SHARK-PORPOISE BEHAVIOR STUDY MAY LEAD TO SURVIVAL AT SEA

Blair Irvine and Ric Martini discuss program with Dr. Gilbert, as porpoise swims in background.

The second phase of the shark-porpoise program, sponsored by the Office of Naval Research, began on 28 April with the introduction of two wild, untrained porpoises into the experimental pool of the MML.

The initial phase under Dr. Gilbert’s direction included a study of the basic behavioral patterns of freshly caught sharks with respect to feeding, locomotor activity, respiratory rate, reaction to other sharks of the same species and other species, and indications of behavioral changes with increased time in captivity. A similar study will now be made of the newly captured porpoises, at first alone, and then in combination with other wild porpoises.

Then with the introduction of sharks and porpoises into the same pool, varying the number and species, the question “Do porpoises respond differently (1) to different species of sharks; (2) to sharks of various sizes; and (3) to varying numbers of sharks?” will be broached. Initial reactions and behavioral changes that occur with time will be noted. Sonic signals of the porpoises will be taped with an Ampex 601 Recorder and behavior patterns of the sharks and porpoises will be filmed with a 16mm motion picture camera. The sonic records will be synchronized with the filmed records and the orientation of the animals in the pool will be carefully plotted for each experiment. This phase of the program will extend into 1971 when the final phase will be undertaken. Porpoises will then be trained to detect and aggressively ward off sharks and to work reliably in the open sea.

Extensive adaptation of the shark facility preceded the second phase. The existing filter capacity of the pools was doubled (porpoises are not as clean as sharks!) and our versatile marine engineer, Mr. Ben Terry, constructed a tower atop the observation platform to house the time-lapse camera to be used in the study. Housecleaning operations involved scrubbing down both experimental pools, a 2-day chore resulting in blisters, sunburned backs, and lots of blue air. One pool was cleaned each day, with animals confined to the other pool. Now with all traces of algal growth removed (an observation hazard with Gulf waters), photographic results will not be marred by distracting background patches.

To implement the second and subsequent phases of the program, Mr. Blair Irvine joined the Laboratory in January as Research Associate. Now on leave from the Naval Undersea Research and Development Center in San Diego, he has also worked at the Navy’s Marine Bioscience Facility, Point Mugu, Calif., where he was responsible for a number of behavioral experiments concerned with teaching dolphins to perform reliably in the open sea and to work with divers. Mr. Irvine was also in charge of a project to train the first killer whale for controlled release into the ocean. An accomplished SCUBA diver and photographer, Mr. Irvine has developed camera and training techniques to be used in the present study.

Porpoise moves into new home at the MML.
CORNELL STUDENTS WORK AT LAB

Easter week at the MML has become synonymous with the arrival of Cornell Professors Harrison W. Ambrose and William T. Keeton, and Biological Science Class 622. This year 15 students enrolled in the advanced course, arrived to study the general ethology of fiddler crabs and laughing gulls.

No time was lost in setting up camp on the Lab grounds with gaily striped blue and white tents. From then on it was a work week, including around-the-clock shifts to observe and study behavioral traits of the two seaside dwellers. While the short duration of their stay, one week, precludes an exhaustive study of their subjects, Dr. Ambrose explained, the real purpose of this project is to give these selected students a first exposure to techniques and methods used in field work.

Monday, March 30, was declared "Cornell Day" when the group was joined by Dr. Jerry Downhower and his honors biology field class, and by Dr. and Mrs. Wm. N. McFarland, Professor of Comparative Physiology, Division of Biological Sciences at Cornell.

At a seminar conducted shortly before their departure, three of the students discussed what they had accomplished during their stay. One team, explained Sue Weinstein, a senior, attempted to establish patterns in nocturnal and diurnal habits within the several species of fiddler crabs found in the area. Another group, with which Lew Lutton, a graduate student, worked, investigated homing and orientation of these crabs. They observed that the crab's ability to find his own burrow depends largely on the creature's familiarity with the gradient of the beach upon which he lives. Earlier research in the field had stressed the importance of orientation by sun angles and landmarks. Senior student Don Young's group spent their stay recording and analyzing the various calls of the laughing gull. Recorded calls were played back to the birds in an attempt to identify calls related to specific activities. It appeared that at least two of the calls related to feeding activity. On their return to Cornell the group will spend the remainder of the term analyzing their work and preparing reports on the results of their findings.

