The Basics of “Bio-Active”: What Are Bio-Active Enclosures, And How to Build One!

By Eric Roscoe

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Materials and Supplies Needed:

1. Suitably sized glass, plastic, or other material front opening, or top opening enclosure of any brand, model, and size, or dimensions, depending on the species, or groups of animals intended to be kept.

2. Multiple pieces of driftwood and/or cork bark for basking, climbing, and hiding opportunities.

3. One or more bags, blocks of suitable top substrate, depending on the species being maintained. These top substrates can include, but are not limited to: organic topsoils, orchid bark, compressed coconut fiber or cypress mulch blocks, peat moss, sphagnum moss, compressed sands, or even activated carbon/charcoal. Commercially available Leaf litter bags can also be used as an additional layer of top substrate as well.

4. Large bottle of Gorilla Glue, or similar types of glues.

5. One or more live and/or artificial plants to be added to the enclosure. *See “Using Live Plants in the Terraria” Educational Article for many different choices and options for plants which can be used.

6. Overhead heating and lighting hood or fixture; Including suitable overhead lighting and/or heating, or fluorescent bulbs for your enclosure, depending on the species or animals maintained as well as size and dimensions of the enclosure.
6. Species-appropriate or dependent water bowl, water source, and/or plastic cups for water and hydration.

7. One or more bags of Lava Rocks, Porous Clay Balls, Growstone, Pebble Rocks, or other similar types of substrates. This will serve as the enclosure’s drainage layer, or “false bottom”.

8. A Cleanup Crew! This will depend on the overall enclosure and setup, species or animals being maintained, and each of the individual or overall needs and requirements for maintaining the selected bioactive setup. Can include springtails, isopods (or pillbugs and sowbugs), earthworms, millipedes, certain roaches, and/or various beetles and/or their larvae.

9. Silicone, Foam Expanding or Cork Background Fitted to the Enclosure (*Optional).

10. Temperature and Humidity Monitoring Equipment (i.e. digital indoor-outdoor thermometer, infrared thermometer, hygrometer/humidity gauge, etc.)

11. 1 piece Drainage guard (window or screen mesh, or other materials) cut to size of floor-space of the enclosure.*Optional if a “false bottom” is used.

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What Are Bio-Active Enclosures?

One of the recent trends and developments within herpetoculture, or the reptile and amphibian hobby and industry, as well as within the overall pet industry, have been the development of “bioactive”, or more naturalistic vivariums and enclosures for these animals. Reptile keeping has continued to grow in interest among amateur and professional keepers and hobbyists alike, and many questions as to providing the proper enclosure and overall setup for one’s reptile or amphibian are often asked.

So just what exactly are “bioactive” enclosures or setups, why are they all the rage nowadays, and what might be some of the pros and cons to maintaining a bioactive enclosure or setup? To basically define the term, a ***“bioactive” enclosure can be any self-contained, self-sustaining ecosystem and environment able to house and maintain a variety of animals, plants, fungi, invertebrates, and/or other micro-organisms, all of which can play their own roles in these overall environments.*** The term “bioactive” was most likely coined at some point during the mid 1990’s when some dart frogs began to be housed utilizing springtails and isopods in the Atlanta Botanical Gardens Mix using leaf litter and other organic material to provide a self-cleaning, and self-sustaining ecosystem within these animal’s environment, but at the time, was much less easy to replicate and much less widely known and available. Until in more recent years.

Perhaps one of the most defining characteristics of a “bioactive” enclosure are the presence of one or more “cleanup crews” within the enclosure, as well as the use of live plants. These cleanup crews not only can provide a self-sustaining food source for your reptile or amphibian, but they also can help break down and consume feces and other wastes within the enclosure, converting them to more valuable nutrients for live plant growth, while also eliminating, or at least greatly reducing the need to clean up after your reptile or amphibian by hand.

