable before. However, traditional approaches and contributions of serious amateurs are still important.
- 10:30 Group photograph on steps at southeast entrance of Chafee; coffee break in Chafee Lobby.
- 11:00 Robert Hershler, Florida State Museum, University of Florida, Gainesville, FL. **PHREATIC GASTROPODS FROM SOUTH-CENTRAL TEXAS.** The discovery and systematics of a diverse phreatic hydrobiid fauna in south-central Texas is discussed. The significance of this discovery in relation to the remarkable subterranean aquatic ecosystem in the Edwards (Balcones Fault Zone) Aquifer is described, and the status of this fauna is reviewed.
- 11:30 Robert G. Hudson, Department of Biology, Presbyterian College, Clinton, SC. **CONSERVATION OF FRESHWATER MUSSELS BY ARTIFICIAL GLOCHIDIAL CULTURE AND LABORATORY REARING OF JUVENILES.** Freshwater mussel conservation historically has been slowed because of difficulties in obtaining reproduction. An artificial laboratory method is presented for bypassing the fish-parasite phase necessary for glochidial transformation and also for successfully raising these transformed juveniles in the laboratory.

MONDAY AFTERNOON, JULY 29

SYMPOSIUM: ECOLOGY OF FRESHWATER MOLLUSCS.

Organizer: Eileen Jokinen. Moderator: Robert McMahon. Chafee 271.

- 1:55 Introductory Remarks: Eileen Jokinen.
- 2:00 Daniel J. Hornback and Carolyn Cox, Department of Biology, Macalester College, St. Paul, MN. **ENVIRONMENTAL INFLUENCES ON LIFE HISTORY TRAITS IN *PISIDIUM CASERTANUM* (BIVALVIA: PISIDIIDAE): FIELD AND LABORATORY EXPERIMENTATION.** Populations of

P. casertanum from two ponds (one ion-poor, the other ion-rich) display differences in population parameters of maximum shell size and reproductive output. Laboratory culture experiments and field transfer experiments indicate that ionic environment and pond of origin (and thus genetic background) account for population structure differences.

- 2:30 Glen Lopez and Ismo Holopainen, Marine Sciences Research Center, State University of New York, Stony Brook, NY. **INTERSTITIAL SUSPENSION-FEEDING BY PISIDIID BIVALVES: A NEW GUILD IN THE FRESHWATER BENTHOS.** *Pisidium casertanum* and *P. conventus* of Lake Paajarvi, Finland, feed by filtration of suspended microorganisms from interstitial water. They typically pump water out from the distal end of a long blind burrow. Interstitial suspension-feeding is a functional mode not previously described for either marine or freshwater habitats.
- 3:00 Gerald L. Mackie, Department of Zoology, University of Guelph, Guelph, Ontario, Canada. **DIRECT AND INDIRECT EFFECTS OF ACIDIFYING ENVIRONMENTS ON FRESHWATER MOLLUSCA.** Laboratory and field experiments show that increases in hydrogen ion and metal concentrations in low alkalinity environments have little effect on adult survival, but the independent and combined action of hydrogen ions and metals may have profound effects on molluscan growth, reproduction, and development.
- 3:30 Coffee Break.
- 4:00 Carl M. Way, Department of Natural Sciences, Alderson-Broadus College, Philippi, WV. **SEASONAL PATTERNS OF ENERGY ALLOCATION IN THE PISIDIID CLAMS, *PISIDIUM VARIABILE* AND *P. COMPRESSUM*.** The ecological energetics of the pisidiid clams, *Pisidium variabile* and *P. compressum* were studied. Data support the idea that life histories and population energetics of organisms with complex life histories can be understood only by analyzing how physiological and development processes are affected by environmental variability.
- 4:30 Richard J. Neves, Department of Fisheries & Wildlife Sciences, Virginia Polytechnic Institute & State University, Blacksburg, VA. **HABITAT ECOLOGY OF JUVENILE FRESHWATER MUSSELS IN HEADWATER STREAMS.** Two streams in western Virginia were systematically sampled to quantify the abundance and habitats of juvenile mussels (ages 0-3 years). Young-of-year mussels were

clustered in distribution and occurred in habitats slightly different from that of older juveniles. Annual mortality of the age 0 cohort was greater than 50%.

MONDAY AFTERNOON, JULY 29

CONTRIBUTED TALKS I. MARINE MOLLUSCS. Presiding: James Nybakken, Moss Landing Marine Laboratories, Moss Landing, CA and Kashane Chalermwat, Department of Biology, University of Southern Mississippi, Hattiesburg, MA. Chafee 277.

- 2:00 James K. Culter and Nora V. Maddox, Mote Marine Laboratory, Sarasota, FL. **NEW RECORDS FOR SEVEN SOLENOGASTRES FROM EASTERN GULF OF MEXICO, WEST COAST OF FLORIDA.** Seven species of Solenogastres were identified from 473 specimens collected off the west coast of Florida from depths of 2 m to over 140 m. Most specimens were obtained from deeper waters; two species were found only in shallow nearshore areas. Distributions were not clearly linked to measured environmental parameters.
- 2:20 * G. Thomas Watters, Museum of Zoology, Ohio State University, Columbus, OH. **ALLOMETRY AND THE EVOLUTION OF THE POLYPLACOPHORA.** Recent species exclusive of the Cryptoplacidae are isometric for similar shapes for vermiformity and valve coverage. Chitonidae are the result of phyletic size increase within this trend. It is suggested that Cryptoplacidae are isometric for similar metabolisms for valve coverage.
- 2:40 Hugh J. Porter, Institute of Marine Sciences, University of North Carolina at Chapel Hill, Morehead City, NC. *Chaetopleura apiculata* (Say), *Ischnochiton striolatus* (Gray), and *Diodora cayenensis* (Lamarck) were observed in studied region during the period 1981-1985. Distributions seemed limited by salinity and available hard shelly substrate. Extension of the northern range of *I. striolatus* from Florida to North Carolina is probably not of accidental occurrence.
- 3:00 David Hargreave, College of General Studies, Western Michigan University, Kalamazoo, MI. **STROMBUS COSTATUS COMPLEX IN NEOGENE OF SOUTH FLORIDA.** Four distinct members of the *Strombus* subgenus *Tricornis*, all apparently related to the extant

species, *Strombus costatus*, are present in the Pliocene and Pleistocene of South Florida. Salient morphologic characteristics of these fossil and recent forms are compared, with special attention to relationship between *S. leidy* of the Caloosahatchee Formation and *S. costatus*.

- 3:20 Break.
- 3:40 * Robin Hadlock Seeley, Biology Department, Yale University, New Haven, CT. **RAPID MORPHOLOGICAL EVOLUTION IN A NEW ENGLAND PERIWINKLE SNAIL.** The shell of *Littorina obtusata* evolved from a tall-spined thin-shelled to a flat-spined thick-shell form in New England between 1871 and 1984. Historical data on crab (*Carcinus maenas*) abundance and studies of periwinkle-crab interactions in Maine suggest that this rapid change in shell form occurred in response to increased crab predation.
- 4:00 * Michael G. Kellogg, Department of Paleontology, University of California, Berkeley, CA. **LARVAL ASYMMETRY AND GASTROPOD TORSION.** Many paradigms entrenched in the malacological literature are rarely questioned. The current paradigm of torsion suffers from at least four problems that act to prevent resolution of available data. An alternative interpretation helps to synthesize these data by uniting various expressions of torsion; the major difference being development of timing of contractile muscle tissue.
- 4:20 Rudiger Bieler, Division of Mollusks, National Museum of Natural History, Washington, DC. **REVISION OF GENERA AND INDO-PACIFIC SPECIES IN FAMILY ARCHITECTONICIDAE.** Characters of both proto- and teleoconch show that there are 8 valid recent and fossil genera in the family Architectonicidae and 85 recent species in the Indo-Pacific. Low level of endemism and aspects of ecology of the group are discussed.
- 4:40 James H. McLean, Los Angeles County Museum of Natural History, Los Angeles, CA. **TROCHID GENUS LIRULARIA DALL, 1909: A FILTER FEEDER?** Radular and gill characters of *Lirularia* are those of subfamily Umbroniinae. Long monopectinate gill filaments and a ciliated tract (interpreted as a food groove), examined with SEM, suggest that filter feeding is involved. Seven species are known from hard substrates in northeastern Pacific.

