

# MARINE JOURNAL

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BLACK AND WHITE PHOTOGRAPH

## JELLYFISH

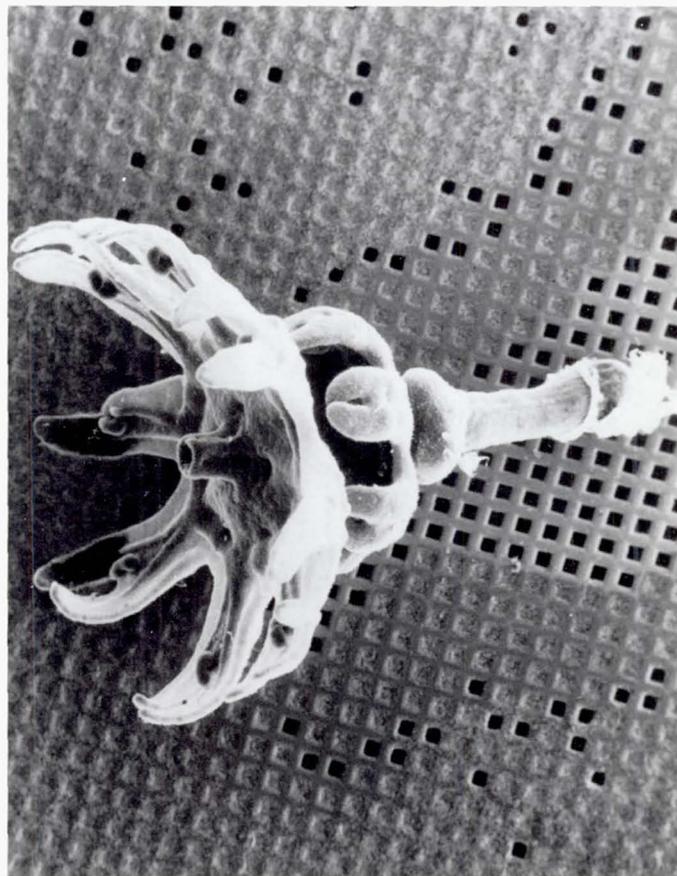
*Special Tools for Biological Research  
on Earth and in Space*

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When I was a youngster beachcombing in Galveston, Texas, I often saw large numbers of jellyfish washed up along the beach. I viewed the jellyfish, then, as most people do today, as nuisances. They cluttered the sand, often obscuring the more interesting seashell specimens I was collecting, and, of course, in general, they fouled the beach. It was years later, while studying at the University of Texas, Austin, that I began to realize what extraordinary creatures the jellyfish are and what great tools for biological research they could be.

My serious studies of the jellyfish, *Aurelia aurita* (moon jellies or plates) began in 1962 using a strain collected at Corpus Christi, Texas. I learned that the small polyp form of the *Aurelia* can be reared easily in small dishes of sea water (or artificial sea water) while being fed newly hatched brine shrimp (*Artemia salina*). Given good care, which involves changing the polyps into clean dishes and sea water after each feeding (now being done in my laboratory by ODU student Suzanne Davis), the jellyfish polyps will live indefinitely while continuously reproducing through budding. Indeed, I still have some of the Texas strain of jellyfish collected so many years ago!

The most intriguing nature of the jellyfish polyps, to me, is their ability to metamorphose, giving rise to tiny immature medusae called ephyrae which have a different form or shape from the polyps. In order to study the process of metamorphosis in the jellyfish, we had to be able to induce animals to metamorphose on command. After many years of research, we achieved this purpose by discovering that the jellyfish needed iodine in order to make a thyroid-type hormone required for metamorphosis. Today, we can "make" as many ephyrae as we need for our research studies whenever we need them by administering iodine and controlling their environmental temperature. This ability to control metamorphosis of polyps with iodine treatment led to the development of an exciting new test system, the *Aurelia* Metamorphosis Test System.



*A nearly mature ephyra is developing at the top of a metamorphosing polyp. Less mature ephyra is underneath it. This is magnified approximately 50X.*

