ISSN 1072-2440 Vol. 44, No. 2, June 2016

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American CONCHOLOGIST

Quarterly Journal of the Conchologists of America, Inc.

CONCHOLOGISTS OF AMERICA, INC.

In 1972, a group of shell collectors saw the need for a national organization devoted to the interests of shell collectors; to the beauty of shells, to their scientific aspects, and to the collecting and preservation of mollusks. This was the start of COA. Our membership includes novices, advanced collectors, scientists, and shell dealers from around the world. In 1995, COA adopted a conservation resolution: Whereas there are an estimated 100,000 species of living mollusks, many of great economic, ecological, and cultural importance to humans and whereas habitat destruction and commercial fisheries have had serious effects on mollusk populations worldwide, and whereas modern conchology continues the tradition of amateur naturalists exploring and documenting the natural world, be it resolved that the Conchologists of America endorses responsible scientific collecting as a means of monitoring the status of mollusk species and populations and promoting informed decision making in regulatory processes intended to safeguard mollusks and their habitats.

AMERICAN CONCHOLOGIST, the official publication of the Conchologists of America, Inc., and issued as part of membership dues, is published quarterly in March, June, September, and December, printed by JOHNSON PRESS OF AMERICA, INC. (JPA), 800 N. Court St., P.O. Box 592, Pontiac, IL 61764. All correspondence should go to the Editor. ISSN 1072-2440.

MEMBERSHIP is for the calendar year, January-December, late memberships are retroactive to January. 2010 DUES: $25; postal surcharge: USA none ($5 additional for USA first class), $5 for Canada and Mexico (total of $30), $15 for all other countries (total of $40). New members apply to Debbie Freeman, Membership Director. Please pay in U.S. dollars ($), or with a check on a U.S. bank with Transit Enrouting and Account Numbers printed at the bottom, or with money order. Make checks payable to: CONCHOLOGISTS OF AMERICA. Notify Membership Director with change of address.

BACK ISSUES are available from Debbie Freeman, Membership Director. Prices: prior to 1999, $3 each, 2000 to 2008 $4 each, 2009 to current, $5 each; postage extra.

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In This Issue

Editor's comments: First a bit of business. The slate of COA officers for 2016 was published as required by our by-laws in the September 2015 issue. In case anyone missed it and just as a reminder prior to the election during our Chicago convention, it is repeated here.

A nominating committee consisting of Doris Underwood, Everett Long, and Alan Gettleman was established to report a slate for the elected offices to be voted at the 2016 annual meeting of the Conchologists Of America (COA) convention to be held in Illinois. The proposed slate of officers is:

President: Harry G. Lee, M.D.
Vice President: Wayne Humbird
Secretary: Phyllis Gray
Treasurer: Steven Coker
Trustee: Everett Long

That out of the way, I hope you enjoy this issue. As usual we have an eclectic offering, from filming living mollusks to raising minute land snails. Of course, the major event on the horizon is the COA convention in Chicago. The folks in the windy city have pulled out all of the stops to make this a memorable event. Yes, you should already have your reservation set, but it is really never too late. The COA convention is a once a year opportunity to mix and mingle with shell folks from around the world. This event is guaranteed to increase your enjoyment of conchology. Really! If not, see me in Chicago and I'll buy you a drink.

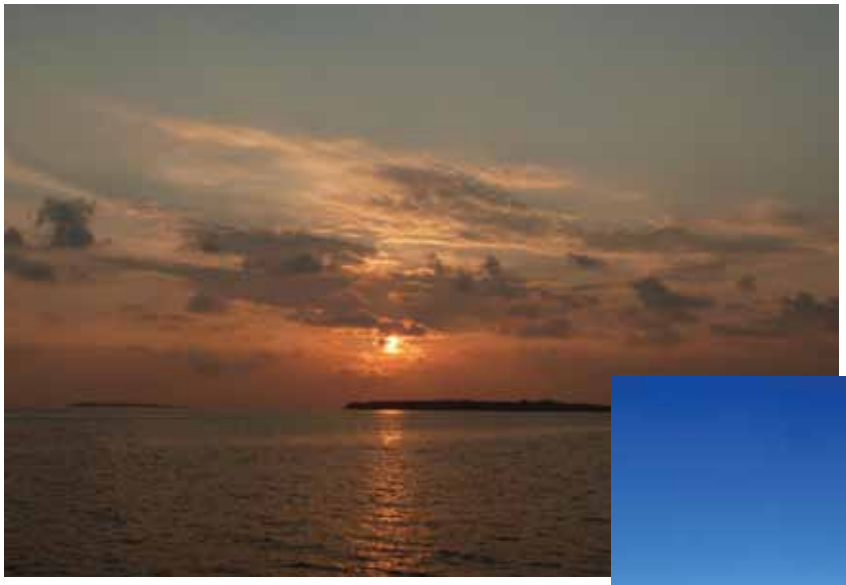
Tom Eichhorst

Front cover: *Cuspivolva tigris* (Yamamoto, 1971), photographed by Charles Rawlings at night on soft coral, Ambon, Indonesia. This beautifully marked ovulid is fairly wide-spread throughout the Pacific, but never really commonly found. Originally named *Primovula tigris* by Yamamoto, it was subsequently placed in *Crenavolva*, and most recently moved to *Cuspivolva*. The brightly colored orange mantle with black stripes outlined in white covers a shell that is uniformly yellow to orange with a bit of darker shading around the aperture.

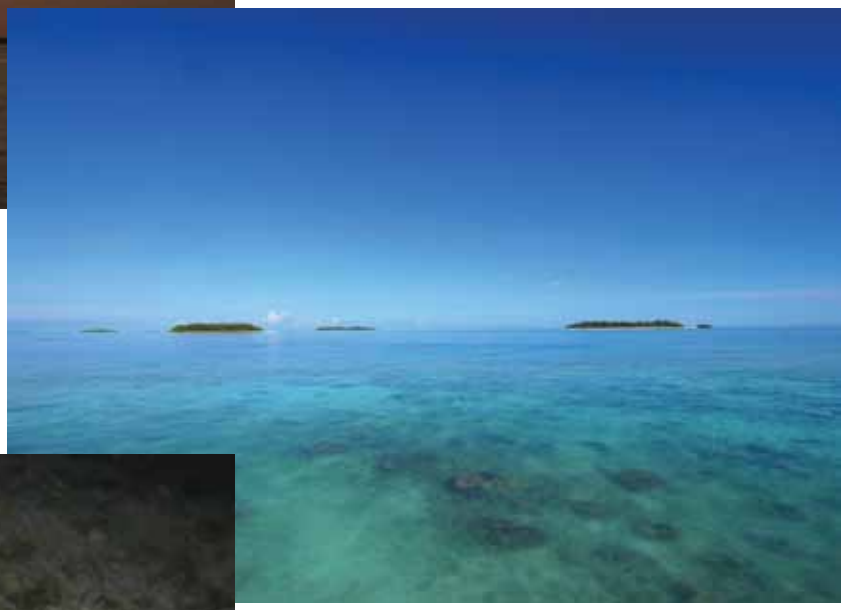
Back cover: *Empleconia vaginata* (Dall, 1891), 30mm, in mud at 350 meters, trawled by the "Northwest Explorer," off Kodiak Island, Alaska, by Scott Walker, June 2015 (ex. Will Ritter, May 2016). Originally named as *Limopsis vaginata* by Dall, subsequently moved to *Empleconia* (one of eight genera in the family Limopsidae). If the "hairy" periostracum is removed, the collector is left with an unremarkable white shell.

Adventures in producing a documentary: "HEALERS AND HUNTERS: THE SECRET LIFE OF SEA SNAILS"

Astrid Koch (images © Duino Film, 2015)



Palm fringed islands with pristine sandy beaches…for most people, this is a slice of paradise.



The infinite blue sea is perfect for swimming, but few people are aware of just how many dangerous, even deadly, animals lurk beneath the surface.

Most notorious are the venomous lionfish, stonefish (shown here), moray eels, and the poisonous puffer fish; but often it's the seemingly innocent that are the most treacherous.

As an avid diver and shell collector, I am always looking for snails when I travel to tropical islands. Cone snails are especially interesting when it comes to research as well as documentation. A lot of good images can be captured while diving and snorkelling along the shore and in tide pools. Since cone snails are mostly nocturnal, we spent many hours in shallow waters wielding flashlights.

Most cones were found around midnight. Of course, filming during the night is difficult, which is why we collected our findings in plastic nets and proceeded to film them under more favourable conditions, such as clear water, a slower current, and smaller waves. Nevertheless it is still difficult to film such a slow-moving animal. A single turn by a crawling cone snail often took several minutes, requiring patience and persistence to film the snail's movements. Holding them in a small space enabled us to get images of *Conus bandanus* hunting. While under observation, it preyed on other toxic cone snails.

***Conus bandanus* relocated with us to Vienna.**

Unfortunately our plans were too ambitious for the time we had, so we decided to take *Conus bandanus* back with us to Vienna. We wrapped it in moist washcloths to enable it to survive the flight unharmed. Back in Vienna we carefully unpacked our special "souvenir" and proceeded to slowly accustom it to the water in our research tank.

It took a few minutes for it to extend its foot and begin to smell with its olfactory organ. Shortly afterwards, it started to leave trails of mucus in our aquarium. We were able to closely observe and film the beautiful patterns on the shell and body.

Conus bandanus gave us a lot of good imagery of its hunting method. We managed to capture the venom canal stretching, the prey getting shot by its venomous harpoon and 'reloading,' and repeatedly shooting time and time again. In nature, capturing this material would have been almost impossible!

One of our research aquariums.

It is hard to obtain marine snails in a country without a sea-side…Austria

For months we tried to get our hands on living cone snails from various sellers, but to our disappointment, only *Strombidae* were available. In a very fortunate turn of events, we got a call from an animal shop owner in Linz, who informed us he had just received several cones, despite not having ordered them! We were suspicious at first and asked for proof in the form a photo. We could barely believe our eyes when we received a photo of a bucket containing more than 50 cones! A *Conus geographus* seemed to be the most active by far and caught our eye.

A bucket with over 50 live cone snails.

We were excited on the 200km trip to Linz, for we could take a true treasure trove with us back to Vienna. We purchased the cones and headed back to Vienna. They arrived alive and in good shape, but we knew they could not remain in their temporary home for long. Even though the

best efforts were made to make the best out of it, the bucket was far too small. We hastily prepared three 100 litre tanks, as well as several smaller research tanks for the less active among them and, if that wasn't enough, two filtered tanks. We had no clue as to how active the animals would be, which meant we were uncertain when it came to adding lids, or whether or not they would start preying upon each other, but we were confident that separated tanks would prevent many such problems. It took us until midnight to put all of the snails in their respective new homes. We tried to keep related kinds together, for example *Conus mustelinus*, *Conus vexillum* and *Conus capitaneus* were put into one tank.

Stack of three research aquariums.

Predators like *Conus geographus*, *Conus textile*, *Conus pennaceus*, and *Conus magus* were kept together in a pool without fish. Several *Conus imperialis*, *Conus miles*, and *Conus omaria* were kept together as well. All in all we had more than 50 cone snails now and it was very exciting to observe them undisturbed.

Surprisingly plenty of egg capsules in the aquarium!

Only three days later, we discovered the first eggs in our tanks and it was not just one *Conus* that had laid eggs, but nine! The first egg capsule was attached to the front glass of the aquarium by a *Conus mustelinus*. The eggs were near the top and surrounded by a constant flow of water. After four days, the single eggs became clearly visible, but one

***Conus geographus* cruises through its aquarium habitat.**

day later, the eggs were gone, which either meant they were taken by the current, or a brittle star got them.

Another *Conus mustelinus* carried an egg capsule on its shell for several days. It behaving passively and remaining under stones most of the time. A couple days later the egg capsule was lost. It was found later, ripped apart.

Over the course of two days yet another *Conus mustelinus* laid more than 30 egg capsules on the bottom of a stone plate, where they were in a constant flow of water. The *Conus* itself kept close to them. Finally, we could get a good view of the development of the eggs. Every day, the eggs grew larger, while we kept our cameras on them. The eggs within the capsule looked like they were threaded on a piece of string. Apparently, they did not touch each other and seemingly had just enough space to grow in every direction. We estimated around 1000 eggs per capsule!