*In competition for best student talk.

*In competition for best student talk.

MONDAY EVENING, JULY 29

- 8:00 Boston Malacological Club Anniversary Party. University Club. (See separate program.)

TUESDAY MORNING, JULY 30

SYMPOSIUM: ECOLOGY OF FRESHWATER MOLLUSCS II.

moderator: Virginia Vail. Chafee 277.

- 9:00 Claus Meier-Brook, D. Haas, G. Winter, and T. Zeller, Tropenmedizinisches Institut, Universität Tübingen, 7400 Tübingen, West Germany. **HYDROCHEMICAL FACTORS LIMITING DISTRIBUTION OF *BULINUS TRUNCATUS* (PULMONATA: PLANORBIDAE), AN INTERMEDIATE HOST OF *SCHISTOSOMA HAEMATOBIIUM*. A FIELD AND LABORATORY RESEARCH STUDY.** *Biomphalaria* is limited in Tunisia to habitats below a critical Mg/Ca ratio, but *Bulinus truncatus* is not. This may explain why *B. truncatus* inhabits North African arid zones and *Biomphalaria* does not. High total electrolyte concentrations rather impede *Bulinus* in habitats where prosobranch snails still thrive.
- 9:30 Robert F. McMahon and Bruce E. Whitehead, Department of Biology, University of Texas at Arlington, Arlington, TX. **ENVIRONMENTAL INDUCTION OF SHELL MORPHOMETRIC VARIATION IN EUROPEAN STRAM LIMPET, *ANCYLUS FLUVIATILIS* (MÜLLER) (PULMONATA: BASOMMATOPHORA).** Specimens of *Ancylus fluviatilis* from 21 states in the Republic of Ireland were measured for aperture length and width, shell height, and percent shell calcium carbonate. Analysis of variance indicates that most interpopulation variation in shell shape appears to be environmentally induced and not a result of genetic differences.
- 10:00 Brian S. Morton, Department of Zoology, University of Hong Kong, Hong Kong. **ECOLOGY, POPULATION DYNAMICS, SEXUAL AND LIFE HISTORY STRATEGIES OF FRESHWATER BIVALVES OF SOUTHERN CHINA.** The paper will review all bivalve species of southern China and how each is variously adapted to subtropical habitats.
- 10:30 Coffee Break.
- 11:00 Robert T. Dillion, Biology Department, College of Charleston, Charleston, SC. **A NEW MONTE CARLO**

METHOD FOR ASSESSING TAXONOMIC SIMILARITY WITHIN FAUNAL SAMPLES. III. REANALYSIS OF GASTROPOD COMMUNITY OF ONEIDA LAKE, NY. F. C. Baker's snail faunal samples from Oneida Lake were categorized simultaneously by number of species and number of families. As in previous studies, Baker's data were indistinguishable from an abundance-weighted Monte Carlo simulation but showed substantially less taxonomic similarity than a simulation where relative abundances were omitted.

- 11:30 Eileen H. Jokinen, Biological Sciences, University of Connecticut, Storrs, CT and New York State Museum, Albany, NY. **STRUCTURE OF FRESHWATER SNAIL COMMUNITIES.** Lake surface area-species diversity correlations are poor for small ponds but improve for medium to large lakes. Incidence functions are used to describe biological and physicochemical niche parameters of species within families and within communities.

TUESDAY MORNING, JULY 30

CONTRIBUTED TALKS II. MARINE MOLLUSCS. Presiding: William Lyons, St. Petersburg, FL and John Ewart, College of Marine Studies, University of Delaware, Lewes, DE. Chafee 275.

- 9:00 Richard S. Houbbrick, National Museum of Natural History, Smithsonian Institution, Washington, DC. ***CLYPEOMORUS*, A GENUS OF LITTORINID-LIKE CERITHIIDS.** The prosobranch genus *Clypeomorus*, endemic to Indo-Pacific, represents a major cerithiid adaptive radiation onto intertidal hard substrata habitats. The 12 living species are eurytopic, style-bearing microphagous herbivores that usually occur in large populations. Shells show wide sculptural variability. Males are aphallate and produce spermatophores. Development can be planktonic or non-planktonic.
- 9:20 *Silvard P. Kool, George Washington University, Washington, DC. **SYSTEMATIC REVISION OF THAIIDID GENERA BASED ON ANATOMY.** A study of the validity and status of the thaidid genera *Nucella*, *Thais*, *Purpura*, and *Mancinella* was undertaken based on comparative anatomy. Possible phylogenetic relationships are proposed based on phenetic and cladistic analyses.

*In competition for best student talk.

- 9:40 Gamil N. Soliman, Department of Zoology, University of Cairo, Egypt. **EGG MASSES OF GASTROPODS FROM NORTHWESTERN RED SEA: A PROPOSED SCHEME FOR THEIR CLASSIFICATION.** Egg masses of more than 50 species of prosobranchs (including a number of coral-boring coralliophilids) and opisthobranchs (mainly dorid nudibranchs) are described. Egg masses are classified into four main types and these are subdivided into varieties within the types.
- 10:00 *Ron J. Etter, Museum of Comparative Zoology, Harvard University, Cambridge, MA. **INTERPOPULATION VARIATION IN HATCHING SIZE OF *NUCELLA LAPILLUS*.** The hypothesis that hatching size should be larger where environmental stresses are more severe was examined with the intertidal snail *N. lapillus*, distributed along an environmental gradient of wave exposures. Populations differed in the manner in which embryos were packaged as well as the per offspring parental investment.
- 10:20 Break.
- 10:40 Qi Zhong-yan, Institute of Oceanology, Academia Sinica, Qingdao, China. **ON THE EGG CAPSULES OF 12 SPECIES OF CYPRAEIDAE.** Based on specimens collected by the Institute of Oceanology, Academia Sinica, from Hainan and Xisha Islands in the South China Sea, egg capsules of 12 species belonging to 7 genera of Cypraeidae are described. Some of these have never been reported before.
- 11:00 *Janice Voltzow, Department of Zoology, Duke University Durham, NC. **FUNCTIONAL MORPHOLOGY OF FOOT OF LIGHTNING WHELK, *BUSYCON CONTRARIUM*.** In the foot of *B. contrarium* collagen-wrapped muscle fibers antagonize each other directly and indirectly via the blood-muscle-connective tissue continuum of the sole. Special features of this continuum are responsible for the amazing functional plasticity of the gastropod foot.
- 11:20 *Thomas N. Rogge, Department of Biological Sciences, University of Southern Mississippi, Hattiesburg, MS. **FUNCTIONAL IMPORTANCE OF PALLIAL EYE OF *CERITHIDEA SCALARIFORMIS*.** Preliminary results indicate that the pallial eye of *C. scalariformis* is important in snails' orientation with regard to light and darkness.

Results show that given a choice between light and darkness, snails with pallial vision react similarly to those with cerebral vision.