This 3-year-old program has proved to be one of the liveliest projects resulting from the Cornell-MML affiliation.
IMMUNITY IN ELASMOBRANCHS

Dr. E. Edward Evans, Professor of Microbiology at the University of Alabama in Birmingham recently spent a portion of his sabbatical leave at the MML, continuing his research on the evolution of immunity in elasmobranchs, particularly the sharks and rays. There are large molecules known as immunoglobulins in the blood of these animals. While man has at least five varieties of immunoglobulins, the shark has only one. Dr. Evans, here assisted by Mrs. Evans, is investigating the steps in the evolution of immunity between the elasmobranchs and man. He will conduct similar studies on invertebrates (lobsters, crabs, whirls, oysters, and clams) to determine the point at which genes coded for immunoglobulins first appeared in the animal kingdom.

PLAY ON A GUITARFISH

An eccentric cousin of sharks and rays, the guitarfish, is frequently used as an experimental animal by our biomedical investigators. More docile than the sharks, less cumbersome than the rays, this animal has a relatively large caudal vein from which it is fairly easy to draw blood samples. It is not only used as the experimental animal of choice, but, often a novice, in working with sharks, will perfect his technique of drawing blood samples from a guitarfish before work is actually begun with sharks.

Part shark, part ray in appearance, the guitarfish actually belongs to the ray family. Its shape has evoked musical names around the world; it is the French violon de mer and in Australia some guitarfishes are called fiddler rays and banjo sharks.

The spotted guitarfish (Rhinobatos lentiginosus), the most common of the 30-odd known species, is the sole species recorded from Gulf waters by the MML. Its appearance each spring in large numbers indicates an inshore movement for the mating season. Like the rays, guitarfish are ovoviviparous; unlike the rays, they swim by propelling themselves with their tails. Their pectoral fins are merely used as planes to raise, lower, or turn their bodies. The underside, containing the gills, is flattened like a skate or a ray. This duality persists in its habits—sometimes, like a skate or a ray, it lies half-buried in the sand or mud; at other times, it swims, though usually hugging the bottom.

The 34 specimens now in our holding pools have become great lab favorites. Mrs. Pat Bird, our aquarist, finds them appealing and friendly in marked contrast to our panhandling turtles, whose mouth-agape approach leaves no doubt as to the reason for their interest in every passerby.

MEMBERSHIPS AND CONTRIBUTIONS

We welcome the following new members:

**BENEFACTOR:** Mr. H. Edward Redwine, Atlanta, Georgia.
**SPONSOR:** Mr. and Mrs. W.A. Kiggins, Placida, Fla.
**SUSTAINING:** Mr. Carl C. Langen, Bogota, N.J.
**ASSOCIATE:** Mr. S.F. Armington, Placida, Fla.; Mr. and Mrs. Peter Fiolliard, Boca Grande, Fla.; Mr. J.C. Goddard, Placida, Fla.; Mr. and Mrs. Harlow J. Hemenger, Sarasota, Fla.

