An Experimental Method of Studying Corals During Early Stages of Growth[1]

Research in the subjects of taxonomy and ecology of reef-building corals would be benefited if we could manipulate the location, species composition, dispersion pattern and abundance of settling planula larvae or of polyps soon after metamorphosis. The taxonomy of corals is confused by the variation in growth form of corals when growing in different habitats. It would be instructive to obtain planulae, or polyps soon after metamorphosis, known to be of the same genotype and place them in several habitats to compare their resultant phenotypes. However, even sibling planulae do not have identical genotypes and they are not easily placed in predetermined locations.

As with most other long-lived invertebrates, scleractinian corals have a very high rate of mortality early in life and their chance of further survival increases as they grow to a larger colony size. Their relative chance of survival at these critical young stages may be influenced by location in relation to the reefs physiographic features, depth, pattern of dispersion, species composition of other settling larvae, nearness of large colonies of their own or other coral species, fish or urchin grazing, and other factors. In attempting to experimentally test the relative importance of these factors in the survival of recently set planulae we find that we are not able to induce planulae to settle in a given location, pattern and abundance among others of their own or other species. Recently settled polyps are difficult to collect and adequate numbers of the species in the combination desired are usually not available.

An alternative method for obtaining tiny colonies is by breaking off the growing tips of arborescent or ramose colonies and attaching them as nubbins to the desired positions on the substratum with underwater repair putty (Sea Goin' Poxy Putty, Permalite Plastics Corporation, 1537 Monrovia Avenue, Newport Beach, California 92660). This has several advantages: the several nubbins from a single colony will have the same genotype, the nubbins can be placed in the order and abundance desired, and plenty of material is available from adult arborescent and ramose colonies.

If the comparison is between the effects of two specific alternative factors and the variation in micro-habitat is desired to be controlled as much as possible, the nubbins can be cemented to terra cotta tiles (Fig. 1). If new cement construction blocks are to be used, they should be placed in a circulating sea water system, or perhaps preferably in the ocean, for at least a week in order to leach out the lime. Unleached cement blocks are toxic to coral nubbins. Coral polyps of the species worked with (*Pocillopora damicornis, Pocillopora meandrina, Madracis dedactis, Acropora kenti* and *Porites furcata*) do not display symptoms of a toxic reaction to Sea Goin' Poxy Putty.

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Fig. 1. Coral nubbins mounted with underwater repair putty on terra cotta tiles. One tile was placed inside a fish exclusion cage.

To obtain nubbins, the branches of the colony should be placed in a plastic or enamel tray, such as a dish pan or photograph developing tray, full of sea water. Care should be taken that the trays have never been in contact with formalin or other toxic substances. Nubbins can be broken off by placing a dive knife or a small chisel against the colony and tapping it with a hammer, lightly so as not to puncture the tray. For some species, such as *Pocillopora damicornis* or *Porites furcata*, a growing tip of a branch is not required; any small section with living polyps will do. After the nubbins are made, place them in a glass bowl and place the bowl in an aquarium with running sea water.

If the nubbins are to be set in a pattern on terra cotta tiles or previously mellowed (leached) cement blocks, the base and catalyst of the underwater epoxy putty can be mixed on a pallet and small drops of putty can be applied in the desired pattern with a toothpick. The putty can be applied to the block most rapidly and efficiently out of water, either in the laboratory, in a boat or on shore. The bricks should be set in the water table, in a holding tank or in the ocean, and the nubbins set in the putty within a half hour. This time limit is the reason for obtaining the