- 11:40 *Lisa C. Hendrickson, Southeastern Massachusetts University, North Dartmouth, MA. **DIET AND THE CRYSTALLINE STYLE IN THE OMNIVOROUS NEOGASTROPOD *ILYANASSA OBSOLETA* (SAY).** Temporal fluctuations in crystalline style size and composition among filter-feeding bivalves have been explained in terms of diurnal, tidal and endogenous rhythms. Preliminary studies suggest that breakdown of style mucoproteins in *I. obsoleta* was due to extra-cellular digestion of carrion.

TUESDAY MORNING, JULY 30

CONTRIBUTED TALKS III. MARINE MOLLUSCS. Presiding: Paula M. Mikkelsen, Harbor Branch Foundation, Inc., Fort Pierce, FL, and J. Evan Ward, College of Marine Studies, University of Delaware. Lewes, DE. Chafee 273.

- 9:00 Deborah R. Hayes, Connecticut College, New London, CT. **SEASONAL VARIATION IN FREEZING TOLERANCE IN THE MARSH SNAIL *MELAMPUS BIDENTATUS*.** *M. bidentatus* exhibits a mean lethal temperature of -13.0 C in December and -5.5 C in July. The corresponding supercooling point of hemolymph ranges from -7.4 C to -11.5 C. Winter hemolymph contains macromolecular ice nucleating agents that promote extracellular ice formation at high temperatures. Nucleators are heat labile and probably proteinaceous.
- 9:20 Donald R. Moore, School of Marine Science, University of Miami, FL. **EARLY EVOLUTION OF BIVALVES AND GASTROPODS.** Traditionally, bivalves and gastropods have been considered rather closely related. However, they have recently been put into separate subphyla. While gastropods have some features found in classes other than the bivalves, spiral shell, radula, etc., many anatomical features show a close relationship with the bivalves.
- 9:40 A. G. Eversole, Department of Aquaculture, Fisheries & Wildlife, Clemson University, Clemson, SC, and W. D. Anderson and W. H. Lacey, South Carolina Wildlife and Marine Resources Department, Charleston, SC. **EXPLORATION FOR A COMMERCIAL SOURCE AND MARKET**

*In competition for best student talk.

*In competition for best student talk.

FOR BLOOD ARKS. *Anadara ovalis*, *A. brasiliiana* and *Noetia ponderosa* appeared to be the most abundant and economically harvestable of the three species. Responses from questionnaires indicated a worldwide market, but little demand for the U.S. product.

- 10:00 Harold W. Harry, 4612 Evergreen Street, Bellaire, TX. **RELEVANCY OF THE GENERIC CONCEPT TO THE GEOGRAPHIC DISTRIBUTION OF LIVING OYSTERS.** Extensive generic analysis of living oysters, based on anatomy of flesh and shell, demonstrates a principle probably applicable to most marine benthic shallow water mollusks: a genus or sub-genus is represented in any restricted area by only one species.
- 10:20 Break.
- 10:40 Thomas R. Waller, Department of Paleobiology, Smithsonian Institution, Washington, DC. **EVOLUTION OF LIGAMENT SYSTEMS IN THE BIVALVIA.** Study of ligament systems throughout the Bivalvia, with particular attention to composition, early development, and nature of shell supports, has led to new concepts of ligament clades, with important implications for the origins and phylogeny of bivalve subclasses.
- 11:00 * Antonieto Tan Tiu, Department of Biological Sciences, University of Southern Mississippi, Hattiesburg, MS. **MICROSTRUCTURAL VARIATION REFLECTS HABITAT INFLUENCE IN *GEUKENSIA DEMISSA GRANOSISSIMA*.** Specimens of *G. demissa granosissima* transplanted to a continually submerged habitat (spring 1984 and winter 1985) showed nacre different from that of mussels of higher *Spartina* marsh. These differences reflect habitat influence on mussel physiology resulting in shell microstructural variation.
- 11:20 * Thomas F. Brakonieccki, RSMAS-BLR, University of Miami, Miami, FL. **GENERA OF LOLIGINIDAE (CEPHALOPODA, MYOPSIDA) WITH A CONSIDERATION OF THE COMPARATIVE MORPHOLOGY OF THE HECTOCOTYLUS.** Loliginid genera are reviewed and a generic key is provided. The genus *Loligo* is eliminated from the coastal waters of North and South America. Those American species formerly in *Loligo* are placed in the genus *Doryteuthis*, and *Doryteuthis* is redefined. *Loliolus* is reduced to a

subgenus of *Loligo*, and *Uroteuthis* is considered a junior synonym of *Loligo*.

- 11:40 Susan M. Candela, RSMAS-BLR, University of Miami, Miami, FL. **BEAKS OF PELAGIC OCTOPODA FROM WESTERN NORTH ATLANTIC.** Nine species of pelagic octopods have been reported from the Atlantic north of the equator and west of the midoceanic ridge: *Japetella diaphana*, *Eledonella pygmaea*, *Vitreledonella richardi*, *Tremoctopus violaceus*, *T. gelatus*, *Ocythoe tuberculata*, *Argonauta argo*, *A. hians* and *Alloposus mollis*. Morphology of their lower beaks is compared and discussed.

TUESDAY AFTERNOON, JULY 30

SYMPOSIUM: ECOLOGY OF FRESHWATER MOLLUSCS III.

Moderator: David Kesler. Chafee 277.

- 2:00 Mark R. Young, G. J. Purser, and B. Al-Mousawi, Department of Zoology, University of Aberdeen, Aberdeen AB9 2TN, Great Britain. **REPRODUCTIVE STRATEGY OF *MARGARITIFERA MARGARITIFERA* (LINN.) WITH PARTICULAR REFERENCE TO GLOCHIDIAL STAGE.** This paper will review studies on the reproduction of the freshwater pearl mussel, *Margaritifera margaritifera*, with special note on glochidial mortality while on the fish host. This study clarifies possible reasons for glochidial loss and progresses towards a unified account of the reproductive strategy of the mussel.
- 2:30 Ismo Holopainen, Karelian Institute, Section of Ecology, University of Joensuu, SF-80101 Joensuu, Finland. **SURVIVAL OF *SPHAERIUM CORNEUM* (L.) AND *PISIDIUM AMNICUM* (O.F. MÜLLER) (PISIDIIDAE) IN ANOXIC WATER.** The survival time of *S. corneum* and *P. amnicum* in closed vials varied from one week to over 20 weeks depending on temperature and season. Part of the *P. amnicum* population overwintered inside the ice of a small river. The glycogen of both species varied seasonally from 0.5 to 2.5% of tissue wet weight.
- 3:00 Georges B. J. Dussart, Christ Church College, Canterbury, Kent, United Kingdom. **BEHAVIORAL RESPONSES OF DIFFERENT TAXA OF AQUATIC GASTROPODS TO CHANGES IN ENVIRONMENTAL CONDITIONS.** Efforts to control bilharzia snail vectors by molluscicides, canalizing, and flushing have not proved totally successful. This research investigates the behavioral responses of

*In competition for best student talk.

pulmonates to flow regime and substrate as well as possible factors (e.g., dissolved ions, pheromones, overcrowding) that cause ostensibly aquatic gastropods to leave the water.