The environment and setup one chooses for a bioactive enclosure should still replicate the specific needs and requirements each specific species may reside in, or encounter while living in the wild, which are reasons why it is still very important to know the overall natural history and habitat of the animal or species being maintained. The overall goal for maintaining a successful bioactive setup entails achieving a balance between the habitat’s or enclosure’s inputs and outputs. While the initial costs, labor, and efforts needed to setup a bioactive enclosure in the first place might seem daunting, once all of the right supplies and materials have been gathered, and the enclosure has been properly set up, maintaining such enclosures can become much more relatively easy and less time consuming afterwards once they

become more self-sustaining.

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Pros to Bioactive Enclosures:

-Can be much more aesthetically and visually pleasing than other types of enclosures or setups, once completed. They can become a small piece of nature in one's living room or household!

-Can make regular cleaning and enclosure maintenance much easier, more self-sustaining, and efficient, with the use and addition of both live plants and one or more "cleanup crews".

-Bioactive enclosures are a must, or are at least much more highly recommended for some groups of smaller animals, such as many small, terrestrial and arboreal frogs and toads, many arboreal geckos or other small lizards, small terrestrial lizards, and even some species of arboreal snakes, or smaller terrestrial snakes.

Cons to Bioactive Enclosures:

-Initial costs, setup, planning, and level of effort and knowledge may be more involved, at least initially than it may be in utilizing other types of enclosures or setups.

-Species selection may not always best favor the use of a bioactive setup in terms of environmental parameters some groups of animals require. Some species require too dry or arid of environments for the decomposers, or “cleanup crews” to be maintained.

-Bioactive setups may also not be suitable choices for all groups or species of animals, due to their larger space or enclosure requirements, and/or their more destructive natures when it comes to all but the most sturdily planted or secured bioactive setups (i.e. most chelonians, or turtles and tortoises, most mid-sized to larger lizards, and many larger, more active, or heavily bodied snakes). Similarly, waste outputs of larger animals can still be too large for “cleanup crews” to efficiently manage.

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Step 1: Selecting the Proper Enclosure

When it comes to setting up a bioactive enclosure, the first, and most obvious step and component is having and selecting a suitable enclosure for the animals to be maintained. There are a number of different types and materials for enclosures which work for bioactive setups; however, any enclosure selected should generally be sturdy and durable, and be able to tolerate wet or damp conditions over long periods of time without molding, sagging, or warping. Visibility provided by the enclosure may also be a desired consideration. The enclosure dimensions you will use and select depend greatly on one’s needs, as well as on the particular species being maintained.

Oftentimes, a front, or top opening glass enclosure, or similar, such as ones manufactured by all of the larger reptile brand companies (i.e. ZooMed, Zilla, and ExoTerra), can work well for, and are

manufactured specifically for naturalistic and bioactive setups. Other types or materials which can work, can include plastic or fiberglass enclosures, or custom built enclosures as well. Another factor to consider with the enclosure, is that it must generally be deep enough for a drainage layer and/or at least several inches of a top substrate. A larger enclosure size than might otherwise be provided with other types of enclosures, might also be considered.

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Step 2: Add a Drainage Layer to the Enclosure (*Optional, but Recommended)

The next step, once a proper enclosure has been selected, will be to add a drainage layer to the enclosure. A drainage layer in the enclosure will help ensure that the bottom layers of the top substrate do not become waterlogged, and end up promoting *unwanted* bacterial and/or fungal growth. This layer will help aerate the top substrate above it, and preventing it from becoming anerobic, or otherwise stale and lacking adequate oxygen flow. This layer is also usually where the “beneficial” bacteria and other micro-organisms reside, which help aerate the above soil layers. Then add at least ½” of water to the drainage layer to add necessary moisture. This bacteria also breaks down the ammonia in the animal’s waste products. This ammonia is then converted by the bacteria into nitrites, and then into nitrates, which are then rea-absorbed by the plants.

There are several different types of drainage layer substrates, or “false bottoms” which are widely available commercially that can be used, including Gravel, Lava Rocks, Porous Clay Balls, Growstone, Pebble Rocks, or similar substrates. Add anywhere from 1 to 4 inches of a false bottom substrate, but use care not to accidentally crack the bottom of the enclosure if a glass enclosure is being used. One can make the layer flat, or add terrain to the false bottom layer, by adding small mounds, depressions, or other features. Feel free to get creative with features and designs!

