Labs

Natural Living Exhibits

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A terrarium with plants, a pond and a few animals would appear to be an easy exhibit to set-up for teaching. Many books and pamphlets give simple directions for setting up desert, woodland and tropical terraria. When the materials are gathered together and set up everything seems fine. Then plants get uprooted by animals, wastes begin to accumulate, plants grow too fast or die, and what was a beautiful terrarium is now unsightly.

It's a bit easier if only plants are used. But plants must be selected which can live under similar lighting conditions, pruning is often required, and all the details of normal plant care have to be considered eventually. Combined plant and animal exhibits can seem impossible to maintain.

My first experience was with a woodland terrarium early in my career. I was delighted with the immediate results and very discouraged a month later. For many years, I exhibited only lower plant terraria and specimens maintained in the greenhouse. I forgot the idea of a natural animal exhibit except for aquaria. A few years ago, I decided to try again, and with the help of some local zoo people I pursued a new approach. They had just opened a new reptile house and had tried a number of approaches.

Zoo keepers have learned that sand, soil and similar substrata are not desirable media for exhibits because natural wastes accumulate and act as nutrients for disease causing bacteria. The limited space available in most institutions makes natural exhibits with enough substratum to provide for normal breakdown of waste impossible. Smaller exhibits would have to incorporate efficient and effective drainage and waste removal procedures. With this kind of requirement, how could the exhibits be made to look natural? An intern at the zoo had had some success with styrofoam.

I discovered that styrofoam had some properties I knew only slightly before. The intern shaped the styrofoam with a candle and cut it with a hot knife. After a few simple experiments, I was able to produce most of the shapes I needed for my exhibits. A colleague's heat gun turned out to be the best tool for shaping the foam but candles, soldering irons and a variety of other heat sources also worked well.

The styrofoam was easy to cut with a knife heated in a bunsen burner. The knife should only be heated to a temperature hot enough to cut the styrofoam rather than burn it. The fumes caused by burning are not particularly dangerous; the health officials I talked to said that toxic gases are barely detectable with sophisticated test equipment. However, if there are fumes, you might want to work in a well ventilated place or under a fume hood. Even though I had enough styrofoam shipping containers around to make the exhibits, I found the thick styrofoam sold at the local lumber yard better for making joints and fitting pieces together.

Four Habitats

I wanted to set up exhibits illustrating several different habitats so students could observe a variety of living organisms in the lab demonstration area. I used four 20-gallon aquaria to develop dry (desert), semidry (terrestrial), moist (woodland), and semiaquatic environments.

The desert terrarium I constructed by making a sand-like bottom with a rocky ledge at the back. To make the surfaces look appropriate, I covered the shaped styrofoam with a layer of clear silicone sealant. This turned out to be the most expensive part of the project since each exhibit required about a liter of sealant. The fresh silicone I then covered with a layer of sand to give it the proper appearance. I was able to get a variety of sands and gravels from a local gravel company. Placing these on the silicone, leaving them overnight, and pouring off the excess produced a natural looking surface. I glued a variety of decorative, flat pieces of rock into the styrofoam to produce a ledge and other features. The result was a rather natural looking habitat that could easily be cleaned because residues remained on the surface. I hoped a small depression I made in the bottom would hold water but even with a second coat of silicone the water always disappeared overnight. A glass dish had to be placed in the bottom of the depression.

I placed potted plants in holes cut in the styrofoam, covering them lightly with sand that matched the adjacent surface. Because cacti require more light than fluorescent fixtures can supply, we found we had to maintain another set of plants in the greenhouse. When the terrarium plants showed signs of light deficiency, we switched the sets.

A large red-legged tarantula I placed in the terrarium has lived for many years and molts several times a year. The spider eats crickets and new born mice and only needs to be fed about once a week, although it has gone through periods when it did not feed.

The semidry-terrestrial environment tank consisted of a slanted bottom with a stream and a number of large plants. Because the silicone stream did not stay filled with water overnight it ended up being a stream bed with some standing water in it. A large Jade plant filled one end of the terrarium. Several Curly-tailed lizards and a baby iguana became the occupants of this tank. The Jade plant withstood the iguana's climbing reasonably well but two plants were required. Pet stores sell flat rocks with heaters in them called hot rocks; I placed one at one side of the tank. The

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lizards liked the hot rock and occasionally exhibited head bobbing territorial behavior.

The Curly-tailed lizards were generally secretive and buried themselves in the soil in the Jade plant flowerpot except when feeding or warming themselves on the hot rock. Some animals tolerate exhibit conditions far better than others. Nocturnal and highly nervous animals should be avoided. Even animals of the same species vary considerably in their ability to survive in captivity. The first group of Curly-tailed lizards we exhibited did not survive well. The animals we received a year later lived for several years and became much less secretive. The iguana would only eat green leafy vegetables at first but eventually ate canned dog food. The Curly-tailed lizards ate crickets.

The moist-woodland terrarium we developed around a log in the center. Wholesale florists often carry a variety of dried plant materials for display purposes. I bought a dried hollow log and filled it with plaster of Paris so nothing could hide or grow inside. We developed a small pond at the front of the tank. For landscaping we put dried plants at the back of the tank and a small potted fern in the front corner, opposite the pond. Two glass lizards have lived in this tank for several years. At first we tried keeping a bed of living moss around the pond but it did not hold up well. A shallow layer of sandy soil seems to work well. The glass lizards burrow in it but also spend a fair amount of time basking on the log. Their respiratory movements are interesting to watch. They are fed crickets and, occasionally, earthworms.