After a few days, brittle stars started to threaten the eggs. We tried to collect all of them, but we did not entirely succeed. One egg capsule got destroyed, but then we had the chance to take a very close look at it through a microscope. It still contained plenty of larvae. They were moving and had visible eyes and the embryonic whorl. We managed to film what we saw under the microscope. Fortunately the other capsules remained intact and were constantly guarded by the *Conus mustelinus*.

Conus miles laid 15 egg capsules on a stone plate that covered the hole of two gobies, about 14 days after we brought the snails to Vienna. Was that on purpose? Did *Conus miles* know that the gobies created a small current around the eggs by leaving and entering their hole? The eggs developed nicely and we got a lot of wonderful pictures of the gobies who seemed like little guardians for the eggs.

Conus vexillum created a nest of 18 egg capsules at roughly the same time, but it was destroyed after a few days by a *Conus geographus*. It crawled repeatedly over the capsules and ripped the thin hulls apart. It looked like it went for the larvae, so we thought it was not only preying on

***Conus mustelinus* with eggs.**

other snails, but also on their larvae.

We were only able to view a female *Conus mustelinus* laying eggs and the much bigger male crawling over them to fertilise the eggs once. The process took several hours and took place underneath a large stone at the back of the aquarium, where unfortunately we could not film.

The larvae's development takes between seven and nine days from initial laying to hatching. Despite the snails having limited neurons for mental processing at their disposal, we noticed that the places they choose for their eggs were carefully selected. All of the sites had a constant flow of water - not too little, not too much, maybe just the perfect amount for ideal development. In our case the biggest threat to them were the brittle stars, but, as noted, *Conus geographus* destroyed at least one set of eggs as well. The hulls of the egg capsules are double layered, flexible, soft, and transparent. They are often attached to stones with their thinner end, the non-attached side is round.

Conus striatus makes a successful hunt on tape

Only after multiple attempts with different fish, we found the right kind of goby that animated *Conus striatus* to hunt. In front of our camera, it first placed a shot on the gill cover, the second shot hit the goby behind its head. The predator's stomach then enveloped the fish. The fish's desperate attempt to escape failed and he was sucked deeper into the cone shell. In less than a minute, the fish had decomposed to such an extent that it could be digested inside the narrow shell. After its successful hunt *Conus striatus* dug itself into the sand and did not move for several days.

Our *Conus bandanus* from the Maldives started to hunt only after we offered it snails of the family Nassaridae, which were from the Maldives as well. After two months without eating, the *Conus bandanus* hunted and preyed upon several of these snails.

***Conus striatus* hunts a goby on film.**

***Cypraea arabica* grazes across rocks and coral in one of the research tanks.**

The satisfaction of filming Cypraeidae!

During our nightly snorkelling tours, we also discovered many different Cypraeidae, such as *Cypraea tigris*, *Cypraea arabica*, *Cypraea carneola*, *Cypraea talpa*, *Cypraea scurra*, *Cypraea eglantina*, *Cypraea caputserpentis*, *Cypraea nebrites*, *Cypraea clandestina*, and *Cypraea nucleus*. We managed to film them in their biotope and were amazed by the beauty of the patterns of their shells and the delicacy of the papillae of their mantles.

Cypraea annulus produces offspring in our aquarium

We were incredibly lucky to witness and film the mating and subsequent egg laying of *Cypraea annulus* on the front glass pane of our research aquarium. The endeavours of the male to get the attention and win the favor of the female were intriguing to watch and 13 days after mating the female *Cypraea annulus* laid her egg capsules on the front glass of our research aquarium right in front of our eyes. The fascinating observations of breeding behavior - from the front row as it were - had never been filmed like this before.

Cypraea annulus brought the egg capsules close to each other in a circle on the smooth surface. In total there were 102 egg capsules. It was impossible to count the number of eggs per capsule, but we estimated there were between 300 and 400. On the sixth day, larvae were whirling around in all of the egg capsules. Using the microscope camera, embryonic whorls and eyes could be clearly seen. We observed how the brooding mother cleaned the egg capsules by gently lifting her foot, allowing water to flow between the egg capsules and out the other side.

On the 9th day there was the great event, the hatching of the *Cypraea annulus*. The female proceeded to bite open the skin of an egg capsule so the young could swim away. She would then eat the egg capsule membrane and bite open the next one. After all of the larvae were released into the open water, she removed all traces of her eggs by thoroughly cleaning the glass pane. The entire process (brood care) took nine days.

Prof. Wilfried Ilias, Department of Anesthesiology, Intensive Care and Pain Therapy at the teaching hospital of the Merciful Brothers Vienna, provided an insight into the modern uses of conotoxins.

Academic advice from top scientist

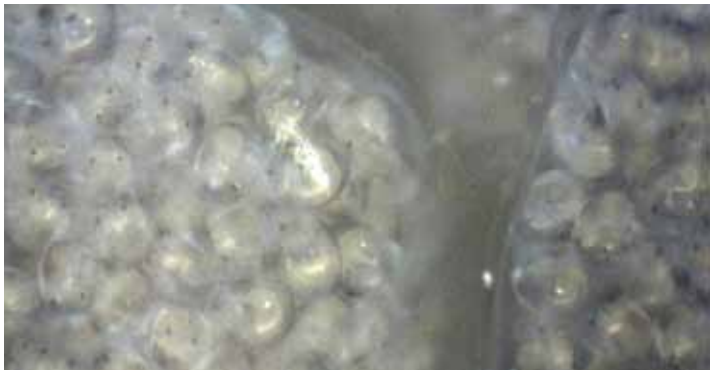
Scientific advice for the first feature-length snail film was provided by Prof. Wilfried Ilias. In an interview for the film he explains the effect of conotoxin on the prey organism.

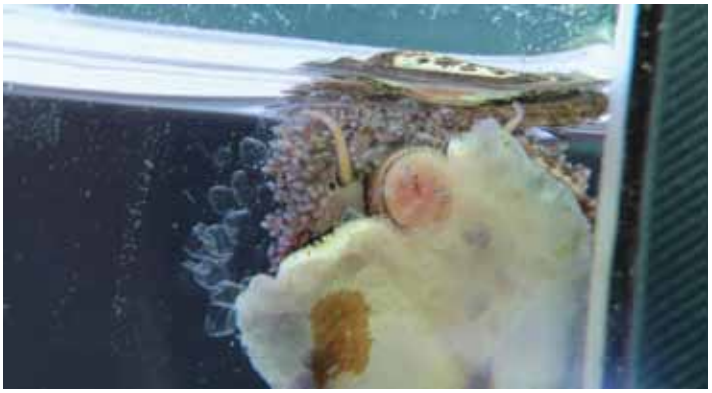
Various channel systems of muscle and nerve cells respond to the envenomation. First, the sodium channels are opened by one of the toxins. Then the victim goes into a shock-like spasmodic state, followed by paralysis of the muscles. Finally pain receptors are blocked so the victim can be consumed without feeling pain and struggling. The way they hunt, by approaching a victim with their radula extended and ready to fire, is so refined that you could almost imagine

***Cypraea annulus* mating in research tank.**

***Cypraea annulus* guarding egg cases.**

Above & below: magnified views of *Cypraea annulus* egg cases with hundreds of embryos in each egg case.





Cypraea annulus **chewing through egg case covers to release the hatchlings.**

they have a thought out a strategy. Given the simplicity of their brains, this is obviously impossible. Survival of cone snails is due in large part to their development of a variety of venom 'cocktails' giving them the ability to hunt and subdue a variety of prey animals. Their toxins are targeted precisely at the respective nervous systems of the animals they hunt.

Cone shells are dangerous hunters that produce their venom in order to kill their prey, but now in modern medicine some of the various components of cone toxins have been isolated and are used in pain relief therapy. One is the so-called ziconotide, an omega-conotoxin. It has been ascertained that cone snails contain a variety of toxins and that the toxins vary (even within a species) according to habitat and prey. If you add up the various types, altogether there are more than 200 different toxins. These affect different channel systems of muscles and nerve cells. Currently the most researched is *Conus magus*. Its venom consists of 52 different types of toxins or peptides.

I am excited about producing a film that documents our discoveries with various mollusks and I eagerly look forward to new adventures under the sea. Until then I offer what I hope is some insight into the fascinating world of our planet's oceans and look forward to providing new and maybe never before seen pictures of this world.

Visit us at our website **www.duino-film.com.**

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Lt. Col. Robert John Griffiths (9 Feb 1915 – 31 Oct 1986): the forgotten pioneer

Don Cram

In May 1962 Lt. Colonel Robert John Griffiths published a seminal review of the cypraeid genus *Notocypraea* in *Memoirs of the National Museum Melbourne*, which was to be the foundation and inspiration of my 45 year study of these enigmatic southern Australian cowries. In August 2012, I wrote an article in the *Victorian Branch Bulletin* of the *Malacological Society of Australasia* (VBB 265) on his mysterious disappearance after 1968, a summary of his life, his publications, and an appreciation of his ground breaking work that had been largely ignored by academics, shell dealers, and collectors. The article also detailed the search in 1994 to find out what happened to him by Hope Black (née Macpherson), Curator Emeritis, Museum Victoria (formally National Museum of Victoria) and Dr. Jira Zidak of Socorro, New Mexico, USA, who was reviving *The Cowry*, the journal created and edited by Griffiths between 1960 and 1967.

In November 2015, Frances Jolly (née Griffiths), who had been researching her father on line found VBB 265 and contacted me from England; the mystery of his disappearance was solved. Fran also has provided me with personal details of his extraordinary life, which she has kindly allowed me to use in this article.

Born Robert John Griffiths in England, in 1915, he attended Westminster School, a major private school in London and spent his final year of schooling in France, graduating with a French Baccalaureate. He graduated from Kings College, London University, with a degree in mathematics in 1936, and joined the British Army in the same year. During WWII he was involved with the design of a "single action Army weapon" i.e. a machine gun. After D-Day he went to France to work with captured German weapons and tanks, and wrote a very detailed diary about his experiences and observations. During the 50th anniversary celebrations of the end of the war, a part of this diary, together with comments by Fran and her mother, was televised on their local news bulletin.

After the war he spent time working in a number of specialist military establishments and made use of the LEO computer (Lyons Electronic Office I - first computer used for commercial business applications) to calculate trajectories of shells and also worked within the Applied Ballistics Dept of the army. He then went on to work with guided weapons and was in Australia for the firing of the "Black Knight" at Woomera [an early two and later three stage British rocket], in 1959 (among other duties).

Lt. Colonel Robert John Griffiths in Australia.

While posted to various locations after the war he became interested in cowries and published a small paper on Cypraeidae of Akaba, Jordan, in *The Journal of Conchology* (the organ of the Conchological Society of Great Britain and Ireland), of which he became a life member. From September 1953 to April 1954, while posted to British Malaya [Malaysia], he collected extensively on the Island of Penang, the neighboring mainland, and the small island of Pulau Bidan, and he published "*Cypraea* of north-west Malaya," in the same journal in 1956. By 1961 he had published another three articles in that Journal and two more in *Proceedings of the Malacological Society of London.*

Prior to his posting to Australia in 1958 (seconded to the Australian Army), he spent a large part of his embarkation leave putting in order the large cowry collection in the British Museum of Natural History (now NHMUK), which due to Great Britain being the leading maritime nation in the nineteenth century, has what many believe is the finest historical collection of shells in the world.

With his wife Audrey and daughter Frances, he arrived in Australia on the "Himalaya" in December 1957. On arrival in Melbourne he contacted Hope Macpherson, then curator of mollusks at Museum Victoria and began an intensive study of the genus *Notocypraea.* As part of the introduction he wrote, "The present review began with a conchological study. The limitations of this method soon became apparent and the approach was widened to include study of the radula." His interest in the living cowry animal was reflected in his earlier publications.