- 3:30 Coffee Break.
- 4:00 Henry Madsen, Danish Bilharziasis Laboratory, Jaegersborg Alle 1 D, 2920 Charlottenlund, Denmark. **NICHE OVERLAP BETWEEN THREE PLANORBID SNAIL SPECIES, *HELISOMA DURYI*, *BIOMPHALARIA GLABRATA* AND *BULINUS TRUNCATUS* EVALUATED FROM LABORATORY STUDIES.** *Helisoma duryi*, a North American planorbid snail, is a promising candidate for biological control of intermediate hosts of schistosomiasis (i.e., *Biomphalaria* and *Bulinus* species). Laboratory studies demonstrate that competition with *H. duryi* results in reduced somatic growth and reproduction of *Biomphalaria* and *Bulinus* species. Both exploitative and interference competition are involved.
- 4:30 David M. Lodge, K. M. Brown, R. A. Stein, S. P. Klosiewski, B. K. Leathers, and A. P. Covich, Center for Limnology, University of Wisconsin, Madison, Wisconsin. **A PRELIMINARY MODEL OF LAKE SNAIL DISTRIBUTIONS: THE RELATIVE IMPORTANCE OF PHYSICO-CHEMICAL AND BIOTIC FACTORS.** Freshwater gastropod distributions have been explained traditionally as the result of physico-chemical factors. Data from ponds and lakes on water chemistry, habitats, predators, and snail distribution suggest a conceptual model of snail distributions that includes food and habitat selection, habitat disturbance, and predation.
- 5:00 **CONCLUDING REMARKS.** Eileen Jokinen.

TUESDAY AFTERNOON, JULY 30

SHELL CLUB PROGRAM I, 2:00-5:00. Presiding: Edward Nieburger. Talks and slide programs by amateurs. Chafee 275.

TUESDAY EVENING, JULY 30

- 8:00 **PREVIEW: MARINE FIELD TRIP.** James Carlton, Williams College, Mystic Seaport Museum, Mystic, CT, and Robert Bullock, Department of Zoology, University of Rhode Island, Kingston, RI. Chafee 275.

- 8:00 **PREVIEW: FRESHWATER FIELD TRIP.** Eileen Jokinen and Peter Rich, Biological Sciences Group, University of Connecticut, Storrs, CT. Chafee 277.
- 8:00 Ralph W. Dexter, Kent State University, Kent, OH. Slide show of past AMU meetings. (After Dr. Dexter's show would be a good opportunity for others who wish to show slides). Chafee 273.

WEDNESDAY MORNING AND AFTERNOON, JULY 31

- ~~8:00~~
11:00 **MARINE FIELD TRIP (James Carlton and Robert Bullock) AND FRESHWATER FIELD TRIP (Eileen Jokinen and Peter Rich).** Meet buses at main entrance to Memorial Union. Special areas have been chosen for collecting and sightseeing.
- ~~8:00~~
9:00 **NEWPORT BUS AND BOAT TRIP (Edward Nieburger).** Meet bus at main entrance to Memorial Union. This is a special tour arranged by the Boston Malacological Club to include a drive along the ocean front of Newport past beautiful mansions, lunch and shopping at Brick Market, and a boat cruise in the harbor past the mansions for those not going on the field trips.

WEDNESDAY EVENING, JULY 31

SHELL CLUB PROGRAM II, 8:00. Presiding: Edward Nieburger. Talks and slide programs by amateurs. See separate program. Chafee 277.

DISCUSSION: WHAT IS A MOLLUSC? 8:00. Moderator: David R. Lindberg. An informal evening of discussion on an intriguing topic, no decisions required. Discussants welcome. Conference Room, Biological Sciences.

THURSDAY MORNING, AUGUST 1

SYMPOSIUM: THE ENCAPSULATION OF EMBRYOS BY MOLLUSCS I. Moderators: Frank E. Perron, Peterborough, NH, and Jan A. Pechenik, Biology Department, Tufts University, Medford, MA. Organizer: Jan A. Pechenik. Chafee 275.

- 9:00 Jan A. Pechenik. **ENCAPSULATION OF EMBRYOS BY MOLLUSCS: AN OVERVIEW.** Encapsulation of fertilized eggs within capsules or jelly masses is encountered commonly among gastropods and cephalopods, and occasionally among bivalves. Important topics to consider are: formation, costs of production, structure, functional properties,

factors regulating capsule structure and distribution of embryos within capsules, escape mechanisms, and evolutionary implications of encapsulation in shaping life history patterns.

- 9:30 Charles N. D'Asaro, Biology Department, University of West Florida, Pensacola, FL. **LABORATORY SPAWNING AND EGG MEMBRANES AND EGG CAPSULES OF 14 SMALL MARINE PROSOBRANCHS FROM FLORIDA.** Light microscopy and scanning electron microscopy are used to describe egg membranes and egg capsules of 14 prosobranchs (phasianellids, neritids, littorinids, rissoids, rissoidins, caecids, and marginellids). Capsular structure and dimensions; enumerations of structural laminae, capsules per egg mass, and embryos per capsule; developmental pattern; and data on reproductive behavior are given.
- 10:00 Linda S. Eyster, Biology Department, Tufts University, Medford, MA. **THE STRUCTURE AND FUNCTION OF THE EMBRYONIC CAPSULE OF NUDIBRANCH MOLLUSCS.** Embryos of nudibranch gastropods develop inside tiny, fluid-filled capsules within the jelly masses. Capsule morphology for several species was examined with transmission electron microscopy. The role of the capsule in nutrition and protection of the embryos until hatching is unclear.
- 10:30 Break.
- 10:45 S. V. Boletsky, CNRS Laboratoire Arago, F-66650 Banyuls-sur-Mer, France. **ENCAPSULATION OF CEPHALOPOD EMBRYOS.** Cephalopods provide their eggs with protective envelopes produced by special glands. In octopods, the material secreted around the egg chorion (Cirrata) or chorion stalk (Incirrata) is produced by the complex oviducal gland, which thus fulfills the function of both oviducal and nidamental glands of decapods. Implications for hatching modes are discussed.
- 11:15 Gregory L. Gruber, College of Marine Studies, University of Delaware, Lewes, DE. **THE ROLE OF THE VENTRAL PEDAL GLAND IN FORMATION OF AN EGG CAPSULE BY THE MURICID GASTROPOD *EUPLEURA CAUDATA ETTERAE* B. B. BAKER 1951: AN INTEGRATED BEHAVIORAL, MORPHOLOGICAL, AND HISTOCHEMICAL STUDY.** Spawning behavior of females defined discrete times to sample egg capsules and females during capsule formation. Spawning behavior of females and structure of egg capsules and ventral pedal glands

(VPG) suggested that the VPG molded an egg capsule into its species specific shape, attached it to a hard substratum, chemically hardened its wall, but did not secrete any layers of its wall.

- 11:45 J. G. Goodsell and R. A. Lutz, Rutgers Shellfish Laboratory, New Jersey Agricultural Experiment Station, Port Norris, NJ, and M. Castagna, Virginia Institute of Marine Science, School of Marine Science, College of William and Mary, Wachapreague, VA. **EGG ENCAPSULATION IN CONTINENTAL SHELF BIVALVES.** Embryological stages of several continental shelf bivalves are encapsulated to varying degrees. Duration of encapsulation and extent of development within the capsule increase while duration of planktonic existence decreases with increasing egg size. Those species with relatively large eggs (170-190 μm) are characterized by "direct" development.

THURSDAY MORNING, AUGUST 1

CONTRIBUTED TALKS IV. MARINE AND TERRESTRIAL MOLLUSCS.

Presiding: Louise R. Kraemer, Department of Zoology, University of Arkansas, Fayetteville, AR, and Antonieto Tan Tiu, Department of Biology, University of Southern Mississippi, Hattiesburg, MS. Chafee 277.