**ACTIVE:** Mrs. S.P. Appleby, Sarasota, Fla.; Mr. Howard D. Austin, Sarasota, Fla.; Mrs. Howes Burton, Boca Grande, Fla.; Mr. and Mrs. Herbert M. Cady, Sarasota, Fla.; Mr. John E. Cutter, Boca Grande, Fla.; Mr. Dewey A. Dye, Jr., Bradenton, Fla.; Mr. John Gilbert, Santa Cruz, Calif.; Mr. W. Huntingtow, Boca Grande, Fla.; Mr. David Junkin, Bokas, Calif.; Mrs. Joseph Junich, Boca Grande, Fla.; Mr. Joseph W. Lippincott, Lakewood, Calif.; Mr. Francis H. Low, East Islip, N.Y.; Mrs. Gale McLean, Boca Grande, Fla.; Mrs. H.S. Pieriepoint, Princeton, N.J.; Mrs Robert A. Pinkerton, Boca Grande, Fla.; Mr. and Mrs. Paul Seward, Clearwater, Fla.; Mr. Edward Shields, Sarasota, Fla.; Mr. and Mrs. Daniel Simonds, Boca Grande, Fla.; Mr. Norman Smith, Boca Grande, Fla.; Mrs. D. duPont Weymouth, Boca Grande, Fla.; Mr. H. Pearce Wright, Boca Grande, Fla.

**STUDENT:** Sg.t James C. Join, Sarasota, Fla.

**ADDITIONAL CONTRIBUTIONS** were also received from: Mr. and Mrs. Russell Chamberlain, Sarasota, Fla.; Mrs. F. Trevor Hill, Sarasota, Fla.; Mr. and Mrs. Eugene Lutz, Sarasota, Fla.; Mrs. L. Sanford Reis, Sarasota, Fla.; Mr. and Mrs. C. Fred Ritter, Sarasota, Fla.

**W E A L S O W I S H T O T H A N K:** the H.F. Mason Foundation, Inc., of Lakeland, Fla., for their contribution to the Library Fund of the Laboratory.

Mr. Stewart Springer, Washington, D.C., for early issues of Chesapeake Science and Limnology and Oceanography.

Mrs. Phoebe T. Dempsey, Juno Beach, Florida, for the donation given in memory of the late Joseph Junkin, good friend and member of the Mote Marine Laboratory.

The T.R. and G.W. Bartels Foundation, N.Y., whose active support of the Charlotte Harbor program has insured the continuation of this vital study.

Pat Bird, aquarist, feeding guitarfish. Below her arm is our 4-week old brown shark (Carcharhinus milberti). Sole survivor of 8 pups born in the pen, this male brown has lived in captivity longer than any other pup of this species born at the Lab.
Observations on a group of captive catfish have revealed that the sounds do indeed play a role in maintaining a coherent school. Sound production is suppressed during feeding and, for short periods of time, after a startle response to a disturbance. Sound production is increased with the introduction of obstacles, including both opaque and transparent materials. Sound production also increases at night and in murky water. Playback of sounds also stimulates sound production.

The pulse-type sounds have an average duration of 0.1 to 0.05 sec and a dominant frequency at about 100 Hz. The distribution and intensity of harmonics varies as the animal approaches obstacles. This change in sound quality can be readily detected by the observer’s ear. There is, therefore, information available that can assist the orientation of the animal. Whether, in fact, the catfish use this information is not yet clear.

A second type of sound consisting of a longer duration pulse was found to be associated with dominance behavior in an aggregation. It was emitted by a dominant animal when nipping or chasing a subordinate individual. A third type of sound, still longer in duration, is produced under extreme duress. Sightless individuals produce a fourth type of sound that consists of a continuous series of short, low-intensity pulses with a very regular repetition rate. This sound is detected only in recently blinded individuals. Sightless animals show an almost uncanny ability for obstacle avoidance, and a few hours after the operation become totally silent and remain so even in the presence of normal individuals and sound playbacks.

A second, most intriguing problem was their effort to elicit a “pattern of responses of sharks to vibrations produced by struggling fish” which involved the use of an unwieldy looking device with an equally unwieldy name—the Ichthyo-Uro-Simulator..... and thereby hangs a tail, a flexible plastic one.

There is now a body of evidence that indicates that some species of predatory sharks will be attracted to sounds produced by struggling or injured prey fish, as well as by some artificially produced sounds of extremely low pitch. It is presumed that the stimulus quality here is primarily a near-field effect, i.e., a water particle displacement, rather than a far-field, pressure wave.