He collected at Flinders, Victoria, where on 3 February 1958, he found a specimen with a plain flesh coloured dorsum and described it as a new species - *Cypraea* (*Notocypraea*) *wilkinsi* sp.n., of which he illustrated, mounted, and figured the radula. The holotype radula and paratypes 4, 5, 6, and 7 are housed in Museum Victoria. Paratypes 2 & 3 are in the British Museum (which I have seen), paratype 1, a juvenile shell, appears to have been lost. He also collected at Port MacDonnell, visited and studied the collections of the Australian Museum (AM) (where he mounted the radulae of the holotypes of *N. emblema* and *N. dissecta*), the South Australian Museum (SAM) where he examined the type series of *N. euclia*, all now lost, but his radular mount of one specimen remains (Cram 2010), and the Western Australian Museum (WAM) leaving shells and radular mounts. He gained access to many live-taken deepwater specimens of uncertain taxonomic status, now no longer available due to dredging restrictions, leaving mounted radulae and shells in museum collections for future study.

After the family returned to England in January 1960, he retired from the army and moved to Cornwall, where the idea of a cowry journal was conceived. In December 1960 and April 1961, issues 1 and 2 of *The Cowry* were published and he would have been working on his review of *Notocypraea.* In September 1961, they bought Sea Acres, a nature park at Port Macquarie, New South Wales, and returned to Australia on the *Oriana*.

In February 1962, issue 3 of *The Cowry* was published followed by his review of the cypraeid genus *Notocypraea* on 1 May 1962. By August 1965, 8 issues of *The Cowry* had been published and the last appeared as an occasional magazine and, although not dated, was probably in 1968.

Sea Acres also housed his shell collection that was on display in glass cabinets and was sold in 1968 to Robert Harmer and his wife, who gave it to the National Wildlife Service in 1987. They did not want the shell collection and it was sold at auction later that year. Lance Moore purchased much of it for Lord McAlpine in Broome, who placed it in unsuitable storage, where it was ruined and its identity lost. Griffiths kept none of his shells; Fran has one only, a "snakes head cowry."

After Sea Acres was sold in August 1968, the family moved to Kalimna in Beechmont, Queensland, a five acre property laid with rhubarb and avocado trees, which they took to markets in Brisbane. Fran left home in 1974 for a holiday, fell in love with Europe and made it her home. Her parents moved to Nerang, in 1976, and as she describes it, "After they moved to Nerang in 1976, my father felt he preferred the cooler weather in the mountains and moved to Stanthorpe, Queensland. My parents were very close even though they lived apart. From Stanthorpe he moved to Toowoomba, and finally to Eagle Heights, to be near my mother. In 1986 my father developed bowel cancer and had an operation in October of that year, which was successful, but unfortunately this brought on a heart attack and he died on October 31st 1986. My mother stayed on in Nerang until 1993, when she decided to come back to England and live with myself and my husband. She died on the 23rd of February 2012."

Display case at Sea Acres, a nature park at Port Macquarie, New South Wales, Australia, purchased by Griffiths in 1961 and subsequently sold in 1968, along with the shell displays – now lost.

Why a pioneer ?

During his time at the British Museum in 1957, while sorting out the large cowry collection, he found Beddome's original specimens of *N. subcarnea* and *N. albata*, which had been purchased from shell dealers Fulton and Sowerby. He also discovered Gray's original specimen of *N. comptonii* and a specimen of *N. bicolor*, originally from the collection of Gaskoin. These were then incorporated in the type collection, two large trays that I was able to examine in 1980. There would be many other cowry types that he separated out. Fran still has the letter from the director of the museum thanking him for the valuable help given to the Zoology department by putting in order the large collection of cowry shells and devoting so much of his embarkation leave to the task.

The cowry magazine was a testament to his absorbing interest and enthusiasm in all Cypraeidae. Although the magazine carried articles by many prominent cowry special-

ists, such as F.A. Schilder, Cernohorsky, Donohue, William Old, and Dr. D.A Brand, Griffiths wrote a large proportion of the articles himself. He did not agree with the large number of genera, species, subspecies, and varieties being created on evidence that could not be substantiated. This view was vigorously debated when Schilder and Summers in 1963 described *Notocypraea casta*, the pure white form of *N. comptonii* from Port MacDonnell, as a new species in *The Cowry* 1(5): 65-66. This form and the intermediate had been incorrectly known as *albata* and *subcarnea* respectively. Griffiths (1962a) described in detail the type specimens, "The differences between the type specimens of *albata* and *subcarnea* is small and may prove to be one species and final opinion must be left until similar specimens are found with animals inside. One thing is for certain. Of the cowries labeled *albata* and *subcarnea* now being found in Victoria and South Australia, none I have seen belong to either of Beddome's varieties." This article was the trigger for introduction of the name *casta.*

Notocypraea taxonomy in Australia from the early 60's was influenced by the writings of Iredale and Cotton, neither had any interest in the living animal, (Hope Black, pers. comm.), and these views were reflected in Joyce Allan's 1956 *Cowries Shells of World Seas.* Griffiths in his review of this publication in 1957 stated, "Some interesting information is given about the breeding habits of *Cypraea*: considering however, the facilities available in Australia for study of the living animal, it is most disappointing that more is not made of this subject."

Although live specimens were difficult to find in most areas throughout their range, they were at the time abundant intertidally at Port MacDonnell, where variation in shell patterning was far in excess of typical specimens found elsewhere. This variation of shell patterns produced a collecting frenzy where specimens were sold or traded with names that were derived either by guesswork, opinion, or the views published by Iredale, Cotton, and Allan.

In his 1962 review, Griffiths published a detailed analysis of the shell morphology, habitat, and range of all known taxa, including examination of types, and made radular mounts simply unstained in Euparal. Other than drawings of the radulae of *N. declivis* and *N. pulicaria* by Albert Vayssière (1923), it was the first time any cowry specialist looked beyond shell morphology of *Notocypraea* in any detail with his rudimentary line drawings of the central teeth of the radulae of all five generally recognized valid species and five others whose taxonomic status was debatable. The review included for the first time animal descriptions of common species of *N. angustata, N. comptonii, N. piperita*, and his own species *N. wilkinsi.* It was clearly shown and backed up by radular mounts that the three most common and best known forms *N. angustata*, *N. comptonii*, and *N. piperita* were separate species, easily determined by central tooth structure.

The most significant discovery, was the major difference of the central tooth structure between the two most

Robert John Griffiths at Kalimna in Beechmont, Queensland, a five acre property he purchased after selling Sea Acres in 1968.

common species, *N. piperita* and *N. comptonii*. Although typical specimens can easily be separated conchologically, proper identification can be very difficult when the dorsum markings are unusual, indistinct, or absent (plain coloured or albino), and this difference could be easily seen by conventional light microscopy. This method clearly separated Griffiths 1959 *N. wilkinsi* as a form of *N. piperita,* and Schilder and Summers 1962 *N. casta* as an albino form of *N. comptonii.* What Griffiths did for the first time, using a sound taxonomic basis, gave a relatively simple method of diagnosing specimens that were atypical and puzzling as the radular form remained constant between typical and atypical shells, with preserved evidence that was unarguable. "This method of species determination, started in a small way by Griffiths, is importantly and uniquely applicable to *Notocypraea*, as radulae within other genera of Cypraeidae retain a similar form and in themselves are not useful in distinguishing to species level" (Cram 2011).

About 16 radular mounts embracing all his studies are preserved and have been available to researchers since 1959. In 1973, I repeated and confirmed his studies, republishing radular drawings of *N. angustata*, *N. comptonii, N. piperita* and *N. declivis*. Between 1973 and 1980, I made about 50 slides mounted in the same way and matched to shells, plus seven slides with shells donated to NHMUK. SEM images were done by Dr. Brian Smith of four species and one variety from shells I donated, and are located in the collections of Museum Victoria. This material and that of Griffiths available to researchers at the time, is preserved and is now of historical significance.

One would think that all this evidence would have changed the way study of a genus that paradoxically was in some areas relatively simple and in others extremely complex was viewed, but it had little to no effect...bordering on distain. Academics dazzled by the new SEM technology dismissed the research as outdated, although published differences could be easily seen by simple light microscopy and many collectors questioned the credibility of the author.

Dr.Burgess in *The Living Cowries* (1970) and *Cowries of the World* (1985: 36), in a two page ("Discussion on Southern Australian Cowries") calls the *Notocypraea*, "... without doubt conchologically the most confusing cowrie group." He then rejects the diagnostic use of the radula, stating that "Dr. Alison Kay who is experienced in microscopic dissection found only minor differences in the radulae of these cowries (personal communication)." Sadly, a series of radular mounts of typical and atypical specimens left by Griffiths and those of mine would have easily proved this research flawed. As the participants in this study were not able to collect in the field they had to rely on typical and atypical specimens, diagnosed by and sent by collectors.

Felix Lorenz (1993 & 2000) in his cowry books relied on shell morphology and did not reference Griffiths's work. There is little doubt that Bradner and Kay (1996) in *An Atlas of Cowry Radulae* used an atypical *N. comptonii* specimen to illustrate a *N. piperita* radula (Cram 2011). All of these authors incorrectly listed *N. wilkinsi* as a form of *N. comptonii*, which according to its radula, is a form of *N. piperita* that I had seen and noted in my 1973 article.

Confirmed specimens of *N. wilkinsi* had not been found at or around the type locality until March 1996, when, while dredging with Jack Austin, I obtained my first live specimen from 10-12 meters clearly identified by animal and radula. The second specimen collected at nearby Bear Gully by Simon Wilson was featured with its radula (Cram 2009). Since then about another five have been found by divers all identified in the same way. As there appear to be no intermediates it should now be regarded as an occasional mutant related to *N. piperita*.

It is now clear why Griffiths did not query these publications as he had retired from the scene and never kept any shells other than the one "snake's head cowry," which Fran still has. All his previous acquaintances lost contact, including the Conchological Society of Great Britain and Ireland. No one seemed able to find him.

There is no doubt that Griffiths (John or Griff to his friends) was a highly intelligent well educated man, with an inquiring mind and a brilliant mathematician. His statistical analysis table in his 1962 review of specimens of ten described species, the remnants of some that are still available, but many lost, is now of incalculable value. He was not a man who relied on opinion but was determined to get to the facts, having personally collected and observed in the field many of the specimens used in his studies. In Fran's own words, "He was a man to whom numbers meant everything, whether within the army sphere or little things such as probability problems or counting the number of wild strawberries he had just picked and writing to tell me about it! He could spend an evening throwing dice, recording the answer, and doing it again and again to test the bias of the dice. I still have his dice. My father was extremely meticulous in everything he did, but he also had the ability to cut himself completely away from something if it had upset or annoyed him." Maybe there is a clue in this last sentence as to why in 1968 he disposed of all his shells and went into quiet reflective retirement.

His last publication was an obituary to Dr. Franz Alfred Schilder who wrote many articles for *The Cowry.* He described him as a man with a magnificent eye for detail and a foremost author on Cypraeacea and in particular Cypraeidae for over 50 years, but due to the location of his home was unable to undertake field work and it was said that he only twice saw living cowries, which was a serious limitation. Although Schilder disagreed with many of the proposed genera and splitting of species, he wrote that Griffiths' system must be recognized as a starting point in the study of Cypraeidae.

Maybe this summary of Griffiths' life will serve as an example for budding researchers to not ignore basic research that disagrees with current published data, but to repeat and check as I did in early 1970. In the conclusion to the introduction of his 1962 review Griffiths wrote, "It only remains to emphasize that this paper is no more than a preliminary review of an extremely complex group. Study of new material which modern methods of collecting are now providing will inevitably change the picture in many respects. This further research will only be possible if every collector adopts a new point of view. He will have to realize that information on the animal – its habitat, appearance, structure, radula, and method of breeding – is even more important than collection of the shell. Until further knowledge of the animal is gained, little progress is likely."

How true has all this proved to be? The basic rules of scientific enquiry do not discriminate, but apply equally to amateur, student, and professional researchers. His publications, preserved shells and radular mounts of specimens, particularly from deep water in the Bass Strait and the south eastern coast, which other researchers have not seen or bothered to seek out, have been a foundation to my study of the genus for 45 years, resulting in many papers and finally now, a combined DNA project with a leading geneticist now in progress. John Griffiths is perhaps no longer a forgotten pioneer.