- 9:00 David G. Reid, Department of Invertebrate Zoology, Smithsonian Institution, Washington, DC. **INTENSE PREDATION BY CRABS ON MANGROVE LITTORINIDS.** Evidence from caging experiments, analysis of repaired shell breakages and population structure, suggests that five species of the *Littorina scabra* complex suffer severe predation by crabs in a Queensland mangrove forest. Shell form, behavior and reproductive mode can be viewed as adaptive responses to selection imposed by crab predators.
- 9:20 Eliezer de Carvalho Rios and Manoel Haimovic, Museu Oceanografico da Furg, Fundacao Universidade do Rio Grande, Rio Grande, Brasil. **RIO GRANDE DO SUL MALACOPHAGE FISHES.** A list of the mollusks found in the digestive tract of the following Rio Grande do Sul marine fishes is presented: black drum (23 spp.), bullnose ray (2), croaker (10), sea catfish (2), and smooth puffer (1).
- 9:40 Ralph W. Dexter Department of Biological Sciences, Kent State University, Kent, OH. **CONTRIBUTIONS TO ALPHEUS HYATT MALACOLOGY.** Alpheus Hyatt (1838-1902) trained by Agassiz, was part-time curator of cephalopods at M.C.Z., curator of conchology and paleon-

tology at the Boston Society of Natural History, and for lower invertebrates at the Peabody Academy of Science. He became museum director of the Boston Society of Natural history, founded the Teachers School of Science, and the Annisquam Seaside Laboratory, which became the M.B.L. at Woods Hole, and researched fossil planorbids and land snails of Hawaii, leading to evolutionary theories.

- 10:00 Robert Robertson, Department of Malacology, Academy of Natural Sciences, 19th and the Parkway, Philadelphia, PA. **REPORT ON BAHAMA MARINE MOLLUSK BOOK.** *The Marine Mollusks of the Bahamas: Identification, Systematics, Zoogeography, and Natural History* is being prepared by Robert Robertson, Jack N. Worsfold, and Colin Redfern. A progress report, mainly concerning archaeogastropods, will be given. The intended readership is primarily serious amateur shell collectors and marine malacologists and biologists.
- 10:20 Break.
- 10:40 *James E. Hoffman, Department of Ecology and Evolutionary Biology (West), University of Arizona, Tucson, AZ. **A PRELIMINARY BIOGEOGRAPHY OF THE BULMULIDAE (PULMONATA: SIGMUETHRA) IN SONORA, MEXICO.** The genus *Rabdotus* in Sonora is unusual for a southwestern desert snail in that two species seem to inhabit areas of hundreds of square miles each. In contrast, *Rabdotus* in Baja California and *Sonorella* in southern Arizona are comprised of many species that inhabit small local areas.
- 11:00 Artie L. Metcalf, Department of Biological Sciences, University of Texas at El Paso, El Paso, TX. **LAND SNAILS FROM TWO MOUNTAIN RANGES IN NORTHERN COAHUILA, MEXICO.** Land snail faunas, living and fossil, from areas in (1) the Serranias del Burro and (2) the Sierra Maderas del Carmen in northern Coahuila, Mexico, are discussed. Emphasis is on biogeographic affinities of the fauna, faunal changes documented by fossils, undescribed taxa and the need for further work in the region.
- 11:20 *S. Rajasekaran, Department of Zoology, Annamalai University, Annamalai nagar 608 002 India. **INFLUENCE OF OPTIC TENTACULAR PRINCIPLE ON THE BIOSYNTHESIS OF STEROIDS IN THE OVOTESTIS OF *CRYP-TOZONA BELANGERI* (DESHAYES) (PULMONATA:**

GASTROPODA). Results of optic tentaculized snails illustrate the relationship of the optic tentacle with the gonad. Switching from one phase to the other depends on the optic tentacular principle that plays a decisive role in modulating the biosynthesis of specific steroids, either androgens or estrogens, by the gonad, characterizing the male or the female phase in the snail.

- 11:40 Noorullah Babrakzai, Department of Biology, Central Missouri State University, Warrensburg, MO. **A CYTOLOGICAL BASIS OF MORTALITY IN F₂ INTERSPECIES HYBRIDS OF *ASHUMUNELLA* (PULMONATA: POLYGYRIDAE).** Specific marker chromosomes of *A. proxima* have been traced in the F₂ hybrids of *A. proxima* X *A. angulata* cross using the C-banding technique. Sticky mitotic metaphase chromosomes and consequent cell death in the F₂ embryos provided a cytological basis of hybrid breakdown.

THURSDAY AFTERNOON, AUGUST 1

SYMPOSIUM: THE ENCAPSULATION OF EMBRYOS BY MOLLUSCS II.

Moderators: Charles N. D'Asaro, Biology Department, University of West Florida, Pensacola, FL, and Alex Tompa, 1235 Bardstown, Ann Arbor, MI. Chafee 275.

- 2:00 Frank E. Perron, 84.5 Main Street, Peterborough, NH. **FACTORS AFFECTING PATTERNS OF OVA ENCAPSULATION IN GASTROPODS OF THE GENUS *CONUS*.** Within species, patterns of energy allocation to capsule walls vs. ova are controlled by physiological constraints related to capsule volume and surface area. Among species, energy allocation patterns are related to egg size and developmental time.
- 2:30 Brian Rivest, Department of Biology, SUNY at Cortland, Cortland, NY. **ALBUMEN AS A SIGNIFICANT SOURCE OF EXTRAEMBRYONIC NUTRITION IN GASTROPOD MOLLUSCS.** Encapsulated gastropod embryos are provided with albumen that in some species provides a significant source of nutrition. As with nurse eggs, albumen can act to increase hatching size of offspring, and variation in its availability can vary hatching size of siblings and mean hatching size among populations.
- 3:00 Acha Lord, Biology Department, Tufts University, Medford, MA. **IS CAPSULAR FLUID FROM EGG CAPSULES OF**

*In competition for best student talk.

- NUCELLA LAPILLUS AXENIC?** Presence or absence of bacteria was examined in fluid from maturing capsules of the prosobranch *N. lapillus*. Although fluid is not bacteriostatic, it may be axenic, and the capsules may protect against bacterial infection, at least while capsules and embryos are young.
- 3:20 Break.
- 3:40 Pablo E. Penchaszadeh, Universidad Simon Bolivar, Departamento de Estudios Ambientales e INTECMAR, Apartado 80659, Caracas, Venezuela. **PATTERNS OF ENCAPSULATED DEVELOPMENT AMONG SOUTH AMERICAN PROSOBRANCH GASTROPODS.** Studies of South American prosobranchs make a significant contribution to our knowledge of encapsulated development. Direct development is discussed for the Volutidae, Marginellidae, Muricidae, Vermetidae, and others. A peculiar developmental pattern in which planktonic and direct development occur within a single egg mass is shown for Tonnidae, and striking characteristics are given for some Conidae.
- 4:00 K. Elaine Hoagland, Center for Marine and Environmental Studies, Lehigh University, Bethlehem, PA. **TAXONOMIC VARIATION IN EGG SIZE, ENCAPSULATION, AND BROODING IN THE CALYPTRAEIDAE: PHYLETIC PATTERN, ADAPTATION, OR MORPHOLOGICAL CONSTRAINTS?** Three types of larval development in the Calyptraeidae will be described: 1) brooding of a few large, yolky eggs, 2) brooding of numerous small eggs followed by release of planktotrophic veligers, and 3) brooding of small eggs, most of which serve as nurse eggs for a few juveniles. The adaptive significance and phylogenetic distribution of the three types will be discussed.
- 4:30 Alex Tompa, 1235 Bardstown, Ann Arbor, MI. **REPRODUCTION IN TERRESTRIAL SNAILS: FROM CLEIDOIC EGGS TO TRUE VIVIPARITY.** Recent work has shown that in a few land snail families a truly viviparous condition has evolved where embryos that are retained in utero absorb more than a thousand times their original calcium content during development. Comparison between vertebrate viviparous systems, e.g. the chorio allantois evolving into a placental function, and the snail podocyst assuming the function of a placenta, is striking.

THURSDAY AFTERNOON, AUGUST 1

SYMPOSIUM: THE MOLLUSCAN RADULA. Organizers and moderators: Robert C. Bullock, Department of Zoology, University of Rhode Island, Kingston, RI, and Carole S. Hickman, Department of Paleontology, University of California, Berkeley, CA. Chafee 277.