One approach to the study of this phenomenon is to mechanically imitate the displacements produced by an abnormally swimming fish. Accordingly, a device was constructed that produced a reciprocating motion and flapped an artificial fish tail made of transparent plastic. After several attempts, the device was made completely silent, except for the near-field displacements produced by the artificial tail. This device, dubbed the Ichthyo-Uro-Simulator Mk 2, can change the velocity and amplitude of the tail movement, and the tail stimulus itself can be readily changed providing a variety of sizes, shapes, and stiffnesses.

The Ichthyo-Uro-Simulator proved to be an effective attracting stimulus to four small captive lemon sharks (Negaprion brevirostris), although too frequent exposure to the stimulus produced a temporary habituation. The distinction between the approach response to the IUS as compared to a normal attack approach is not yet clear. The responses are quite stereotyped, yet with enough variability that should permit grading them as indicative of arousal levels.

It is expected that this study will lead to a series of experiments in which the characteristics of the stimulus that lead to approach and attack on the part of the shark can be more precisely evaluated.

Our new laboratory-trailer now houses the Microbiology and Immunology Program headed by Dr. E. E. Evans of the University of Alabama Medical School.
ACCORDING TO BREDER...

"Now, according to Breder, ..." a young graduate student recently sought to confirm his identification of a local fish to the quiet, thoughtful gentleman seated next to him during lunch hour at the Lab. And to reaffirm his point he brought out the much dog-eared, well-marked library copy of "Field Book of Marine Fishes of the Atlantic Coast" by Charles M. Breder, Jr. His lunch neighbor conceded the point, but cited more recent research which had revealed certain modifications to the description of the fish involved. The graduate student, however, was mollified, his original interpretation having been confirmed by the vade mecum of naturalist and fisherman alike.

After lunch the graduate student approached one of the Lab staff. "I never did get his name. Who is he?" And, of course, the answer was "Breder," Dr. Charles M. Breder, one of the outstanding authorities on fishes in the world today, and Research Associate of the MML.

When in 1964 Dr. Breder moved permanently to his summer home at Manasota Key, south of Sarasota, his credentials for a well-deserved retirement were impeccable. Twenty-two years with the New York Aquarium (the last three as its Director); 20 years Curator and Chairman of the Department of Fishes and Aquatic Biology at the American Museum of Natural History which included 10 years as the first Director of the Lerner Marine Laboratory at Bimini; field work at the Tortugas Laboratory of the Carnegie Institute and his own Palmetto Key Lab on the west coast of Florida sponsored by the New York Zoological Society, as well as expeditions to Mexico, the Caribbean area, and 6 months in the Darien jungles of Panama — the list is impressive.

And the results of these years, the 300+ papers, are landmarks of the special vision Dr. Breder brings to his work. Utilizing the tools of the taxonomist, ecologist, mathematician, physicist, Dr. Breder was practicing one-man multidisciplinarianship long before the term and the approach became the present scientific modus operandi. His studies on fish locomotion were eagerly sought after by, among others, theoretical mathematicians and naval architects, the latter to incorporate some of his observations into submarine construction. His "Field Book of Marine Fishes" has been in print since 1929 and is still a standard reference for budding ichthyologists and the fishing public. Dr. Breder modestly attributes its enduring success to the fact that "it falls overboard easily and has to be replaced a lot."

Dr. Breder's association with MML, as friend, scientific advisor, and member of the Board of Directors spans its 15-year history. It is since 1964, however, that we have benefited from the full impact of his experience, participation and wise counsel. His special outlook on life and living things is just enough to the left or right of the commonplace to give a new slant and direction to the approach of each of our problems, whether they be scientific, mechanical, administrative, or just plain human. And it's not as the "august doyen" that he dispenses the fruits of his experience with the largesse that his reputation and background would entitle him to; rather, it's as a participant, eager and absorbed, that he shares in each of our current dilemmas, often leading the way to their solution. The MML is singularly fortunate to have him as Research Associate in residence, for if it's "according to Breder," you can count on it.