Acknowledgements:

I would like to thank Fran Jolly née Griffiths for contacting me and supplying personal details on her father, of whom she was very fond and allowing me to use these in this article.

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Don Cram

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***Clavatula diadema* (Kiener, 1839) 30mm, dredged by shrimp trawler at 50 meters, Gabon, W. Africa.**

Still more on turrids...

Bruce Neville

In my recent article on turrids (*American Conchologist* 44 (2): 4), I neglected to make reference to two important articles that laid the foundation for the current understanding of turrid and conoidean phylogeny. The article by Puillandre et al. lays out the familial arrangement in the penultimate paragraph of my article, while the article by Bouchet et al. arranges all the then-known genera by family. As expected, there have been changes to the familial placement of some genera. These changes can be tracked in the WoRMS database online. My sincerest apologies to the authors of these two landmark papers.

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2016 Shell Shows & Related Events (June – December)

- Following information is subject to change. Please verify with individual organization -

Jun. 12-16, 2016
Joint AMERICAN MALACOLOGICAL SOCIETY / WESTERN SOC. OF MALACOLOGISTS MEETING
Ensenada, Mexico
School of Marine Sciences, Univ. Autonoma de Baja California, Ensenada
Dr. Angel Valdes, Cal Poly University, Bldg. 4 Rm. 2, Pomona, CA 91768, USA
e-mail: aavaldes@cpp.edu Tel. (909) 869-3005

Jun. 18-19, 2016
GULF COAST SHELL SHOW, Panama City Beach, FL
Panama City Beach Senior Center, 423 Lyndell Lane
Jim Brunner, 2511 Parkwood Drive, Panama City, FL 32405
Email: jili@knology.net Tel. (850) 215-2086

Jul. 1-3, 2016
TOWNSVILLE SHELL SHOW, Townsville, Queensland, Australia
Orchid Society Hall in Kirwan
Jack Worsfold
Email: jnw_48@yahoo.com.au

Jul. 9-10, 2016
KEPPEL BAY SHELL SHOW, Yeppoon, Queensland, Australia
Gus Moore Pavilion at the Yeppoon Show Ground
Jean M. Offord, 277 McDougall St., N. Rockhampton, Qld. 4701, Australia Tel. 61 (7) 4928-3509

Jul. 27-31, 2016
CONCHOLOGISTS OF AMERICA ANNUAL CONVENTION, Chicago, IL
Crowne Plaza Chicago O'Hare Hotel, 5440 River Road, Rosemont, IL 60018
Katarina Frost
E-mail: 2016COA@gmail.com Tel. 847-458-7000
Website: www.conchologistsofamerica.org

Aug. 19-21, 2016
JERSEY CAPE SHELL SHOW, Stone Harbor, New Jersey
The Wetlands Institute, Stone Harbor, New Jersey
Sue Hobbs e-mail: suehobbs@verizon.net (609) 884-7601

Aug. 13, 2016
CHATSWORTH SHELL FAYRE, Derbyshire, UK
Cavendish Hall, Chatsworth Estate, Derbyshire
Brian Hammond, Sulwath, Dornockbrow
Dornock, Annan DG12 6SX, UK
E-mail: brianandedna@btinternet.com 44 146 170 1096

Aug. 26-Sept. 5, 2016
OREGON SHELL SHOW, Salem, OR
Or. St. Fair Gnds – Jackman-Long Bldg., 2330 17TH St. NE
John Mellott, 1310 Crowley Avenue SE, Salem, OR 97302
E-mail: retheresa@comcast.net Tel. (503) 363-5017

Sept. 17 & 18, 2016
NORTH CAROLINA SHELL SHOW, Wilmington, NC
Cape Fear Museum of History & Science
814 Market Street, Wilmington, NC 28401
John Timmerman, Show Chairman (910) 798-4368
E-mail: jtimmerman@nhcgov.com

Sept. 24-25, 2016
ANNUAL GERMAN SHELL FAIR, Oehringen, Germany
KULTURA Hall, Herrenwiesenstr. 12
Kurt Kreipl, Hoehenweg
D-74613 Oehringen-Cappel, Germany 61 (7941) 62-826
E-mail: meeresmuseum@t-online.de

Oct. 22, 2016
BRITISH SHELL COLLECTOR'S CLUB CONVENTION, Essex, England
Theydon Boys Community Centre, Theydon Boys, Epping, Essex
Debbie Rolfe, 15 Dene Holm Road, Northfleet, Kent DA11 8LF, U.K.
Email: Deborah@deborahrolfe.orangehome.co.uk

Oct. 22, 2016
SYDNEY SHELL SHOW, Sydney, Australia
Ryde Eastwood Leagues Club, 117 Ryedale Rd.
West Ryde, Sydney,.
Steve Dean, 166 Narabeen Pk Pde
Mona Vale, NSW 2103 Tel. 61 (2) 9979-5736
E-mail: steve@easy.com.au Cell: 61 (4) 1175 1185

Oct. 22-23, 2016
PHILADELPHIA SHELL SHOW, Philadelphia, PA
Academy of Natural Sciences, Parkway & 19th St.
Al Schilling, 419 Linden Ave., Glenside, PA 19038
E-mail: odtaa31@comcast.net Tel. (215) 886-5807

Oct. 15-16, 2016
XXI PRAGUE INTERNATIONAL SHELL SHOW, Prague, Czech Rep.
KULTURNIDUM LADVI Buresova 1661, Prague 8
Jaroslav Derka, Holeckova 51/370
15000 Praha 5, Czech Republic 42 (2) 5731 6246
Email: jderka@volny.cz
Web sites: http://www.cksl.cz

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Poser Shell Auction in Boston

Edward Nieburger

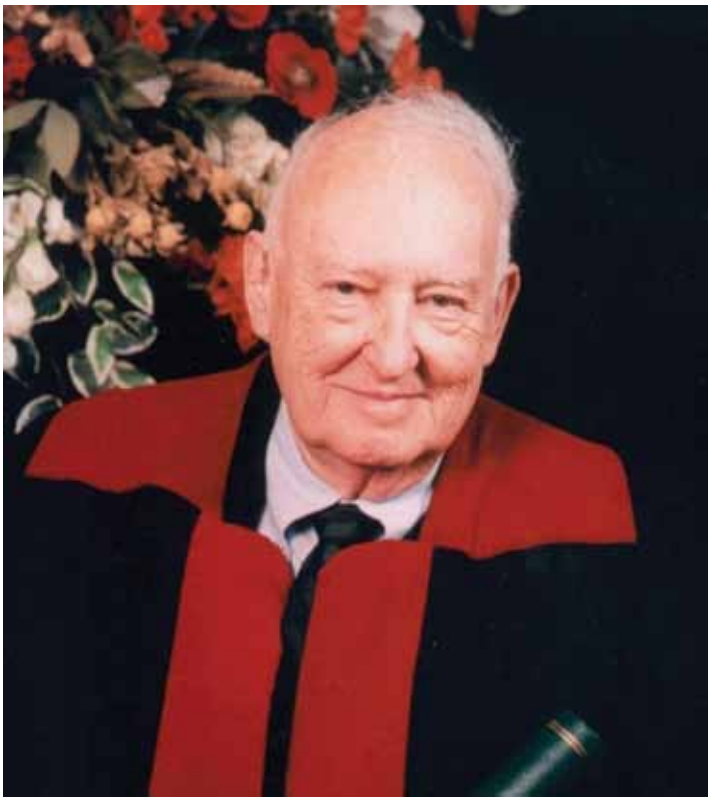
On the remarkably pleasant and snow-free Sunday afternoon of 28 February 2016, Boston area conchologists attended the "event of the decade." Members of the Boston Malacological Club were invited to participate in the auction of the late Dr. Charles M. Poser's seashell collection. The auction took place in Dr. Poser's home, an old "brownstone" in South Boston, in the shadow of Boston's Prudential Tower, a prestigious neighborhood, new to all who attended. Designed when horses and carriages existed, parking was at a premium along Rutland Square, South Boston.

Dr. Charles M. Poser (1923 - 2010) was an internationally renowned neurologist, specializing in multiple sclerosis (MS). In 1983, Dr. Poser published in the *Annals of Neurology* "a definitive system, refined from the criteria for measuring and describing MS." Known as the "Poser Criteria," it was quickly adopted worldwide as the standard tool for diagnosis of MS. He also authored several influential books and hundreds of scientific articles.

Dr. Poser was born in Antwerp, Belgium. His father, a naturalized American citizen, procured passage for his family, all Jewish, to sail from Antwerp to New York, on 12 May 1940. On 10 May, two days before they were to leave, Germany invaded Belgium and bombed Antwerp harbor. The family moved to the Belgian coast near Dunkirk, France, where Charles, then 16 with his Boy Scout First Aid merit badge, volunteered at the makeshift British military hospital on the Channel coast during the epic Anglo-French evacuation of forces to England -- May and June of 1940. Subsequently, the family was smuggled across occupied northern France to Paris, then to Bordeaux, where they were provided with Portuguese visas. They sailed from Lisbon to New York, in September of 1940.

Charles Poser graduated from George Washington High School in New York City in 1941. In 1943, he quit the City College of New York, and enlisted in the U.S. Army, whereupon he returned to Europe as part of a military intelligence unit. He was at Bastogne and the famed Battle of the Bulge in the winter of 1944. Later he was attached to the 3rd Army of George Patton and was present at the liberation of the Nazi concentration camp at Mauthausen, Austria, in May 1945.

Charles returned to New York City and the City College of New York after the war. In 1947, he graduated Phi Beta Kappa. He took his medical degree from Columbia College of Physicians and Surgeons of Columbia University in 1951. He won a Fulbright Scholarship in 1955, which allowed him to return to Belgium to study degenerative neurological diseases.



Dr. Charles M. Poser (1923 - 2010) upon his induction into the Royal Society of Medicine in Edinburgh.

While studying in New York City, Charles's sister, Eliane, introduced Charles to Joan Crawford. Joan graduated from Hunter College at age 20 and was similarly awarded Phi Beta Kappa. During their 60 years of marriage and during over 50 years of Charles's career, Joan edited his medical papers. He always maintained that she was his best editor.

Charles and Joan were legendary hosts for parties, with her skill in French and Chinese cuisine especially noted. In 1981, the couple moved to Boston. Among Charles's eclectic diversions, in addition to his massive collection of carefully catalogued seashells from around the world, was an extraordinary collection of international military medical insignia and badges, now at the National Museum of Health and Medicine at the Walter Reed Army Medical Center in Washington, D. C.

Doctor Poser's son and daughter-in-law kept a few shells as souvenirs, but they wanted the huge bulk of shells, the few shell books, and a dozen or so minerals and fossils, to go to the highest bidders. The members of the Boston Malacological Club were delighted with this opportunity. As can be seen in the pictures, the doctor seemed to have

specialized in pecten (particularly lion's paws), *Spondylus*, *Xenophora* carrier shells, limpets, razor clams, and oysters.

Dr. Poser traveled extensively in Japan, and purchased shells from dealers there with the initials AT, HT, and DZK. From his hand-printed, then hand-written, bound catalog, with 1,549 entries of marine shells purchased from circa 1950 through 1991, the following domestic dealers were coded by their initials in the catalog: Simon de Marco, Ft. Myers, Florida (SDM); Museum of Natural History (MNH); MacArthur's Shell Shop, New York City (McA); George Jeffreys, Brooklyn, New York (GEJ); Ormond McGill, California (McG); John Q. Burch, California (JQB); A. Gordon Melvin, Massachusetts (AGM); and unknown foreign dealers including CSI, who supplied Australian shells exclusively and RK, who supplied European shells exclusively. Additional unknown dealers had initials FSH (West Coast or Hawaii), FKH, NSS, FHK, FKH, VFS, CM (perhaps in Southern California), CFK, FSF, and EM (which could have been Elliot Michaelson of Newton Center, Massachusetts). As Dr. Poser traveled to all continents except Antarctica, thus some of these initials could be from dealers on any of those continents.