Once a false bottom substrate has been put into place, add a piece of window screening, or similar material on top of the drainage layer. This will prevent top substrate from falling down into, or lodging itself into the false bottom substrate.

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Step 3: Add Your Choice of Top Substrate to the Enclosure

Once step 2 has been completed in putting the drainage layer in place in the enclosure, a top substrate can then be added to the enclosure! This substrate will often depend on the animals or species being kept, as well as the needs and requirements for maintaining the bioactive setup. However, compressed and expandable blocks of cypress mulch, coconut fibers and husk, sphagnum moss, and some compressed sands are generally some of the most commonly available forms of top substrate available for bioactive enclosures.

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Generally add anywhere from 1 to 3 inches of top substrate in most cases for bioactive setups, but be sure not to use too much top substrate. Doing so may increase the weight of the enclosure without also providing much further benefits. Some top soil substrates can also produce excess dust when used in larger amounts as well. Leaf litter can also be used as an additional layer of top substrate as well.

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Step 4: Add the Live Plants!

Step 4 entails adding at least one, or preferably more, live plants to the enclosure. Live plants are an essential component to a bioactive setup, and there are hundreds of different species and options one can choose; don't be afraid to do more research and try as many different plants as are recommended! However, only ones which are suitable for the specific habitat or environment you are creating need to

be selected. Generally, plants which stay relatively small and do not overgrow, thrive in relatively low light, and can tolerate wet and damp conditions make for good bioactive setup plants. Plants which are also safe and non-toxic or otherwise not harmful to reptiles, amphibians, or other animals, should they be intentionally or accidentally ingested or eaten, or should they into contact with the inhabitants.

Different plants can also have different ways they can be installed, as well as different ways or methods of growth. Some plants can be installed right in their pots, while others can be transferred directly into the substrate. Some plants have the tendency to be “creeping”, along the tops and/or sides of the enclosure, while others have more typical growth. Different plants with different methods of growth can provide additional, unique hiding and enrichment opportunities for animals in the bioactive setup!

One type of plant which almost always makes for a good, aesthetically pleasing bioactive enclosure plant would be the Pothos. However, many more options also exist! For much more information on using plants in naturalistic and bioactive enclosures, and which specific ones all may be used, be sure to also check out the **“Using Live Plants in the Terraria”**!

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<u>Step 5: Choosing Your Lighting and Heating Equipment</u>

Step 5 will entail sufficiently and appropriately choosing your lighting and heating supplies and equipment for your naturalistic or bioactive enclosure. There are many different products and types, or forms of lighting and heating which are widely available. However, selecting the ones that are most suitable and appropriate for not only the animals or species being maintained in the bioactive enclosure, but also for any of the specific species or types of live plants as well, for their optimal growth. In any type of enclosure or setup, providing and maintaining a species appropriate thermal gradients, or opportunities for the animal to warm up or cool down by selecting the areas of the enclosure where it

wants, or needs to be, are key recommendations.

Your decisions on choosing lighting and heating for the bioactive setup largely influence one another, as most types of lights can also elevate the temperatures of the enclosure to at least some degree or another. Typically, for most bioactive setups, it may be best to select the best types of heating products for the enclosure first, and then developing or adding the lighting accordingly. Some non-light emitting heating devices which can be used for bioactive, as well as other types of enclosures and setups, can include radiant heat panels, heat cables, or under-tank heating pads. As always, be sure that any animals housed within a bioactive, or any type of setup, cannot come into direct contact with any heating or lighting device. In some cases, a wire or screen mesh guard may be added to these devices for additional protection.

For visible lighting of a naturalistic or bioactive enclosure, a low-heat option, such as LED lighting, or fluorescent lighting, are typically the best options for being able to provide the best outcomes. Be sure the type of lighting used also can provide sufficient UVA and UVB lighting for both the live plants, as well as animals which may require, or at least greatly benefit from it, when used for the enclosure. Using a dual lighting and heating shroud or light fixture overhead, can better accommodate different types of bulbs for lighting and heating, if they are needed.