LAB NOTES

Royalty briefly descended on the MML this summer in a delightful fashion. Boat Captain Hugh Scott and his wife, Lab Technician Roberta Scott, found that almost-deserted island they had been dreaming about, and departed the MML in August for Little Cayman Island, BWI, where they will manage a small private resort. Word was that Scotty and Berta would be virtually "king and queen" of the island with its 12 residents, 4 miles of dirt road, 2 jeeps and countless iguanas. Regret at the loss of this able and genial couple who have been such an important part of the MML for the past 5 years was happily secondary to sharing the excitement of their new adventure. And we're not without a touch of royalty still. Our new boatman, Bob Hughes, formerly with the Aquatarium in St. Petersburg, is a prince of a fellow.
SHARK-PORPOISE PROGRAM

Behavioral studies of the first two porpoises suddenly became more dramatic when it was discovered that one of the pair (both females) was pregnant. Rather than being a happy event, the pregnancy caused concern because 1) parturition occurring during a shark-porpoise encounter might endanger the baby and/or the mother, and 2) a birth in the MML tank would delay the project at least several months since a new baby could not be transported to another area safely without endangering its life. Experts were consulted, but since they didn't feel the mother was quite ready, it was decided to move our program forward and then return her to the Aquatarium in St. Petersburg (both porpoises were on loan to the MML). The day after behavioral observations were completed both animals were returned by truck — suspended in cloth slings, covered with red terry cloth traveling outfits, and constantly kept wet during the 70-minute ride. Both arrived in good shape and two days later “mother” gave birth to a healthy son.

Since that time, another pair of porpoises (both adult bulls) have been studied with the sharks. Both pairs of porpoises are part of what is actually the first phase of the program. This phase involves the study of behavior patterns that become evident when recently captured sharks and porpoises are introduced into the same captive environment. Locally available species, including the Atlantic bottlenose dolphins, and brown, bull and lemon sharks are used in the experiment. Behavioral parameters such as position in a 50' diameter tank, speed, direction, orientation to the tank walls, and to other animals are noted.

Of the four porpoises thus far studied, this one has been selected for training to ward off sharks. Here the porpoise, hoping to be petted, seeks attention from Research Associate Blair Irvine who is in charge of the training program.

Time-lapse movies, taken at predetermined intervals before and during a shark-porpoise encounter, are analyzed frame by frame on a screen overlaid by a grid (to facilitate quantitative comparisons). Over 2,000 ft. of film has been taken and analyzed to date. Tape recordings made during all encounters are being synchronized with the movies to determine whether the porpoise's sonic signals affect the behavior patterns of the sharks. It is too early to draw conclusions, but for those of you who are curious, neither the porpoises nor the sharks were particularly aggressive during the controlled encounters.

Porpoise No. 3 is now being conditioned to ward off a shark on command. The training regime will require him to hit a stationary dead shark, then a towed dead shark, and finally to contact live sharks of increasing size. After demonstrating a capability to contact live sharks in captivity, No. 3 will then be trained to respond reliably in the open sea and to ward off wild sharks.

Ric Martini has assisted in the program since January and volunteer Randy Wells joined the program in June. At the start of the new school year, Ric returned to Cornell to begin graduate work leading to an MS degree, under Dr. Gilbert's direction. Randy has become so involved with the program that he made arrangements to continue his work on a half-time basis at the Lab as part of his high school curriculum. Randy is a straight A student and plans to study marine biology in college.
MML: A PROGRESS REPORT

MML Director, Dr. Perry W. Gilbert, left, receives a guided tour of the new microbiology lab by Dr. E. E. Evans, head of the recently inaugurated microbiology-immunology program.

At the year's end we welcome this occasion to send our many friends and colleagues news of the Laboratory and Season's Greetings.

1970 has brought to the MML many satisfactions — several new and excellent additions to our staff; increased interest of many individuals in contributing to the operating expenses of the Laboratory; and solid progress in our four established programs — biomedical, shark biology, bioacoustics and the ecological study of Charlotte Harbor — plus the introduction of a new major research program in microbiology and immunology.