- 2:00 Robert C. Bullock. **INTRODUCTION.**
- 2:15 G. Alan Solem, Field Museum of Natural History, Chicago, IL. **PULMONATE RADULAE: A NEGLECTED ORGAN COMPLEX.** A review of major patterns and opportunities for research in the pulmonate radula and jaw.
- 2:30 Carole S. Hickman. **RADULA DYNAMICS: ANALYSIS OF MOVEMENT PATTERNS AND SUBSTRATE INTERACTIONS.** Documentation of radular morphology in functional orientation is difficult because positions, spatial relationships, and rates of movement of individual teeth change constantly during the feeding stroke. Motion analysis of filmed feeding strokes reveals higher-order patterns. Combined with analysis of rasps marks on substrates, dynamic analysis provides refined understanding of the range of capabilities of the molluscan radula.
- 2:55 Dianna K. Padilla, Department of Zoology, University of Alberta, Edmonton, Alberta, Canada. **USE OF BIOMECHANICAL TECHNIQUES TO STUDY FUNCTIONAL MORPHOLOGY OF LIMPET RADULAE.** Biomechanical techniques for testing properties of limpet radulae allow insight into the functional morphology of the radula and possible defensive strategies on the part of algae.
- 3:25 Break.
- 3:40 James Nybakken, Moss Landing Marine Laboratories, Moss Landing, CA. **ONTOGENETIC CHANGE IN THE CONUS RADULA, A PRELIMINARY REPORT.** Preliminary work has demonstrated that certain *Conus* species undergo considerable change in radula between juveniles and adults. This can be correlated with food.
- 3:55 Robert C. Bullock. **FUNCTIONAL MORPHOLOGY OF THE POLYPLACPHORAN RADULA.** Preliminary studies on polyplacophoran radular functional morphology corroborate previous findings that centro-lateral and major lateral teeth are principal excavating elements during

grazing activities of chitons. A few additional teeth can also contact the substratum, but these provide different functions.

- 4:15 David R. Lindberg, Museum of Paleontology, University of California, Berkeley, CA. **PATTERNS OF RADULAR EVOLUTION IN THE PATELLOGASTROPODA.** Results of studies on patterns of radular evolution, tooth morphology, tooth number, and basal plate structures are presented.
- 4:45 Carole S. Hickman. **CLOSING REMARKS.**

THURSDAY MORNING AND AFTERNOON, AUGUST 1

EXHIBITS AND SALES OF MALACOLOGICAL ITEMS OF INTEREST. Organizer: Edward Nieburger, P.O. Box 3095, Andover, MA. There will be displays of shell collections, and six dealers of shells, books and related objects will offer their wares for sale. (See separate program). 9:00-4:00. Memorial Union.

THURSDAY EVENING, AUGUST 1

AUCTION. Organizer and Auctioneer: Dick Petit, P. O. Box 30, North Myrtle Beach, SC. This is a special event each year. Proceeds of the Auction go to the AMU Symposium Endowment Fund instituted by Louise Kraemer. 8:00. Chafee 277.

FRIDAY MORNING, AUGUST 2

CONTRIBUTED TALKS V. FRESHWATER MOLLUSCS. Presiding: Thomas R. Waller, Department of Paleontology, Smithsonian Institution, Washington, DC., and Gregory Gruber, College of Marine Studies, University of Delaware, Lewes, DE. Chafee 271.

- 9:00 *Mark E. Gordon, Department of Zoology, University of Arkansas, Fayetteville, AR. **AQUATIC MOLLUSCA OF THE ARKANSAS RIVER BASIN.** The Arkansas River drainage is a major tributary system of the Interior Basin and includes a diverse assemblage of geological regions. A review of published and unpublished data indicates that approximately 95 species of freshwater mollusks have occurred within this basin during historic times.

*In competition for best student talk.

- 9:20 Raymond W. Neck, Texas Parks and Wildlife Department, Austin, TX. **FRESHWATER MOLLUSKS IN A CENTRAL TEXAS FISH HATCHERY.** Rearing ponds at the San Marcos Fish Hatchery were surveyed for presence of freshwater snails and bivalves. Preferred microhabitats and immigration routes to the ponds were examined.
- 9:40 Clement L. Counts, III, College of Marine Studies, University of Delaware, Lewes, DE. **CORBICULA FLUMINEA (MÜLLER, 1774) (BIVALVIA: CORBICULIDAE) AT NUCLEAR POWER FACILITIES.** A review of zoogeographic records for *C. fluminea* reveals its presence in 27 states where nuclear power stations are presently operating or under construction. A review of the proximity of populations of *C. fluminea* to these facilities is presented with strategies for control in differing cooling systems.
- 10:00 G. L. Mackie, Department of Zoology, University of Guelph, Guelph, Ontario, Canada. **FUNCTIONAL MORPHOLOGY OF THE MANTLE OF NORTH AMERICAN CORBICULACEA.** The mantle folds of North American corbiculacean clams have morphological features that are diagnostic of genera, subgenera, and in some cases species. The inner lobe tends to be ciliated in "lentic species" and non-ciliated in "lotic species."
- 10:20 Break.
- 10:40 *Kashane Chalermwat, Department of Biological Sciences, University of Southern Mississippi, Hattiesburg, MS. **DIURNAL AND SEASONAL VARIATION OF TERTIARY DIGESTIVE TUBULE MORPHOLOGY IN CORBICULA FLUMINEA (MÜLLER).** Digestive tubule morphology changes during 24-hour periods in *C. fluminea* show that animals maintained and sampled in the laboratory and those that were field sampled show different tubule variations. Field sampled animals were regularly dominated by disintegration and digestive stages; laboratory sampled animals showed more random tubule morphology.
- 11:00 Louise Russert-Kraemer, Marvin L. Galloway and Mark E. Gordon, University of Arkansas, Fayetteville, AR. **ASPECTS OF COMPARATIVE EMBRYOGENESIS IN THE PISIDIIDAE AND THE CORBICULIDAE (BIVALVIA: CORBICULACEA).** Microscopical serial sections and freeze-cracked SEM sections were prepared and examined to work out aspects of the comparative

*In competition for best student talk.

embryology of *Corbicula fluminea*, *Sphaerium striatinum* and *Pisidium casertanum*, and to investigate events of developmental "timing" in representative species of corbiculid and pisidiid bivalves. There are indeed timing "deficits" in corbiculid embryogeny, which would account for earlier evidence (Kraemer & Galloway 1984) of heterochrony in *C. fluminea*.

- 11:20 Francis G. Doherty, D. S. Cherry and J. Cairns, Jr., Virginia Polytechnic Institute and State University, Department of Biology, University Center for Environmental Studies, Blacksburg, VA. **SPAWNING ACTIVITIES OF THE ASIATIC CLAM, CORBICULA FLUMINEA IN THE NEW RIVER, VIRGINIA.** The spawning pattern of a New River *Corbicula* population is described. Data collected include the presence of pediveligers in the sediment, collection of naturally spawned veligers in the laboratory, and gill examination for presence of brooding veligers. Data collected indicate three major spawning events occurred in 1984.
- 11:40 Robert S. Prezant and Antonieto Tan Tiu, Department of Biological Sciences, University of Southern Mississippi, Hattiesburg, MS. **UNIQUE SHELL MICROSTRUCTURE OF CORBICULA FLUMINEA.** The peripheral shell edge (beneath the perio-stracal infolding) of the Asiatic bivalve *Corbicula* c.f. *fluminea* shows a unique spiral form of crossed-lamellar microstructure. This structure can have antipredation functions.