The semiaquatic environment was accomplished with an undergravel filter. The air lifts we cut off about three inches above the filter so a shallow pond could cover the bottom of the tank. A large flat rock covers most of the back of the tank and rises about an inch above the surface of the water. A variety of potted aquarium plants sit along the side of the tank. Several Cuban tree frogs, a couple of grass frogs and a caecilian have lived in this tank. The caecilian seemed to be doing very well and then died suddenly. The frogs have all done very well, feeding mainly on crickets. The caecilian we fed earthworms.

Maintenance

What has been amazing to me about these exhibits is their durability. Even though it took a fair amount of time to build the exhibits, they have required very little maintenance. The nonliving parts of the exhibits have held up very well over the past five years and have required only a small amount of isolated cleaning with water to remove residues. This is a very different story from what happens in terraria where animals move soil and overturn plants.

Don't let me mislead you. This does not mean maintaining exhibits does not require considerable amounts of time. The organisms will require almost daily checking and care. Leftover food and feces need to be removed. Water needs to be changed. You have to acquire and maintain organisms used for feeding. There's plenty to do but most of it is routine enough that you can train others to perform these tasks. A high school teacher could assign interested students to care for individual animals or exhibits.

Several specific kinds of problems related to exhibiting organisms need to be discussed if your exhibits are to be successful. I would be particularly interested in how others have solved these problems and if you have reached the same conclusions. Please send me a short note if you have comments.

Sources

Quite often there are individuals or groups in your area that have a considerable amount of experience obtaining and maintaining organisms of interest to biology teachers. Some of these people, even though not trained in biology, will be able to give valuable assistance in developing living exhibits. Animals which have been bred and raised in captivity are often the best forms for exhibition. Frequently, cooperative efforts to obtain both organisms and their food can save considerable amounts of time, money and energy. Therefore, before you order everything out of a catalog, check with local individuals to see if there are networks of interested people in your area.

The above exhibits could not have been developed without help and cooperation from several local people. I ordered animals for several people in exchange for a regular supply of crickets and some help in caring for a few extra animals in case we had some losses. Several people had experience with a variety of suppliers and we were able to obtain high quality animals at reasonable prices. Luckily, there are people who can spend far more time than most biology teachers have to care for animals; these people can be very helpful and interested. Don't overlook these resources.

One problem I have not solved is finding sources of terrestrial invertebrates. The animals exhibited above are interesting to have in the biology classroom, but I had hoped to have a better variety of animals on exhibit. I did have two large millipedes in the woodland exhibit but they were elusive and lived only a few months. With the development of insect zoos and more invertebrate oriented aquaria, increased interest in these animals has developed. It should be possible to identify groups of diurnal animals that can be exhibited together, survive well in the classroom and pose no danger to natural populations. I look forward to the day when a biological supply company offers a precast set of natural looking exhibits with a set of compatible, laboratory raised organisms for exhibit.

Feeding

Animals need to be fed, and the maintenance of their food can be a bigger problem than taking care of the predators themselves. Even though some organisms are easy to raise, e.g. mealworms and maggots, they are not always good sources of food. Maggots, for example, are not very digestible and can harm the animal eating them. Mealworms contain so much exoskeleton for their size that they sometimes cause digestive problems. Also mealworms are not as easy to raise in large numbers as often claimed, at least on bran. Someone told me chicken mash works much better. I haven't had a chance to try.

For years, I maintained a large colony of *Blaberus*, large tropical cockroaches, and have used their nymphs for food. Unfortunately, few animals seem to accept them and the colony must be maintained in a heated, humid incubator to get good colony growth. Therefore, I was delighted that I was able to obtain crickets in usable amounts on a regular basis. A variety of animals seem to enjoy crickets as food and they do not cause digestive problems. Dusting the crickets with a vitamin and mineral supplement, such as Reptivite, apparently is necessary for some animals since mineral imbalances can develop. Crickets can be obtained from local bait or pet shops and wholesalers, but if large numbers of insects are required, the cost can become a problem. Cricket farms can mail the animals for fairly

low cost but 500 or more crickets at a time can be a problem. Cooperation with a school system, zoo or group of hobbyists can be helpful. We shared part of a regular shipment that came to the local zoo. We kept a few hundred crickets in a screen covered aquarium for two to three weeks until another shipment arrived. It became a simple solution to an important problem.

Lighting

Most fluorescent lights sold with aquaria are not rapid start fixtures and cannot be used with timers. Consequently, one needs to buy rapid start fixtures, which can sit on top of the glass cover. For us that meant we had to build a housing for the fixture since we did not want the bulb to sit on the glass. Once that problem was overcome, the lights were plugged into a timer and left to run by themselves.

The quality of light is also very important. It is only recently that people have come to appreciate the need for natural sunlight for organisms to lead healthy, reproductive lives. Vita-Lite, manufactured by Duro Test, claims to be the only patented sunlight-simulating fluorescent lamp. These lights are available in pet stores and from local Duro Test distributors. They seem to be a good investment.

The covers on the tanks were standard aquarium covers made of two pieces of glass, one that slides over the other, and a plastic piece, which can be cut for air hoses, etc. We had four two-inch holes cut in the rear piece of glass. We glued screen to the bottom of each hole so the glass discs could be reinserted into the holes. These, as well as different amounts of watering, we used to control humidity.

The development of landscapes from styrofoam worked well in the terraria. There seemed to be no reason why it might not also work in an aquarium. Next time I'll tell you about my adventures with aquaria. If you know of less expensive or better ways of making these kinds of exhibits, please write.