The auction, both oral and silent, was successful. Every shell was sold, although it took five hours to do so. The family furnished sandwiches, vegetable and cheese snacks, water, beer, and wine to make the experience very special. The son and daughter-in-law seemed quite satisfied with the result, and even offered their credit card app. on their phone so some could charge their purchases. Boxes and bubble wrap were also furnished. It was truly a surprise to us all, who had never known that such a serious shell collector was so near, but with whom we never made contact.

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One of Dr. Poser's shell cabinets with a variety of shells.

Another of the shell cabinets with lots of scallops, jackknife clams, and strombs.

And still another of the cabinets. This one has more scallops & strombs, plus abalones, murex, limpets, etc.

Some lion's paws, cones, and other shells in a cabinet.

Miscellaneous shells not in cabinets.

Some of Dr. Poser's colorful scallops on display.

More miscellaneous shells.

Scallops not in a display case.

Some rather nice fossil specimens.

Mid-Atlantic Malacologists Meeting – 2016

Elizabeth K. Shea and Timothy A. Pearce

The 2016 Mid-Atlantic Malacololgists

Back row from left: Zahra Mansur, Kevin E. Scriber II, Ken Hayes, Gary Rosenberg, Bart Tomascak, Colleen Winters, Matt Blaine, Vinnie Peters, Charlie Sturm, Bob Schmidt, Phil Fallon.

Middle Row: Dona Blaine, Lauren Sweeney, Kathy Schmidt, Nate Shoobs, Liz Shea, John Wolff, Francisco Borrero, Janice Voltzow.

Front Row: Beysun Örstan, Aydin Örstan, Rich Goldberg, Kacie Goldberg, Tim Pearce, Alex Kittle, Megan Paustian, Makiri Sei, Heather Brock, and Erika Iyengar.

Missing: Heather Kostick, Jeff Long, Larry and Takako Van Stone.

The 18th Mid-Atlantic Malacologists (MAM) meeting was held on 2 April 2016, at the Delaware Museum of Natural History, hosted by Elizabeth Shea and Alex Kittle. There were 33 people in attendance and 16 talks were given to a receptive and engaged audience. Thanks to all the participants for another fun and informative day!

Next year, MAM will be co-hosted by Ken Hayes (Howard University) and Ellen Strong (National Museum of Natural History) in Washington D.C. Stay tuned for more details as MAM goes on walkabout to our Nation's Capital!

Talks presented, arranged alphabetically:

F. Matthew Blaine, Curatorial Associate, DMNH**. Range extension of the invasive landsnail *Bulimulus sporadicus*.** A brief review of how a group of unusual snails found at Port Malabar, FL, were collected and identified.

Richard Goldberg, Worldwide Specimen Shells. **Observations of terrestrial mollusks at night in Jamaica.** Nighttime observations of annulariid and pleurodontid snails in Cockpit Country showed the unusual behavior of mucus dangling.

Erika Iyengar, Muhlenberg College. **Possible impacts of an invasive slug (*Arion rufus*) on San Juan Island, Washington.** Investigations of possible competition between an invasive slug and the native banana slug by assessing feeding preferences and the lack of impact of alterations by the invasive slug in nutrient cycling on grass growth.

Jeffrey Long, Partnership for the Delaware Estuary. **Freshwater Mussel Recovery Program and Volunteer Mussel Surveys.** An introduction to the citizen-science mussel survey and recovery programs run by the Partnership for the Delaware Estuary. Efforts to propagate and re-introduce mussels and monitor success have been ongoing since 2011.

Zahra Mansur, undergraduate student, Howard University. **Microsatellite analysis of apple snail egg clutches from Lake Sanu, Uruguay.** This paper described the genetic analysis of apple snail eggs to determine the frequency of multiple paternity.

Aydin Örstan, Research Associate, Carnegie Museum of Natural History. **Sizes and shapes: a database for pulmonate land snails.** Shell dimension for most shelled land snail genera analyzed to determine size and shape distributions and to recognize patterns.

Timothy A. Pearce & Chelsea Arnold, Carnegie Museum of Natural History. **Decline of *Anguispira alternata* in Pennsylvania, USA**. Fewer records of *Anguispira alternata* in recent decades suggest this formerly abundant land snail has declined. We demonstrated that the decline is real as opposed to insufficient search. The decline appears to have started about 1960. Of four hypotheses considered for the decline, the timing of rise in acid precipitation best matches the timing of the snail decline.

Winfried "Vinnie" S. Peters, Indiana/Purdue University Fort Wayne. **Olivid gastropods from the Central American West Coast.** This highly entertaining and informative movie clip of olivid gastropods hunting and consuming prey was originally produced for an exhibit at the Museu do Mar Rei Dom Carlos in Cascais, Portugal.

Kathy Schmidt, Simon's Rock College**. Shell Collecting in Vulcan's Shadow.** This talk highlighted ongoing collecting and research efforts on Montserrat, BWI, as part of the Field Biology summer program at Simon's Rock College.

Kevin E. Scriber, II, Howard University. **The trophic ecology of *Pomacea* spp. in the La Plata Basin of Uruguay.** This talk introduced the negative impacts of invasive apple snails, presented results on trophic position within the native range, and highlighted future work in Florida, China, and Hawaii.

Elizabeth K. Shea, Delaware Museum of Natural History. **AMS 2017**. This talk introduced the University of Delaware as the venue for the next AMS meeting in July 2017. Lodging options and possible symposium topics were discussed, a local organizing committee was solicited, and local volunteers were recruited to help develop social events.

Nate Shoobs, Undergraduate student, Simon's Rock College and Research Associate, DMNH. **Preliminary notes on the Lesser Antillean genera *Amphibulima* Lamarck, 1805 and *Pellicula* Fischer, 1856.** Presentation on the taxonomy, anatomy, distributions, and ecology of two rare and poorly known genera of terrestrial neotropical semi slugs.

Makiri Sei and Gary Rosenberg, Academy of Natural Sciences of Drexel University. **The Cockpit Country of Jamaica: a limestone forest of global importance.** This talk provided a description of the geology of the area and the landsnails that occur within.

Bart Tomascak. Discussion of subjective variance of mollusks. Description of yearly collecting activities on New England beaches and observations on difficulties inherent in learning how to identifying shells that may be worn, damaged, or otherwise imperfect exemplars.

Janice Voltzow, University of Scranton. **Why do shells have holes? So we can see inside!** Using an endoscope to look inside the mantle cavities of keyhole limpets and abalone shows that in contrast to how gills are traditionally illustrated, in the living animal the gills are large, inflated and fill the entire mantle cavity.

Colleen Winters, Towson University. **Return of the Snail: The tale of *Patera sargentiana***. The story of *Patera sargentiana* land snails that were raised in captivity, multiplied like crazy, and were released back into the location where they were originally collected.

In Memoriam:

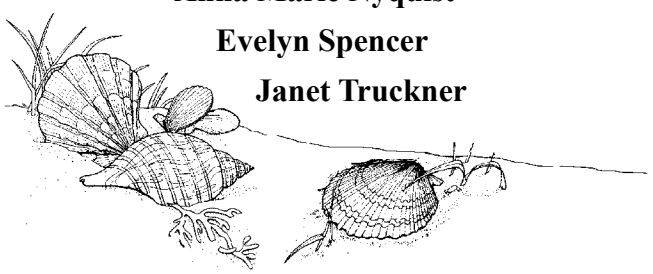
Cliff Harris

Patricia Humphrey

Anna Marie Nyquist

Evelyn Spencer

Janet Truckner



Studies of satiation in *Melibe leonina*

Colin A. Lee (photos by author except as noted)

As I swam through the kelp bed in Friday Harbor, I scanned each blade of algae fervently, searching for my quarry. With each empty frond I grew less and less hopeful, until at last, in the distance, I saw a blade surrounded by ghostly apparitions. As I drew closer, several of them detached from the kelp and swam off, bending slowly from head to tail. Others remained and continued to feed, sweeping their heads forward with contortive movements to pull microscopic prey from the water. In this moment I was struck by the bizarre yet wonderful nature of this species, the nudibranch *Melibe leonina*.

At first glance, few people recognize *Melibe* as a gastropod. It has a large, soft body, translucent skin, and a bulbous oral hood, traits more reminiscent of a jellyfish. Additionally, *Melibe* filter feeds, a strategy rarely seen in this taxon. Closer examination reveals its true heritage. *Melibe* has the muscular foot and anterior to posterior polarity of a gastropod, and more importantly moves in the deliberate and graceful manner of its relatives. As a result of its unique traits, *Melibe* has become popular among slug lovers, a fact that is readily apparent after a quick Google search of the name. Beneath these overt characteristics, though, *Melibe* is even more fascinating. With a simple brain and behavior, *Melibe* is an attractive model species for studies of neurobiology, and is being used to examine a variety of neurological phenomena. For the past several years I have studied these slugs to try to understand an emerging topic in neurobiology: the neural mechanisms of satiation. More specifically, I am trying to understand the way that the *Melibe* nervous system acts during a meal to reduce the motivation to feed. With luck, this research will further what we know about the way nervous systems control behavior.

The use of gastropods, including *Melibe*, in neuroscience is not new. Gastropod brains are many orders of magnitude smaller than our own (most nudibranchs have fewer than 10,000 neurons, as compared to an estimated 80 billion for humans), and are organized into visibly discrete aggregations of cells called ganglia (Kandel, 1979). The neurons are large and can be individually identified, both based on electrical output and function within a neural circuit (good luck individually identifying human neurons). Gastropods also perform fewer behaviors than do vertebrate models, which reduces the number of variables in a neurological investigation of their behavior. Consequently, it is possible to identify the neural circuits that produce a specific behavior. For more than 40 years scientists have done just that, uncovering the neural bases of discrete actions like swimming, crawling, and biting. Other aspects of behavior, however, have remained unclear. One area of behavior that remains poorly understood is the neural control of behavioral modification, meaning the way that nervous systems change motivational state.

***Melibe leonina* North Puget Sound, Anacortes, Washington, NOAA photo, Wikipedia.com.**

As a model topic of behavioral modification, scientists have turned to satiation, or a decrease in the responsiveness to food (Kupfermann, 1974). Why? Feeding motions are easy to count and animals respond consistently to food, which makes feeding experiments easy to run. Much has been learned from traditional model species: the pond snail *Lymnaea stagnalis* (Elliott and Benjamin, 1989) and the euthyneurans *Aplysia calfornica* (Kupfermann, 1974) and *Pleurobranchaea californica* (Croll *et al*., 1987), but there is still much to learn. These species will undoubtedly continue to yield more knowledge about satiation, but *Melibe leonina* may very well be the ideal species in which to study this topic.

The excellent fit of *Melibe leonina* starts with the part of the nervous system that controls the mouth: the paired buccal ganglia. Most gastropods use the mouth to bite, chew, and swallow: complex motions controlled by many neurons. *Melibe*, as filter feeders, do not bite or chew, and consequently do not need many neurons to control the mouth; each ganglion has only 30-40 neurons, as compared to the buccal ganglia of *Aplysia californica*, which each have an estimated 840 neurons. There are also only four nerves that project from each ganglion, which means that there are

Figure 1: a side view of *Melibe leonina*. This animal was in the middle of opening its oral hood to capture brine shrimp (the numerous small white specks surrounding *Melibe leonina*). The tentacles lining the oral hood are used to create negative pressure that draws water into the hood. Common names for *Melibe leonina* include: "hooded nudibranch," "lion's mane nudibranch," or "lion's mane sea slug."

not many ways in which information about feeding can travel to the rest of the brain. This simplicity extends to the rest of the nervous system, as *Melibe* have far fewer ganglia in total than other species.

The unique morphology and behavior of *Melibe leonina* also contribute to its tractability as a model species. The semi-transparent skin, which creates such a unique appearance, also allows one to see the stomach without cutting the animal open. The feeding motions, wide, sweeping movements of the oral hood that draw in prey organisms, are impossible to miss and easy to quantify (Watson and Trimarchi, 1992).