FRIDAY MORNING, AUGUST 2

CONTRIBUTED TALKS VI. FRESHWATER MOLLUSCS. Presiding: John B. Burch, Museum of Zoology, University of Michigan, Ann Arbor, MI, and Paul M. Mikkelsen, Harbor Branch Foundation, Inc., Fort Pierce, FL. Chafee 277.

- 9:00 John E. Schmidt, West Virginia Department of Natural Resources, Division of Water Resources, Charleston, WV. **NOTES ON THE HISTORIC AND PRESENT NAIAD FAUNA OF THE CANEY FORK RIVER, CENTRAL TENNESSEE.** A survey of the naiad fauna of the Caney Fork River was conducted from August 1980 to August 1981. Only 8 of the 36 species collected were taken alive or freshly dead. Twenty-nine species were collected only as fossil or relic shells from middens.

- 9:20 M. Bowie Kotrla, Department of Biological Science, Florida State University, Tallahassee, FL. **GAMETOGENESIS IN THREE HETEROGENERIC UNIONIDS (PELECYPODA: UNIONIDAE).** Gametogenesis of *Anodonta imbecilis*, *Elliptio icterina*, and *Villosa villosa* was compared morphologically and histochemically. No differences among species were observed, although there was interspecific variation in the seasonality of gametogenic events and in the brooding pattern. Gamete morphology is not entirely consistent with that predicted by bivalve fertilization biology.
- 9:40 *Michael A. Hoggarth, Ohio State University, Museum of Zoology, Columbus, OH. **MECHANICS OF GLOCHIDIAL ATTACHMENT (MOLLUSCA: BIVALVIA UNIONIDAE).** The mechanics of a third class lever system are examined in regard to the structure of a glochidium. This analysis suggests the best possible structural configuration for shell and adductor muscle of glochidia and identifies a number of attachment strategies within glochidia of the Unionidae.
- 10:00 Arthur H. Clarke, Ecosearch, Inc., Portland, TX. **DISTRIBUTION AND TAXONOMY OF CANTHYRIA COLLINA (CONRAD).** A 1984 survey by Ecosearch, Inc. showed that the James River spiny mussel is now restricted to a few upper tributaries still uninhabited by *Corbicula*. Although most *C. collina* lack spines, anatomical features show that it is related to *C. spinosa* (Lea) and *C. steinstansiana* (Johnson and Clarke).
- 10:20 Break.
- 10:40 George M. Davis, Academy of Natural Sciences, Philadelphia, PA. **AN ENIGMATIC BYTHINELLIA-LIKE GENUS FROM CHINA: PROBLEMS OF CONVERGENT EVOLUTION.** A newly discovered freshwater rissoacean genus converges on several families in character-states used to define these families (Hydrobiidae, Amnicolidae, Pomatiopsidae, Bithymüidae). Problems of convergence of radula, shell, and female reproductive system character-states are discussed within the context of zoogeographic distributions of relevant rissoacean families and subfamilies. Phenetic and cladistic analyses are discussed.

*In competition for best student talk.

- 11:00 A. D. Berrie, Freshwater Biological Association, River Laboratory, East Stoke Wareham, England. **HABITAT EXPLOITATION BY *PHYSA FONTINALIS* IN THE RIVER THAMES, ENGLAND.** *P. fontinalis* colonizes the leaves of water lilies near the margin of the river. Leaves are present only during the summer. The use of this seasonal habitat by these snails will be described.
- 11:20 Sherman Hendrix, Department of Biology, Gettysburg College, Gettysburg, PA. **POPULATION BIOLOGY OF *LEPTOXIS CARINATA* (BRUG.) IN ADAMS COUNTY, PENNSYLVANIA.** Egg laying begins in April, peaks in June, and ceases by August. Eggs hatch in 15 days at 20-22°C. Immature snails dominate the population in summer and fall. Sexual maturity is attained in the following spring. Other population parameters will be discussed.
- 11:40 Jay Shiro Balboni-Tashiro, Department of Biology, Kenyon College, Gambier, OH. **INVESTIGATION OF TISSUE DEGROWTH STRATEGIES IN TWO FRESHWATER PULMONATE SPECIES, *HELISOMA ANCEPS* AND *H. TRIVOLVIS*.** Overwintering physiology and degrowth were examined in two pulmonate species, *H. anceps* and *H. trivolvis*. Age-specific differences in protein catabolism were observed in both species. There were age-specific as well as species-specific differences in quality and quantity of nitrogenous weight-specific excretion rates. Animals were maintained in the laboratory under conditions simulating an overwintering period in north temperate latitudes.

FRIDAY AFTERNOON, AUGUST 2

- 2:00 **PRESENTATION OF AWARD FOR BEST STUDENT TALK AND ANNUAL BUSINESS MEETING.** Chafee 271.
- 4:00 **AMU RAP SESSION:** AMU is good, what can we do better? Open discussion for all members and friends. Chafee 271.

FRIDAY EVENING, AUGUST 2

- 6:00 **LOBSTER-CLAM BAKE.** Five full courses served under a spacious tent at the University Bay Campus overlooking the water. Transportation from Memorial Union starting at 6:00.

MONDAY-TUESDAY, JULY 29-30 AND THURSDAY-FRIDAY, AUGUST 1-2

- 10:00-5:00 pm **DISPLAY OF AMERICAN MALACOLOGICAL UNION LITERATURE**, organized by Constance Boone, 3706 Tice Boulevard, Houston, TX, and Paula Mikkelsen, Harbor Branch Foundation, Ft. Pierce, FL. Chafee Lobby.
- 9:00-5:00 pm **POSTER SESSION**, organized by Douglas Smith, Museum of Zoology, Morrill Science Center, University of Massachusetts, at Amherst, Amherst, MA. Chafee Lobby. Authors of posters will indicate on their posters when they will be present to discuss them. The following posters will be displayed:
1. John W. McManus, Graduate School of Oceanography, University of Rhode Island, Narragansett, RI. **BASIN ISOLATION AND TROPICAL MARINE SPECIATION.** Evidence is presented for the possibility that high diversity in marine shelf areas of the tropics resulted from historical isolation of shallow marine basins. Land biogeographic distributions help to explain distribution of many marine endemics. Southeast Asia and the Caribbean could have acted as two-cycle speciation pumps, alternating between land and sea, and controlled by tectonics and sea level changes.
 2. David Strayer, Institute of Ecosystem Studies, Millbrook, NY. **FRESHWATER MOLLUSKS OF THE HUDSON RIVER BASIN: AN HISTORICAL AND ECOLOGICAL SURVEY.** Analysis of literature records, more than 2000 museum lots, and field surveys show the Hudson River basin to contain 82 species of freshwater mollusks, 17 from the Interior Basin fauna.
 3. Alan C. Buchanan, 1110 College Avenue, Columbia, MO. **ECOLOGY OF FRESHWATER MUSSELS IN MISSOURI'S OZARKS.** Mussel distribution in Missouri's Ozark streams is related to basin geology and morphology, and stream order, gradient and temperature, based on data from over 500 sites. In a relatively undisturbed system, the mussel fauna develops from headwaters to mouth in a continuum that reflects changes in the above factors.
 4. John W. Ewart,¹ Janel R. Villalaz Guerra,² Juan A. Gomez,² Luis D'Croz,² and Melbourne R. Carriker,¹
1) College of Marine Studies, University of Delaware, Lewes, DE, 2) Centro de Ciencias del Mar y Limnologia,