Our biomedical program has been active this year with five team visits by investigators from the National Institutes of Health. Dr. D. S. Zaharko and Dr. V. T. Oliverio of the National Cancer Institute (NCI) pursued their investigation of the kinetics of drug distribution in the tissues of elasmobranchs; Dr. Eberhard Trams, National Institute of Neurological Diseases and Stroke, and Dr. Ann Brown, National Heart Institute, were joined by Dr. Frederick Snyder, NCI, in their studies on the central nervous system in sharks. Studies of the blood brain barrier in elasmobranchs by a 5-man team from the NCI, and of the metabolism of sea urchin embryos by a scientist from the Baltimore Cancer Research Center of the NCI are currently in progress.

In our shark program, the shark-porpoise experiments have proceeded on schedule. SIMO, our porpoise in residence, now goes through his training paces daily and Research Associate Blair Irvine reports below on latest developments at the porpoise pool.

Studies of shark hydrodynamics by Capt. H. David Baldridge have been directed this year toward such factors as underwater weight, fin-loading, liver percentages, average body densities, and related parameters in an effort to determine if there may be some delicate balance which may, for antishark purposes, be exploited to the shark's disfavor.

Dr. William Tavolga, in the bioacoustics program, has studied the mechanisms of sound production and thresholds of hearing in catfish. With Mr. Alfred Beulig, he also has investigated the response of sharks to vibrations produced by struggling fish, and has developed an apparatus for simulating such sounds.

During 1970 the geochemistry and hydrography of the Charlotte Harbor Estuary were studied in detail by Dr. Robert Harris and his teams from Florida State University. Dr. Roger Cressey of the Smithsonian Institution began a 2-year study of the copepods parasitic on teleost fishes of the harbor, and Dr. John Morrill and his team from New College completed a preliminary survey of the flora of Devilfish Key.

TO OUR CONTRIBUTORS

In reply to inquiries regarding the effect of the Tax Reform Act of 1969 on the MML, notification has been received from the Internal Revenue Service as follows:

"Based on the information you recently submitted, we have classified you as an organization that is not a private foundation as defined in section 509(a) of the Internal Revenue Code."

Our status, therefore, as an "operating foundation" is very favorable to patrons of the Laboratory, as it broadens our base for tax deductions for contributors.
MML: A Progress Report (Continued from pg. 1)

Our newest program, in microbiology and immunology, was initiated in July when Dr. E. Edward Evans of the University of Alabama Medical School was appointed Senior Research Microbiologist at the MML. A frequent visitor to the Laboratory for the past few years, Dr. Evans will now divide his time between his teaching in Birmingham, and his research at the Laboratory. Dr. Evans' work on the evolution of immunity has led him to concentrate on marine animals; he has worked at the University of California in Santa Barbara and has also been a Visiting Investigator at the Lerner Marine Laboratory in Bimini for the past five years. His work at the MML will delineate the evolution of immunity in the elasmobranchs, especially sharks and rays, and in selected invertebrates.

Dr. Evans has begun his work in new quarters adjacent to the NIH biomedical laboratory on the peninsula at our Siesta Key Station. The Microbiology and Immunology Program that Dr. Evans now heads at the MML will not only stress the marine environment, but will also contribute to our knowledge in several other areas of major importance to man. The immunology study in which Dr. Evans has been engaged since 1958, has important applications to infectious disease, immunity to cancer and to the rejection of transplanted tissues and organs.

Looking back, I find it was a very good year, made possible by dedicated scientists and staff, and by the several private foundations and Federal agencies that support our research programs. We hope 1971 will treat us, and you, as kindly.

Perry W. Gilbert, Director, MML.