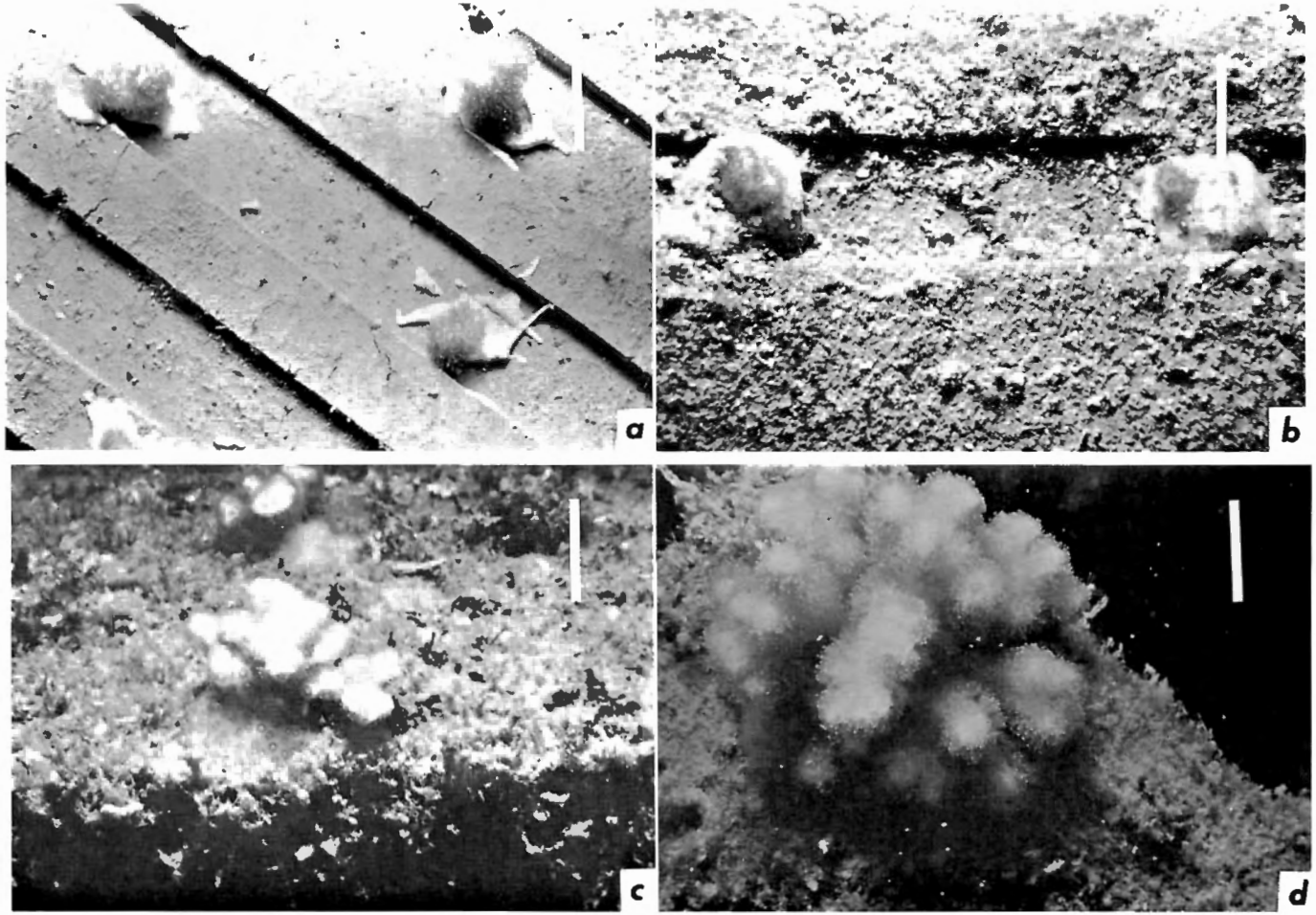

Fig. 2. Growth of coral nubbins over a 223 day period when mounted on terra cotta tile with underwater repair putty. The white bar indicates 1 cm.

a. Nubbins of *Pocillopora damicornis* one day after being set in the putty.
b. After one week in the field, depth 6 meters. Smaller nubbin to the right is 6 mm in diameter.
c. After 3 months the coral has overgrown the putty and has cemented itself to the tile by growth.
d. A nubbin of *Pocillopora damicornis* after 223 days in the field.

nubbins before the putty is mixed.

If the porous terra cotta tiles have not been previously submerged, they may exude streams of bubbles, some of which may become trapped in the putty spots and loosen them. Bubbles forming under the putty spots should be released by prodding with the toothpick before setting the nubbin in the putty. If working near a laboratory, it is best to keep the tiles in a system of running sea water for 24 hrs before setting it out in the ocean because until the putty cures, water turbulence could loosen the nubbins.

If the nubbins are to be set on the natural substratum, the small spot where the putty is to be set should be cleared of filamentous and loose materials by scraping with a dive knife or chisel, then with a wire brush. The putty should be mixed on a pallet on shore or in the boat and then brought underwater and set on the cleared spot. The nubbin should be set in the putty within 30 or 40 minutes. Turbulence in the water can remove the nubbin during the first day.

The method for experimenting with corals during early stages of growth is relevant only for coral species with colonies of many small polyps. A single polyp of a mussid, a *Diploria* or a *Colpophyllia* does not resemble a polyp which has recently undergone metamorphosis from a planula larva. However, the epoxy putty is effective in cementing larger colonies or branches of colonies in new locations for other transplantation experiments. Once set and cured overnight underwater, the epoxy putty can hold for many years. Thirty-six epoxy putty patches were set as quadrat markers on subtidal vertical rock walls near the Friday Harbor Laboratories, Washington, and all 36 are still in place since October 1967. The putty appears nontoxic and is frequently overgrown by fouling organisms.

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