- Universidad de Panama, Panama, Republic of Panama. **DEVELOPMENT OF A HATCHERY FOR COMMERCIALLY IMPORTANT MARINE BIVALVES IN PANAMA.** Scientists at the University of Delaware and the University of Panama are working together to establish an experimental hatchery for the production of several species of commercially important bivalves to replenish declining natural populations and foster development of bivalve aquaculture among coastal fishing families. Recent results of efforts to accomplish these goals are presented.
5. Suzanne G. Ayvazian, Department of Zoology, University of Rhode Island, Kingston, RI. **EFFECTS OF DENSITY AND SURFACE AREA ON THE GROWTH OF *BIOMPHALARIA GLABRATA*.** Populations of *B. glabrata* were examined over a twenty-five week period to assess the influence of augmentations in available surface area and variations in snail density on morphometric growth rates, reproductive rates and intrinsic rates of growth. Populations exhibited asymptotic growth. The fecundity was not influenced by either variable, while the intrinsic rate of growth increased with increasing snail density.
 6. John W. Ropes and Maurice K. Crawford, U. S. Department of Commerce, NOAA, NMFS Northeast Fisheries Center, Woods Hole, MA. **PRELIMINARY INVESTIGATIONS OF GROWTH LINES IN ACETATE PEELS OF THE CHONDROPHORES OF *MYA ARENARIA* AND *M. TRUNCATA*.** Age estimates of *M. arenaria* have historically been determined from poorly defined external valve rings. Thin-sectioned chondrophores display definitive age lines, but the technique can destroy specimens. Acetate peel production is less destructive and reveals well-defined growth lines in *M. arenaria* and *M. truncata*, especially for individuals of advanced age.
 7. Jay Shiro Balboni-Tashiro, Department of Biology, Kenyon College, Gambier, OH. **AGE OF FIRST REPRODUCTION IN SALT-MARSH ELLOBIID, *MELAMPUS BIDENTATUS*.** A paradigm is proposed for factors shaping the age of first reproduction in populations of *M. bidentatus* located in northern temperate regions. An overwintering diapause state imposes a period of degrowth. Younger animals have higher rates of tissue turnover and repair during degrowth regimes. Such tissue degrowth and concomitant repair of somatic base tissues is facilitated by a capacity for utilizing gonadal materials, especially in younger snails.
 8. Kathryn A. Muldoon, Applied Biology, Inc., Jensen Beach, FL. ***CARETTA CARETTA* AS HABITAT: MOLLUSCS AS EPIFAUNA ON THE LOGGERHEAD SEA TURTLE.** Epifauna from 62 Atlantic loggerheads yielded both sessile and motile molluscs, which generally occupied different "habitats" on the turtle. Biological variables of molluscs and turtles are compared. Biogeographical implications of the loggerhead epifauna are discussed.
 9. J. Evan Ward, College of Marine Studies, University of Delaware, Lewes, DE. **HOST SPECIFICITY OF AN ECTOPARASITIC SNAIL IN THE GENUS *ODOSTOMIA* IN THE PANAMAY BAY REGION (GASTROPODA: BYRAMIDELLIDAE).** Varying degrees of host specificity have been reported for many North American and European pyramidellids. However, little is known about the feeding behavior of tropical species. In this study field and laboratory observations and chemotaxis experiments determined feeding habits, preferred hosts, and degree of host specificity of one tropical species of *Odostomia*.
 10. Robert Gilertson and Noorullah Babrakzai, Department of Biology, Central Missouri State University, Warrensburg, MO. **PRELIMINARY OBSERVATIONS ON THE KARYOTYPES OF *ANGUISPIRA ALTERNATA* (GASTROPODA).** Preliminary cytological studies on two populations of *A. alternata* from Warrensburg, Missouri and Rhode Island revealed a diploid number of 64 chromosomes for this species. The chromosomes are biarmed (meta- and submetacentrics). The karyotype has two chromosomes with nucleolar organic regions (NORs). The possibility of NOR heterozygosity in one population (Warrensburg) is indicated.

INDEX TO PARTICIPANTS

Al-Mousawi, B.	11	Goodsell, J. G.	15	Meier-Brook, C.	6	Robertson, R.	16
Anderson, W. D.	9	Gordon, M. E.	20, 21	Metcalf, A. L.	16	Rogge, T. N.	8
Ayvazian, S. G.	26	Gruber, G.	14, 20	Mikkelsen, P.	9, 25	Ropes, J. W.	26
Abrazkai, N.	17, 27	Haas, D.	6	Mikkelsen, P.	22	Schmidt, J. E.	22
Alboni-Tashiro, J. S.	24, 26	Haimovic, M.	15	Moore, D. R.	9	Seeley, R. H.	5
Arrie, A. D.	24	Hargreave, D.	4	Morton, B. S.	6	Seymour, D. T.	1
Bieler, R.	5	Harry, H. W.	10	Muldoon, K. A.	27	Smith, D.	25
Boletsky, S. V.	14	Hayes, D. R.	9	Neck, R. W.	21	Solem, G. A.	19
Boone, C.	25	Hendrickson, L. C.	9	Neves, R. J.	3	Soliman, G. N.	8
Brakoniecki, T. F.	10	Hendrix, S.	24	Nieburger, E.	12, 13, 20	Stein, R. A.	12
Brown, K. M.	12	Hershler, R.	2	Nybakken, J.	4, 19	Strayer, D.	25
Buchanan, A. C.	25	Hickman, C. S.	19, 20	Padilla, D. K.	19	Tiu, A. T.	10, 15, 22
Bullock, R.	12, 13, 19	Hoagland, K. E.	18	Pechenik, J. A.	13	Tompa, A.	18
Burch, J. B.	22	Hoffman, J. E.	16	Penchaszadeh, P. E.	18	Vail, V.	6
Cairns, J., Jr.	22	Hoggarth, M. A.	23	Perron, F. E.	13, 17	Villalez Guerra, J. R.	25
Candela, S. M.	11	Holopainen, I.	3, 11	Petit, R.	20	Voltzow, J.	8
Carriker, M. R.	1, 25	Hornback, D. J.	2	Porter, H. J.	4	Waller, T. R.	10, 20
Carlton, J.	12, 13	Houbriek, R. S.	1, 7	Prezant, R. S.	22	Ward, J. E.	9, 27
Castagna, M.	15	Hudson, R. G.	2	Purser, G. J.	11	Watters, G. T.	4
Chalermwat, K.	4, 21	Jokinen, E. H.	2, 7, 12, 13	Quinn, J. F.	2	Way, C. M.	3
Cherry, D. S.	22	Kat, P. W.	1	Rajasekaran, S.	16	Whitehead, B. E.	6
Clarke, A. H.	1, 23	Kellogg, M. G.	5	Reid, D. G.	15	Winter, G.	6
Counts, C. L., III	21	Kesler, D.	11	Rich, P.	13	Young, M. R.	11
Covich, A. P.	12	Klosiewski, S. P.	12	Rios, E. C.	15	Zeller, T.	6
Cox, C.	2	Kool, S.	7	Rivest, B.	17	Zhong-yan, Q.	8
Crawford, M. K.	26	Kotrla, M. B.	23				
Culter, J. K.	4	Kraemer, L. R.	15, 20, 21				
D'Asaro, C. N.	14, 17	Lacey, W. H.	9				
Davis, G. M.	23	Leathers, B. K.	12				
D'Croz, L.	25	Lindberg, D. R.	13, 20				
Dexter, R. W.	13, 15	Lodge, D. M.	12				
Dillion, R. T.	6	Lopez, D. M.	3				
Doherty, F. G.	22	Lord, A.	17				
Dussart, G. B. J.	11	Lyons, W.	7				
Etter, R. J.	8	Lutz, R. A.	15				
Eversole, A. G.	9	Mackie, G. L.	3, 21				
Ewart, J. W.	7, 25	Maddox, N. V.	4				
Eyster, L. S.	14	Madsen, H.	12				
Galloway, M. L.	21	McLean, J. H.	5				
Gilertson, R.	27	McMahon, R. F.	2, 6				
Gomez, J. A.	25	McManus, J. W.	25				

NOTES