My investigation of satiation proceeded in three steps. First, I attempted to determine if *Melibe* satiates in the first place. After this, I attempted to identify the stimuli that cause satiation, and, armed with that knowledge, sought to characterize how these stimuli influence the nervous system's activity.

That *Melibe* satiates may seem like a foregone conclusion, however, one study has suggested that *Melibe* will eat almost non-stop as long as food is available (Schivell *et al.*, 1997), which would mean it does not satiate. To determine if this is truly the case, I performed an experiment in which I gave brine shrimp (*Artemia* sp.) to *Melibe* and allowed them to eat *ad libitum*. The animals responded immediately to the food, and ate very rapidly for an hour. After this point, they began to eat more slowly and their feeding rate tapered off over the next five hours. Finally, six hours after they had first begun to feed, the subjects stopped entirely. Although the animals fed for a long time, they did stop, showing that they do indeed satiate. With this result, I could now move on to my other questions.

Research in a number of other species has shown that satiation correlates with an increase in stomach volume, so I attempted to see if this happens in *Melibe* as well. I filled the stomachs of several *Melibe* with gelatin to mimic the distention that occurs after a meal and, after they had recovered, fed them. Many of these animals showed no interest in eating, and those that did ate more slowly and for less time than animals with empty stomachs (these animals had been handled in the same manner as those with filled stomachs, but I didn't put any gelatin into them). This was pretty strong evidence that stomach distention decreases the motivation to feed, but I wanted to get a more fine-scale view of how the two factors interact. To do this, I performed an experiment in which I fed several animals and measured their stomach volume every 30-60 minutes. Initially, they ate very quickly, with stomach volume increasing steadily,

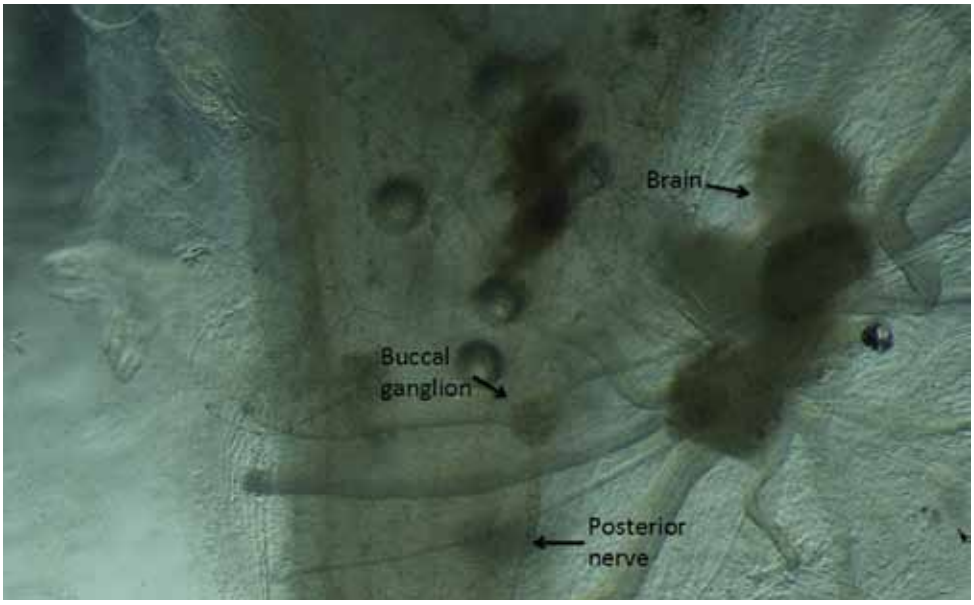


Figure 2: the *Melibe* brain and buccal ganglion. Both structures lie directly on the esophagus (the yellowish shape behind them). The buccal ganglion connects to the brain via a single nerve; another nerve, the posterior nerve, emanates from the ganglion and runs along the esophagus and stomach.

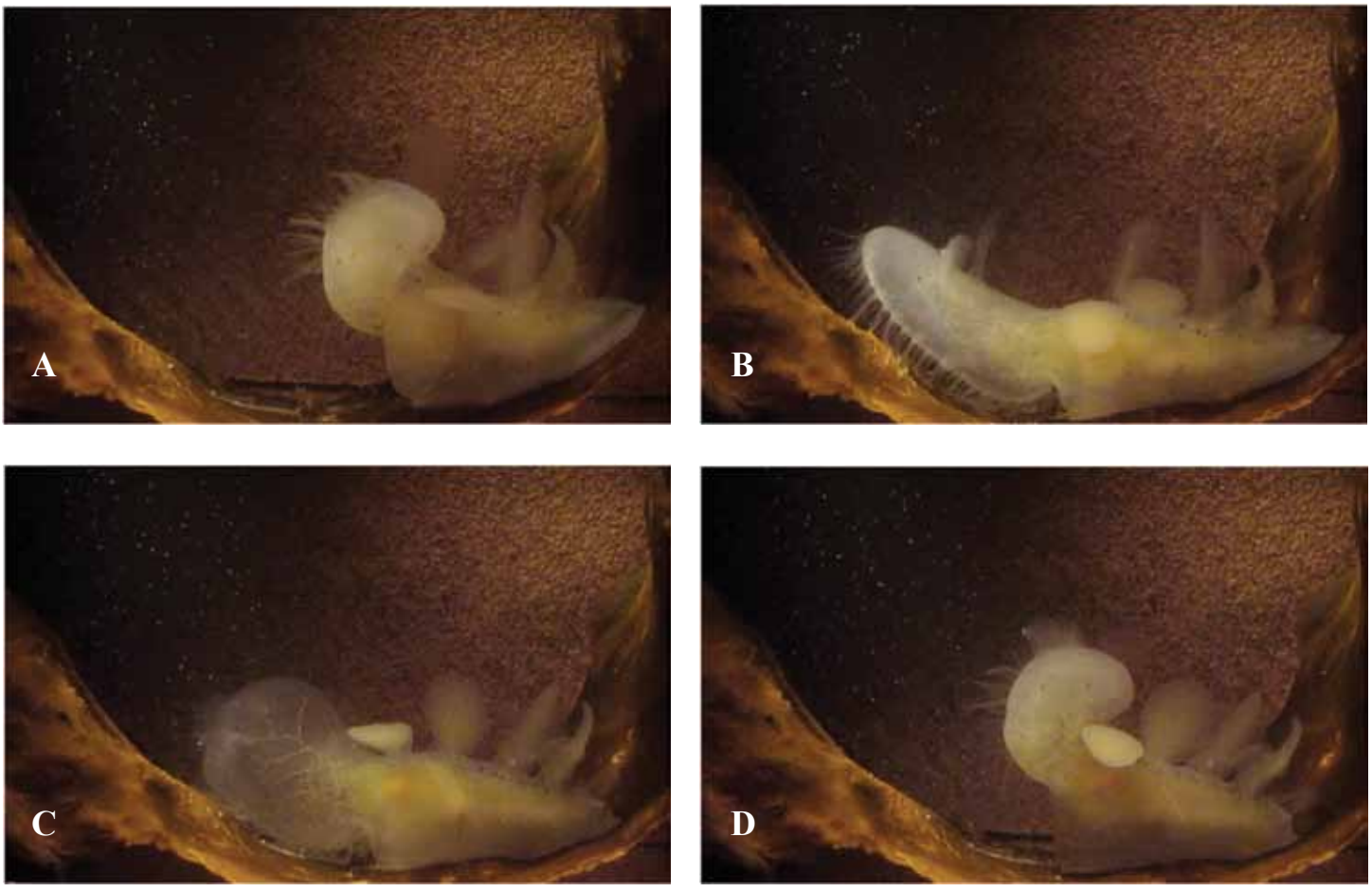


Figure 3: the different phases of a *Melibe* feeding motion. A) The animal begins with its oral hood held closed and upright. B) Casting, oral hood comes forward and creates negative pressure to suck water in. C) Closure, hood comes together and tentacles interdigiate to form a sieve. D) Tilt and squeeze, water is forced out through the sieve and the food swallowed. There is a short video of *Melibe leonina* feeding at: https://www.youtube.com/watch?v=bNXDCkRfA8E

Another view of the enigmatic *Melibe leonina.* This specimen was photographed off Santa Cruz, California, by Robin Agarwal, and is shown on Wikipedia Commons.

but after the stomach had reached about half of its maximum volume, feeding rate slowed down. They continued to feed and the stomach continued to fill for several hours after, but rate of change continually slowed down. These results show pretty clearly that stomach distention inhibits the motivation to feed, and that the degree of inhibition relates to the degree of distention.

My final goal was to determine how this information actually travels to the brain. There is a pair of nerves that run along the stomach and esophagus, the posterior nerves, and these connect to the two buccal ganglia (which, remember, control biting in other species). As such, it seemed likely that the posterior nerves communicate stomach distention. To test this hypothesis, I performed a feeding experiment in which I fed animals whose posterior nerves had been lesioned, comparing their feeding to that of control animals. Both groups ate similarly for the first hour, but while the regular ones slowed down at this point, the lesioned ones kept on eating at a pretty fast rate. Ultimately, the lesioned ones ate longer, and post-meal dissections revealed that they consumed more brine shrimp as well. This result clearly suggested that the posterior nerves convey stomach distention; without the nerves *Melibe* eats longer and consumes more.

To really make the case for the posterior nerves' role in satiation, I needed to dig beyond the behavioral studies, and into the physiology of the nerve itself. To do this, I recorded the electrical activity of the posterior nerve while mimicking the distention that occurs during a meal, creating distention by inflating the stomach with water. The posterior nerve increased its signaling (the number of action potentials it sent) when the stomach was distended and there was a correlation between level of distention and how much the signaling increased. When the stomach was partially distended the firing rate picked up and when the stomach was completely distended the rate increased even more. These data were really exciting to see and unequivocally demonstrated that the posterior nerve responds to stomach distention.

With these experiments complete, I can now answer the questions I originally asked; *Melibe* does satiate, it satiates due to stomach distention, and stomach distention is conveyed by the posterior nerves, which run along the stomach and esophagus. With these questions out of the way, we can now attack the more subtle aspects of satiation in both *Melibe* and animals in general. For example, how does posterior nerve signaling affect what goes on in the buccal ganglion? The journey will do a lot to help uncover the neural basis of behavioral modification, but along the way we will undoubtedly learn more about *Melibe* as a species, and hopefully gain an even deeper appreciation of this majestic slug.

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Carychium cognomen conundrum continues to confound conchologists; culture confirms

Lori Schroeder (photos by the author)

In the course of prematurely terminating a snail-trapping campaign in the style, and on the heels, of the Kochi Hill, Kentucky, study (Lee and Schroeder 2012), I scrupulously searched traps for living specimens. A single *Zonitoides arboreus* (Say, 1817), the quick gloss, was found and placed in a terrarium along with a small piece of bark as "habitat."

Shortly afterward, while observing the quick gloss under microscopic enhancement, I noted a tiny *Carychium* sp. in a bead of condensed humidity. Thinking the snail had drowned, I placed the specimen on the bark for photography. After a few days the specimen seemed to have disappeared. Less than a week later, tiny juvenile *Carychium* sp. were observed crawling in and around minute crevices in the bark. Wanting an identification for the adult and juveniles, I began a search of easily obtainable literature to clarify the matter. Such elucidation has proven elusive.

An adult *Carychium* crawling on a piece of bark. The *Zonitoides* and *Carychium* cohabited without incident for several months. Also pictured on the Jacksonville website maintained by William Frank at: <http://www.jaxshells.org/175b.htm>.

One of five extant subfamilies in the family Ellobiidae, the Carychiinae is composed of land snails averaging approximately 1.75 mm in length. Taxonomic placement was within the order Basommatophora (now considered a non-monophylogentic "informal group" by Bouchet & Rocroi (2005)) and reflected, among other characters, in the location of the eyes (on the head posterior to the tentacles). Many of the world's freshwater "pulmonates" are also placed in this group. Land pulmonates with retractable eye stalks are placed in the clade Stylommatophora, and this latter group predominates in my neck of the woods. Their small stature aside, variability of shell morphology makes the species of Carychium quite difficult to diagnose. This situation poses a problem for even the most seasoned land snailer.