LAB NOTES

"Go and Tell" Time: In October Dr. Perry Gilbert joined an illustrious gathering of diving world greats at the MAN SEA 70 program in San Francisco. Assembled at the 2-day program to honor Dr. Albert Behnke, the father of diving medicine, were Phillippe Cousteau, Paul J. Tzimoulis, editor of Skin Diver magazine, T. A. Pryor, Director of Sea Life Park, Hawaii, among other conservationists, underwater scientists, photographers and writers. After addressing the group, Dr. Gilbert went to the Navy Undersea R&D Center at San Diego where he spent a week running bite-meter tests on blue sharks of that area. Working from the SEA-SEE catamaran with its underwater observation chamber, bite recordings were obtained from 8 sharks and the meters are now being read by collaborator James Snodgrass at the Scripps Institution of Oceanography.

In November at the invitation of Dr. George Bond, Dr. Gilbert and Capt. Baldridge traveled to Panama City, Fla., to address the members of the Naval Mine Defense Laboratory. Early this month Capt. Baldridge spoke before the Trustees of New College in Sarasota.

Two members of our Board of Directors will lecture at the annual post-Christmas meeting of the American Association for the Advancement of Science in Chicago. Dr. Eugene Clark will speak on "The Lady and the Sharks," and Prof. Paul S. Bauer will show his film on Surtsey, "An Active Volcano in Evolution."

Board of Directors Meeting: Dr. Clark and Prof. Bauer joined other members of our Board at the MML on December 15 for their annual meeting. Following the morning meeting at the Siesta Key Station, a picnic lunch of venison, courtesy of Board President William R. Mote and member D. W. Brosnan, and shrimp, was served. That afternoon the group heard presentations by Dr. Gilbert, Capt. Baldridge, Dr. Evans and a report by Dr. John Morrill and two students of New College in Sarasota on their studies at Devilfish Key. They then traveled to Placida to inspect the Charlotte Harbor Station and its program.

FURTHER DATES TO NOTE

FOR MEMBER TOURS

Tours of the Laboratory for members only will be held on:

Wednesday, January 13 - 2:00 p.m.
Wednesday, February 17 - 2:00 p.m.
Wednesday, March 17 - 2:00 p.m.

The November and December tours were extremely well-attended, and we unfortunately were obliged to ask many members to postpone their visits to one of the later dates. Experience has shown that a group of 30-40 can better see and hear the presentations by our investigators, and accordingly we try to limit the tours to this number.

Guests at our November tour were treated to the unprecedented spectacle of one of our investigators falling into the porpoise pen. It proved so popular that we think he's been practicing for subsequent tours. No promises, though!

More space: Completed just in time for the Board meeting were our two new laboratory rooms at the Siesta Key Station. The remodelling program, carried out with funds from the local Wm. G. and Marie Selby Foundation, caused about four months of disrupted activity in the old herbarium and aquarium rooms. But the results are most attractive, with a laboratory/conference room for the Director, and new quarters for Mrs. Dudley and the herbarium.
but as it is in mammals pentobarbital was administered and the in large the usual anesthesia for large mammals and 

Weiner, and Dr. Joseph Fenstermacher, 

Why study this barrier in sharks?

This system is well developed in young and adult mammals and adult spiny dogfish, Squalus acantbias. In newborn mammals, including man, it is poorly developed — the blood brain barrier is “leaky” — but within a few days or at most 2–3 weeks it becomes “tight,” as in the adult.

Earlier studies in young nurse (Ginglymostoma cirratum) and lemon (Negaprion brevirostris) sharks, up to 4 feet, have suggested that the blood brain barrier is somewhat “leaky.” It seemed possible therefore that these animals might develop a tight barrier at a slower rate than do mammals. 

Previous work at the MML by Dr. Rall and Dr. Helen Cserr of Harvard Medical School suggested that in rays (Dasyatis sabina, Dasyatis sayi) the blood brain barrier was leaky in immature individuals (those with undeveloped claspers), while it was tight in mature rays. It was important therefore to determine if the blood brain barrier was fully developed in other sexually mature elasmobranchs such as adult nurse and lemon sharks.

Catheters used to obtain information

Inulin and sucrose, large inert molecules, which are excluded by the normal adult blood brain barrier were injected in the caudal artery of the sharks through a catheter. In addition p-amino hippurate and creatine, also generally excluded from the brain and useful in assessing, in quantitative terms, renal function, were injected. A catheter was also placed in the renal papilla and a bag attached to the first dorsal fin for urine collection. Renal function studies had never before been performed on large free-swimming sharks.