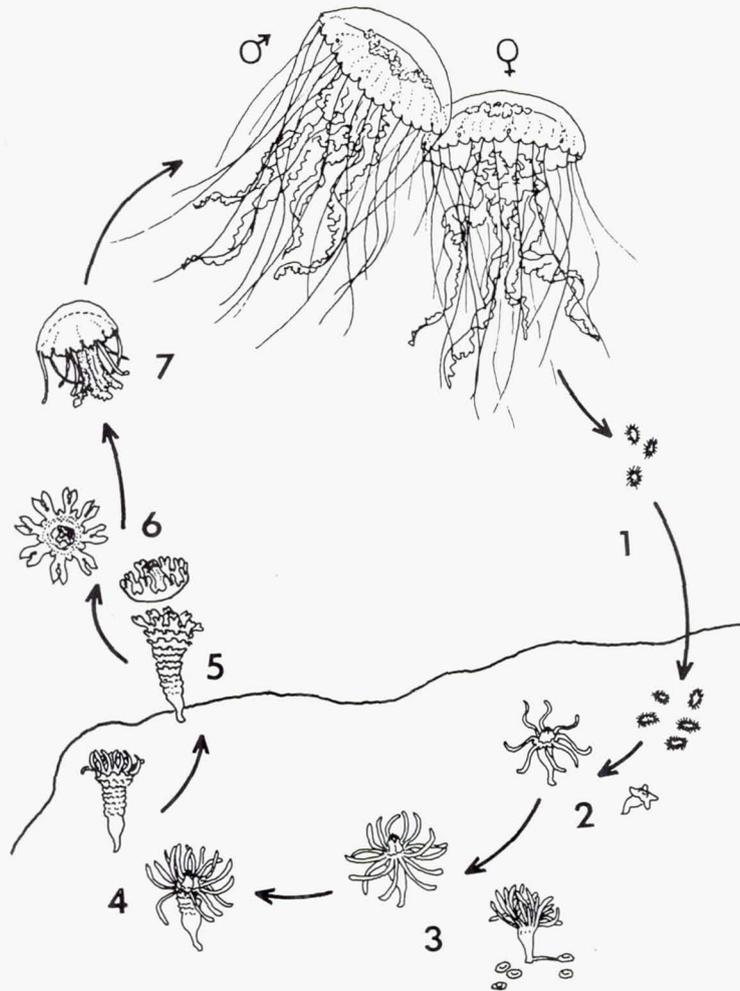
To date, we have used the *Aurelia* Metamorphosis Test System to determine the subtle effects of hydrocarbons found in oil spills (sponsored by the Department of Energy) and the effects of X-irradiation on developing ephyrae (sponsored by Eastern Virginia Medical School and done in collaboration with Mr. Mike Prokopchak). Currently, we are using this test system to determine the effects of the gravity-less environment of outer space on the development and behavior of ephyrae (sponsored by NASA). For this purpose, I am studying the effects of clinostat rotation on development of the ephyrae and their gravity receptors; we are looking at the behavior of the ephyrae during 0 gravity achieved for short intervals of 30 seconds in parabolic flight (in collaboration with Dr. Charles Oman, Massachusetts Institute of Technology); and we are planning exposure of developing ephyrae and of mature ephyrae to the gravity-less environment of outer space via a six or seven day shuttle experiment.

People ask me, "Why should we fly the jellyfish in outer space?" I reply that the jellyfish ephyrae form simple gravity receptor structures which resemble, in a less complicated way, the gravity receptor structures of higher organisms, including humans. The gravity-less environment of outer space is still a new, relatively unexplored frontier. We do not know, yet, how this gravity-less environment will affect the development of biological organisms or their gravity receptor structures. Indeed, we do not know what role gravity may be playing in our own development on earth. By comparing development of the ephyrae in space with that of ephyrae on earth, we expect to be able to answer questions about the importance of gravity which would be impossible to answer without the availability of the shuttle to take the jellyfish and other organisms into outer space.

It's a long journey for the jellyfish from the depths of the ocean to outer space, yet the jellyfish polyps and ephyrae are especially suited for the trip. They are tiny, require little or no care during their week-long journey, and have the capability of forming the special gravity-sensing structures. If the gravity-receptors do not form in outer space, we will deduce that gravity was needed for normal development (having controlled for other factors) and that gravity plays an important role in the normal development of these structures on earth. If gravity receptors do form in outer

space, we will study them in detail using various types of microscopes, including the electron microscope, to determine whether they developed normally in space as compared with controls on earth.

When I walked the beach of Galveston and avoided the jellyfish washed up there, I knew nothing about jellyfish metamorphosis or even that jellyfish made gravity-sensing structures. Indeed, the first space craft had not yet gone into outer space. Through basic science research of the jellyfish over the years, however, we learned about the special features of the jellyfish which make them especially valuable for gravity-related research. Today, when I walk the beaches of Norfolk and Virginia Beach, I think about the vast numbers of unexplored organisms in the ocean (and on the beaches) and I wonder about their special features and how they could be used to answer basic fundamental questions about living organisms. What a wonderful opportunity for scientists to have the use of such a smorgasboard of exotic marine animals with such a wealth of special features for exploration. Who knows what important questions will be answered through these aquatic organisms about life on earth and in space today and in the future!



Jellyfish life cycle, above, and drawing of comb jelly on page 4 are from Common Jellyfish and Comb Jellies of North Carolina by Frank J. Schwartz and illustrated by

Leslie Barling. Copies are available for 50¢ by writing P.O. Box 809, Moorhead City, NC 28557.

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