While attempting to research *Carychium* systematics, I encountered a lack of consensus as to the valid species occurring in the northeastern North American fauna. An example, in order of publication, of incongruent treatment follows. The list is by no means complete and biased by geographic relevance or accessibility: Pilsbry (1948) includes six species and two sub-species; Burch (1962) lists four species, interestingly omitting *C. exile*; Branson (1973) includes three species, and again, *C. exile* is excluded; Burch and Van Devender (1980) proffer the most compelling evidence for eight species; Hubricht (1985) closely follows Burch and Van Devender (1980); Branson and Batch (1988) include three species of *Carychium* and indicate that they follow Burch and Van Devender; Dourson [2010] discusses six species. See Table 1.

As stated earlier, Burch (1962), Branson (1973), and Branson and Batch (1988) excluded *C. exile.* The latter two references are geographically limited to Kentucky,

which was, naturally, of special relevance to my quest. The most recent entry (Dourson, [2010]) records *C. exile* as, "The most common *Carychium* in the state." I would like to note that Branson (1973: 32) seems to have little faith in the distinctions among *C. exiguum*, *C. clappi*, and *C. exile*, made by others (and likely himself) in the "Annotated List." Burch and Van Devender (1980: 62) note Branson and name other authors who "have not treated *C. exile*, *C. exile canadense* as being distinct forms from *C. exiguum.*" Branson (1973) cited Hubricht (1963), "*Carychium exile* and *Carychium exiguum*" in his references, but he does not seem to follow the author, who states he has found the two species living together and could always separate them. *Carychium exiguum* is a more northern species reaching no further south than the Ohio River flood-plain. *Carychium exile* extends much further south (Hubricht, 1985). *Carychium exiguum* has a smoother and more obese shell than *C. exile*. The best distinguishing character, according to Hubricht (1963), is the outer lip. In *C. exiguum* it is expanded, but in *C. exile* it is narrowly reflected. Hubricht further states this difference is constant and stands up when other characters fail. Branson (1973: 32) leaves little by way of explanation in his discordant discussion.

In Nekola and Barthel (2002), a statistical analysis of *C. exile* and *C. exiguum* in the Great Lakes region, demonstrates through the use of histograms, canonical discriminant analysis, scatterplots, measurements of shell height and width, smooth versus striate shells, and images, that the two species are separate and distinct. That is a tremendous amount of work for a < 2.0 mm land snail, and not easily applied. They attribute the confusion between the two, in part, to variable shell striations over shell dimensions and latitudinal variations occurring in northern and southern populations.

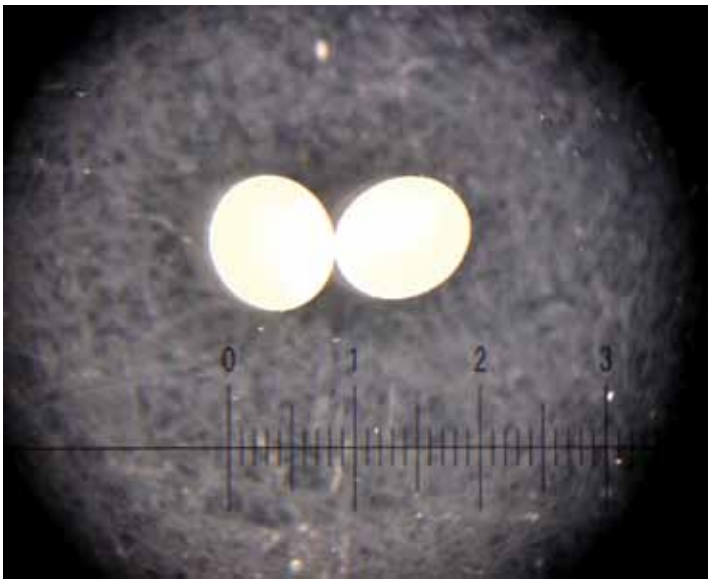
Most recently, Weigand, Jochum, and Klussmann-Kolb (2014) undertook a comprehensive morphological and molecular genetic study which revealed considerable conchological variability within species. Their results call into question traditional morphospecies concepts applied to *Carychium* by previous workers [including me and the various authorities discussed above].

Table 1.

***Carychium* species**	**Pilsbry**	**Burch**	**Branson**	**Burch and Van Devender**	**Hubricht**	**Branson and Batch**	**Dourson**
exiguum	**X**	**X**	**X**	**X**	**X**	**X**	**X**
stygium	**X**	**X**	**X**	**X**	**X**		**X**
nannodes	**X**	**X**	**X**	**X**	**X**	**X**	**X**
floridanum	**X**	**X**					
exile	**X**			**X**	**X**		**X**
exile canadense	**X**			**X**	**X**		
exile mexicanum	**X**			**X**	**X**		
occidentale	**X**						
clappi				**X**	**X**	**X**	**X**
riparium				**X**	**X**		**X**

Without getting into another dimension of *Carychium* taxonomy, the internal lamellae (Pilsbry, 1948, etc.), and considering the volume of literature cited, my attempting to parse my *Carychium* by species is an overreach. Nonetheless, I now return to the *Carychium* culture.

Discussions with Dr. Harry Lee and William Frank, Jacksonville, FL, were exchanged regarding the objects in the photo. The consensus was that the spherical object on the left was a newly deposited ovum. The rest was fungus or some other unidentified growth.



***Carychium* ova measuring approximately 1.0 mm each.**

This baby *Carychium* is less than 1.0 mm. The tiny black spots on the head in between the tentacles are the snail's eye spots.

Above is a newly hatched baby. The specimen on the right is roughly a couple weeks old. The juveniles would disappear into either end of the bark and remain hidden from view for days or weeks. The yellow hued area near the shell's apex is the liver.

On 10 January, 2014 two fully matured *Carychium* snails were observed. The sessile eyes are located at the base of the tentacles towards the shell. Both individuals were hatched from eggs laid by a single adult specimen in July 2013. Notice the snail in the left image has a one whorl size advantage. Due to both the minute stature and shell morphology, identification can be quite challenging with this genus.

This exercise in gastropod husbandry was revealing and taught me a lot about terrestrial malacology. First and foremost, land snails are resilient. Given a suitable habitat with proper humidity, *Carychium* can tolerate living in captivity with little human assistance. Down to the youngest juvenile, all the snails exhibited a marked photophobia, a condition that limited access to the snails for observation and photography. Mortality was a certain 100% if individuals crawled away from their tree bark habitat. An unexpected by-product of the work was the demonstration that observed shell variability, even within what seems to be a single-parent clutch, appears to be confirmed by state-of-the-art molecular taxonomy.

Acknowledgments:

I am grateful to Harry Lee for his expertise and persistent guidance to remain on scientific point. For his beneficent sharing of his vast knowledge of scientific method with this citizen scientist, and for editing and counsel through numerous morphological revisions. Jeffrey Schroeder for escarpment belaying, snail trap retention design, and photo editing. William Frank for creating, updating, and maintaining the Kentucky Land Snail Gallery at <http://www.jaxshells.org/kentmain.htm>.

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The 2016 St. Petersburg Shell Club Shell Show

Cheryl Jacobs holds her Conchologists of America Award for her winning display of 'A Study of Tiger Cowries."

Earl & Carolyn Petrikin won the DuPont Award, the Selma "Sammy" Lawson Award, and the People's Choice Award for their display titled 'Colors of Worldwide Molluscs.'

Some of the 2016 winners...

- Conchologists of America Award: 'A Study of Tiger Cowries' – Cheryl Jacobs
- DuPont Award: 'Colors of Worldwide Molluscs' – Earl & Carolyn Petrikin (also People's Choice Trophy)
- Florida Museum of Natural History Award: 'Introduction to the Elongated Cockle' – Martin Tremor, Jr.
- Shell of the Show: *Amoria grayi kawamurai* Habe, 1975 – Jim Cordy
- Shell of the Show (self-collected): *Murexsul zylmanae* (Petuch, 1993) – Jim Cordy
- Selma "Sammy" Lawson Award: 'Colors of Worldwide Molluscs' – Earl & Carolyn Petrikin
- Best Scientific Exhibit (less than 10 feet): 'I'm older than you' – Alan Gettleman
- Alice Monroe Educational Award: 'Etymology of Cone Shells' – Harry Berryman
- Judge's Special Scientific Award: 'Alum Bluff Group' – Ron Bopp & Spiney Species of the Genus *Hysteroconcha* – Alan Gettleman
- Judge's Special Artistic Awards: 'Pictures' – Caryl Renz & 'Priscilla' – Caryl Renz
- Single Specimen (self-collected): 1st, *Murexsul zylmanae* – Jim Cordy; 2nd *Perna viridis* (Linnaeus, 1758) – Carolyn Petrikin

Martin Tremor, Jr., with the Florida Museum of Natural History Award for his display titled 'Introduction to the Elongated Cockle.'

- Single Specimen Worldwide: 1st *Amoria grayi kawamurai* – Jim Cordy
- Educational: 1st ' Etymology of Cone Shells' – Harry Berryman; 2nd 'I'm older than you' – Alan Gettleman
- Fossils: 'Alum Bluff Group' – Ron Bopp
- Land & Freshwater: 'Unique Land Snail' – Alan Gettleman

The 2016 Sanibel Shell Show

Joyce & Ken Matthys, King City, Oregon, with their Conchologists of America Award. They also won a Judge's Special Ribbon for "Sea Butterflies."

Greg Curry, Sr., Key West, Florida, with his DuPont Trophy. He also won the Most Outstanding Entry – Eugene & Evelyn Spencer Award, Best South Pacific Shell – Shell of the Show – Any source, and a Judge's Special Ribbon.

The 2016 Sanibel Shell Show featured 90 scientific exhibits and 216 artistic exhibits. The exhibitors came from 16 states and three foreign countries (Canada, Japan and Barbados). The states included California, Colorado, Connecticut, Florida, Illinois, Indiana, Maine, Maryland, Minnesota, New York, North Dakota, New Hampshire, Oregon, Pennsylvania, Texas, and Wisconsin. Some of the winners were:

- DuPont Trophy, Most Outstanding Entry – Greg Curry, Sr., Key West
- Conchologists of America Award, Entry That Best Furthers Interest in Shells & Shell Collecting - Ken & Joyce Matthys, King City, OR
- Best Sanibel/Captiva Shells, Self-collected – Bruce Schulz, Fort Myers/Eugene, OR
- Best Florida/Caribbean Shells, Any source – Amy Tripp, Marco Island/Westport, MA
- Howard Sexauer Award, Best Worldwide Shells, Any source – Pat & Bob Linn, Dunedin
- Marilyn Northrop Award, Best Self-collected Single Shell - Amy Tripp, Marco Island/Westport, MA
- Eugene & Evelyn Spencer Award, Best South Pacific Shell - Greg Curry, Sr., Key West
- Shell of Show, Any source - Greg Curry, Sr., Key West
- Shell of Show, Fossil – Sammy Miller, Marco Island
- Elsie Malone Award, Best Student Exhibit - Marissa Linn, Indianapolis, IN
- Best of the Blues – Irene Longley, St. James City

Anne Joffe with the Anne Joffe Sanibel Superstar Award, named in her honor when she retired from actively working on the Sanibel Shell Show Committee. She also won the "People's Choice Award."

- Anne Joffe Superstar Award – Anne Joffe, Sanibel
- Judge's Special Ribbons
- Greg Curry, Sr., Key West
- Ken & Joyce Matthys, King City, OR

The 2016 Sarasota Shell Show

Pat and Bob Linn win the DuPont Award and Most Beautiful Scientific Exhibit with their dispaly, "The Helmetted Bonnets of the World."

David Ervin wins the Young Scientist Award for his display, "Fossiling in the U.S.A."

Ron Bopp accepts the Hertweck Best Fossil Exhibit from Sally Peppitoni for his exhibit, "Fossil Mollusks of the Tamiami Formation."

Greg Curry Sr. accepts the Mote Gold Trophy from Sally Peppitoni for his display on *Amoria*.

Some of the 2016 winners...