When the catheterization took too long for the use of quinaldine alone — the usual anesthesia for large sharks — pentobarbital was administered and the gills were perfused with sea water during the operation. This was completely successful with 2 large lemon sharks and 1 large nurse shark, but was not with 2 smaller brown sharks and a small bull shark.

Laboratory study of the material collected is now underway and will demonstrate if the blood brain barrier is tight — as it is in mammals — in large adult sharks. If it is found to be “leaky,” the next important and exciting question will be “why?”.
SHARK-PORPOISE PROGRAM

Brown, bull, and lemon sharks have been introduced into the 50-feet diameter pool with two pairs of freshly caught porpoises. Ensuing activity was recorded at regular intervals with time-lapse photography. These records have been compared with time-lapse motion pictures, taken at the same intervals, of the sharks and porpoises when not in each other's company.

The filmed records are being projected on a grided screen, one frame at a time; and the positions of the animals are plotted on charts. A separate series of new sharks of 4 species.

In the meantime, porpoise No. 3, now named "SIMO" (Greek for blunt nose) is being conditioned to attack a shark on command. After receiving a signal from an underwater hydrobeacon, he has learned to seek out and ram a 3' dead shark placed anywhere in the pool. Larger sharks will soon be introduced until he has learned to hit dead sharks up to 9' in length, after which he will be required to hit dead sharks of various sizes and species as they are towed across the pool. When reliable performance has been achieved on dead animals, live sharks of gradually increasing size will be introduced, and SIMO will be conditioned to keep them away from a given area in the pool.

In 4 more freshly caught porpoises and a series of new sharks of 4 species.

Simo takes the challenge, making a direct attack on a dead blacknose shark in the most recent step in his operant conditioning experiments.

The One That Didn't Want To Get Away: Research Associate Blair Irvine holds a baby porpoise which repeatedly fouled the capture net when enclosed with its mother on a recent tagging expedition. The baby was taken aboard the capture boat for its own safety until the net could be opened to release the mother. Upon release, both swam away together.

MEMBERSHIPS AND CONTRIBUTIONS

The following new memberships have been received. We wish to thank our new members for their interest in the work of the Laboratory, and to welcome their participation.

BENEFACCTOR
Mr. Daniel P. Hays  Sarasota, Florida

SPONSOR
Mr. J. T. Grindall  Ashaway, Rhode Island
(Ashaway Charitable Trust)
Mr. Louis Fuss  St. Louis, Missouri
Mr. John Vanneck  New York, New York

ASSOCIATE
Mr. Lucius Bebe  Sarasota, Florida
Mr. A. E. Buchanan, Jr  Wilmington, Del.
Mr. John H. Slater  Naples, Florida
Mr. Carl L. Wohlenborg  New York, New York

ACTIVE
Mrs. Robert S. Adams  Boca Grande, Florida
Mr. and Mrs. J. C. Armstrong  Sarasota, Florida
Boca Grande Woman's Club  Boca Grande, Florida
Mrs. Herbert V. Buck  Sarasota, Florida
Mrs. Joseph H. Buzelli  Casey Key, Florida
Mr. Robert C. Duron  Guatemala, C. A.
Mrs. Edward D. King  Boca Grande, Florida
Mrs. James A. Lindamood  Coyahoga Falls, Ohio
Dr. John M. Morgan  Sarasota, Florida
Mr. Paul T. O'Hargan  Naples, Florida
Mr. James Rutgers  Santa Barbara, Calif
Mrs. N. G. Rutgers  Papeete, Tahiti
Mr. Gordon Whitney  Longboat Key, Florida

STUDENT
Mr. Kirk Browton  Sarasota, Florida
Mr. Bruce Calder  Sarasota, Florida
Mrs. W. A. Waller, Jr  Sarasota, Florida
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Blair Irvine, Research Associate