- COA – "Introduction to Elongated Cockles" by Martin Tremor and Conrad Forler
- Mote Gold – *Amoria* by Greg Curry Sr.
- Morrison Young Scientist – "Fossiling in the USA" by David Ervin
- Hertweck Best Fossil Exhibit – "Fossil Mollusks of the Tamiami Formation" by Ron Bopp
- Best Small Scientific Exhibit – "ID Guide to Microshells" by Duane Kauffman
- Sarasota Shell Club Member's Award – "Etymology of Cone Shells" by Harry Berryman
- Best Self Collected Exhibit – "Miniatures of Siesta Key" by Duane Kauffman
- Most Beautiful Scientific Exhibit – "The Helmeted Bonnets of the World" By Pat and Bob Linn
- Judge's Special Merit – "Giant Limpets" by John Jacobs
- Judge's Special Merit – "Caecidae" by Duane Kauffman
- Shell of Show – *Tenebrincola cukri* by Greg Curry
- Self Collected Shell of Show – *Scaphella junonia* by Pay Linn
- Fossil Shell of Show – *Extractrix* by Linda Ervin

The 2016 Marco Island Shell Show

Amy Tripp wins the Conchologists of America Award for Florida/Caribbean Self-collected Shells (below).

Some of the winning displays:

- The DuPont Trophy - Phil Miller
- Conchologists of America Award - Amy Tripp
- USF Best World Wide Single Shell Any Source - Greg Curry, Sr
- Top Novice Scientific Trophy - Karen Ackerman
- Best Miniature Shell(s) Trophy (any source) - Amy Tripp

Greg Curry, Sr. won a blue ribbon and the Doctor William Reid Plaque for this amzing (six case) display of *Amoria*.

Phil Miller won the DuPont Award and the Outstanding Self-collected Marco Island Shell Collection.

- Outstanding Self-collected Marco Island Shell Collection - Phil Miller
- FGCU Best Marco Island Single Shell Self-collected - Bill Tripp
- FGCU Natural History Photographic Award - Amy Tripp
- FORB Best Florida/Caribbean Shell Self-collected - Sammy Miller
- Two Judges Merit Ribbons - Amy Tripp & Greg Curry, Sr.
- People's Choice Award (scientific) - Marge Tunnell

COA CONVENTION 2016

CHICAGO!

The Chicago Shell Club is anxiously waiting to greet you to Shellebrate Chicago. We have a great shellebration planned for you. We will start off with our pre-convention field trips. They are filling up fast, so don't miss out. For complete information about the field trips, go to www.conchologistsofamerica.org.

Cloud Gate also known as "The Bean" in Millennium Park, Chicago, IL

You can also venture out on your own. Chicago has much to offer from shopping to wonderful museums. The Chicago Outlet Mall is just outside from the hotel, so you can visit any time. The Magnificent Mile is just a short train ride away. The Art Institue, Adler Planetarium, Chicago History Museum, Buckingham Fountain, Willis Tower, Millennium Park with "The Bean," Historic Water Tower, and Hancock Observatory are only a few of the many things to see in Chicago. Why not catch a Cubs baseball game while you are here. They are in town that week.

China's First Emperor and his Terracotta Warriors (right) will be on exhibit at the Field Museum of Natural History this summer. Why not take time when you are here for the 2016 COA to see this fabulous exhibit.

The first day of the 2016 COA Convention will include our Welcome Party being held under ***Lucy*** at the Field Museum of Natural History. This will be an exciting event. This year's theme is "shell attire". So pull out those shirts and dresses with shells to show them off! Ladies, we hope to see some of your fabulous shell jewelry. The Welcome Party includes a buffet dinner, open bar and time to wander through a few of the exhibits open especially for us.

Those who go on the Field Museum Field Trip on Monday, July 25th will have the opportunity to tour the Field Museum exhibits after the tour, and can purchase reduced price tickets to see the Terra Cotta Soldiers exhibit . If you want to do this you must contact Jochen Gerber at jgerber@fieldmuseum.org.

We will have some new speakers this year. Please take time to attend the many informative sessions. Our program schedule is shaping up. The **tentative** schedule will be:

COA 2016 July 27-31, 2016

Monday, July 25 –

9:00am-2:00pm field trip: Field Museum of Natural History

2:00pm-7:00pm field trip: John G. Shedd Aquarium

(You can do both of these field trips in one trip, the Museums are across the street from each other)

Tuesday, July 26 –

9:00am–2:00pm field trips: Museum of Science and Industry or Lincoln Park Zoo

1:00pm-5:00pm: Registration at hotel

2:00pm-6:00pm field trip: Architectural Boat Tour

5:00pm-10:00pm field trip: Dinner Cruise, Lake Michigan

(You can do the morning and afternoon field trips without returning to the hotel)

Wednesday, July 27–

8:00am-10:00am: Registration

10:00am: Opening Ceremonies followed by talks (time for lunch included)

1:00pm: Silent Auction begins

6:00pm: Board bus for Welcome Party at the Field Museum of Natural History

7:00pm-10:00pm: Welcome Party

Thursday, July 28 -

7:30am-8:45am: Club tables

8:00am: 2nd Silent Auction begins

9:00am-4:00pm: Presentations with break for lunch

2:00pm: 3rd Silent Auction begins

7:00pm: Oral Auction (preview at 6:30pm)

Friday, July 29 –

8:00am: 4th Silent Auction begins

9:00am-3:30pm: Presentations with break for lunch. End with COA Annual Meeting

2:00pm: 5th Silent Auction begins

6:00pm-10:00pm: Banquet

Saturday, July 30 -

7:30am-12:30pm: Bourse set-up

8:00am-9:45am: Club Rep breakfast meeting

1:00pm-8:00pm: Bourse

Sunday, July 31 –

9:00am-2:00pm: Bourse

Monday & Tuesday, August 1-2 -

Post-convention Field Trip

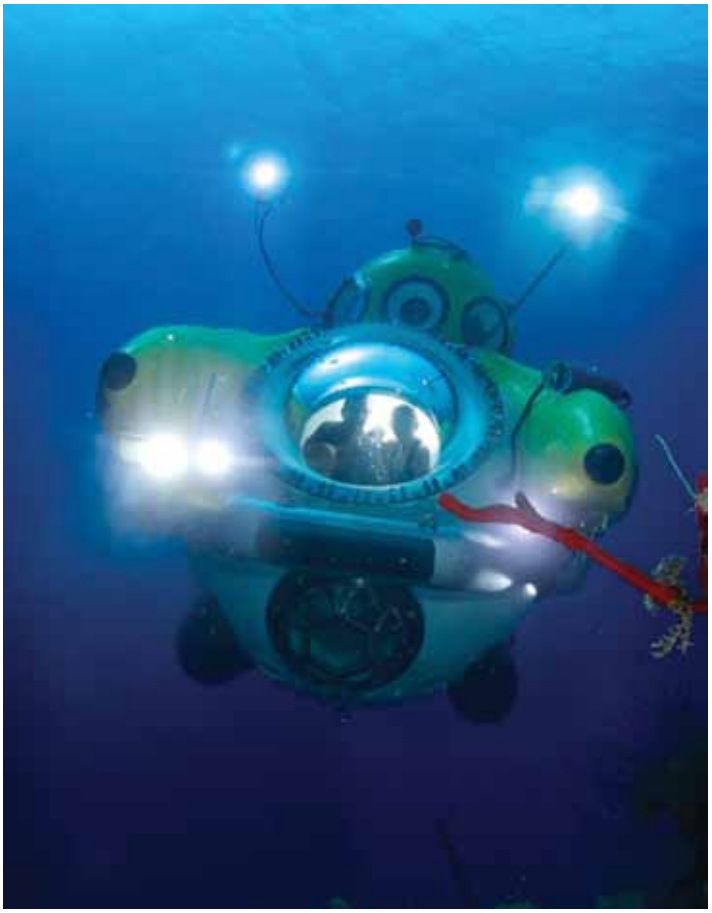
Join us in a post-convention shelling trip in the area. Plans are being made to explore land and freshwater shelling. All you have to do is express interest in joining us. There is no commitment and no up-front cost.

Don't miss our **Oral Auction** on Thursday night. We have some wonderful things for you to bid on. You will be provided with a booklet with pictures of all the items at the time you register. Here are a few to look forward to:

***Harpa costata* – 86mm!!**

Deep water *Conus lorenzianus* -- 68.2mm, w/o, trawled off Honduras.

UltraKleen Shell ultrasonic shell cleaning machine.



Bid on a dive in a submarine to 2000 feet to collect Pleurotomarias in the Caribbean.

MANY, MANY MORE!!! PLUS EXCITING FIELD TRIPS!!

FIELD MUSEUM OF NATURAL HISTORY: A once in a lifetime opportunity to see the behind-the- scenes view of the fantastic shell collection of the Field Museum.

ARCHITECHTURAL TOUR ON THE CHICAGO RIVER: The Chicago Architecture Foundation River Cruise is consistently recognized as the best way to see Chicago. Learn about the architecture and design of over 50 buildings as described by CAF-Certified Volunteer Docents/Guides on this 90-minute tour. Open-air and air-conditioned seating is available. Full Service Bar onboard each vessel. Board the bus at the convention hotel at 2:00 pm; return to the hotel at 6:00 pm. https://www.youtube.com/watch?v=cH-ZDcGpZNs

MUSEUM OF SCIENCE AND INDUSTRY: It is the largest science museum in the western hemisphere. On its 350,000 square feet (approximately 8 acres), it presents over 2,000 exhibits in many fields, including technology, agricultue, transportation, energy, and communications. Featured attractions include a working replica of a coal mine, the Henry Crown Space Center and the German WWII submarine U-505. Boarding at 9:00 am at the convention hotel; return to the hotel at 2:00 pm. http://www.msichicago.org/

LINCOLN PARK ZOO: Founded in 1868, is one of the oldest zoos in the U.S. The zoo's exhibits include big cats, polar bears, penguins, gorillas, reptiles, monkeys, and other species totaling about 1,100 animals from some 200 species. Its Conservation & Science Department runs one of the largest zoo-based research and conservation programs in the country. See unique exhibitions, such as the African Journey and the Center for African Apes and get behind-the-scenes access to areas usually closed to the public. Boarding at 9:00 am at the convention hotel; return to the hotel at 2:00 pm. http://www.lpzoo.org/

JOHN G. SHEDD AQUARIUM: The aquarium contains 32,000 animals representing 1500 species including fish, coral, marine mammals, birds, snakes, amphibians, and insects. The tour offers access to the permanent exhibitions including the Wild Reef (the recreation of a Philippine coral reef), Amazon Rising (repesenting the Amazon River and the surrounding jungle) and an aquatic show in the Oceanarium featuring belugas, dolphins, sea lions and dogs. Boarding at 2:00 pm at the convention hotel; return to the hotel at 7:00 pm. This tour can be combined with a visit to the Field Museum in the morning of the same day. http://www.sheddaquarium.org/

LAKE MICHIGAN DINNER CRUISE: Chicago's world-famous skyline is best enjoyed from the waters of Lake Michigan. The casual, yet lively, atmosphere of a *Mystic Blue* Dinner Cruise in Chicago is a terrific way to cap off the day with a group of friends. Watch the sun set on the horizon and the Chicago skyline light up as you enjoy panoramic views including iconic sights like Willis Tower, Navy Pier and John Hancock Center. Savor a delicious buffet dinner on board the *Mystic Blue* and have a drink from the cash bar while taking in the unparalleled view of downtown Chicago. See all the details at: http://www.mysticbluecruises.com/chicago/cruises/specialty/lake-breeze

POST-CONFERENCE FIELD TRIP, AUGUST 1 & 2: We are planning a two day land and freshwater collecting trip to the Mississippi on Aug. 1-2, staying in a local hotel overnight. We will arrange for transportation and will make a hotel reservation. If you are interested in participating you must send an email to jgerber@fieldmuseum.org. Please indicate whether you need transportation or plan to drive your own car. In the latter case, please also let us know whether you will drive back to Chicago and if so, how many passengers will you be able to accommodate.

See you in Chicago!