Step 6: Choose and Add the Water Sources

Step 6 entails choosing a suitable and appropriate water source, or other means of hydration and humidity for your animal(s) within a bioactive enclosure, as well as for the plants, and cleanup crews. This will depend largely on each individual species of animal; many animals will drink water from a standing water bowl or dish. Many others, however, might not recognize standing water, or may otherwise be “scale drinkers”, drinking only the moisture and condensation collected on their scales, and/or on other surfaces in the enclosure or within their environments.

For many species, consider using a hand mister or spray bottle, for misting manually, or installing an additional misting or fogging system to help maintain hydration and humidity in the bioactive enclosure.

Step 7: Choose and Install All Other Furnishings

Now that most of the other primary components are in place for your bioactive enclosure, you can begin to add additional visual barriers and/or decorations and furnishings within your enclosure. These furnishings can help provide additional basking, climbing, foraging, and hiding places for your reptile or amphibian in a bioactive enclosure. However, adding too many other furnishings in the enclosure can reduce visual appeal, and create additional clutter that can be more difficult to clean and manipulate.

Cork bark, driftwood, rock or log hides, real or faux rocks, bones and skulls, seashells, additional live or artificial branches or foliage, and many other possibilities can be used! Be sure, however, to thoroughly clean and treat any objects or items collected from outside, and ensure they are free of any chemicals or pesticides if they are used, to eliminate or reduce the risk of parasites or other *unwanted* micro-organisms in the bioactive enclosure.

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Step 8: Install a Background (*Optional)

Installing a background can be another step in setting up a bioactive enclosure, but is not required. There are many different types, as well as ways and methods of installing a background for your setup. In some cases, a simple adhesive photograph or graphic background can be adhered to the rear and/or sides of the enclosure. However, for something more three-dimensional, several more realistic looking natural materials or surfaces can also be used.

First, coat the wall in which the background is to be attached using an expandable foam. One can make the foam flat, or add some additional creativity to the foam by creating ridges, divots, or other shapes and textures. If any live plants are intended to be mounted on the back or sides, remember to add the compartments or recesses in which the plants can be installed and placed.

Once the foam is dry, add a thin layer of silicone to the entire foam surface. Before this silicone dries, one can add small decorations to it, such as cork bark, or small branches. If further sturdy support and reinforcement is needed, additional expanding foam may be used. After the primary decorations are added, and before the silicone dries, additional coverings giving the background a more natural appearance and texture can be added. Coconut husk, mosses, and/or sand may be used. Then, any other plants or decorations can be added to further complete the background!

Conversely, many materials of commercially available foam or cork bark background may also be used by either adhering them using silicone and expanding foam, or can simple by inserted or removed into place.

Step 9: Add Your "Clean Up Crew"!

The last, and perhaps one of the most important and defining steps to setting up a bioactive enclosure or setup is finally, adding in your "clean up crew"! These "clean-up" crews help break down and recycle wastes in the top soil substrates, which then help add nutrients to the live plants in the enclosure, thereby ensuring that a cycle continues.

A cleanup crew, which are also known as the "decomposers", can be insects or insect larvae, springtails, isopods, fungi, bacteria, earthworms or other annelids, or other micro-fauna or micro organisms which live in and amongst the top layer substrate and furnishings, which help break down and convert wastes and other uneaten food within the enclosure. There are a many number of different species, or types of clean-up crews one can choose and experiment with that can be collected locally, or purchased from any number of a growing array of online or local suppliers, reptile pet specialty stores, or other similar sources.

Do keep in mind, however, that some springtails, isopods, or other "clean up crew" members can be more tolerant of drier, or conversely, more humid and wet conditions, or other soil conditions than others, so there may still be some environmental considerations to keep in mind when best selecting

the decomposers for your bioactive setup. The diversity in springtail and isopod availability for bioactive enclosures alone has skyrocketed in recent years, and has largely become its own niche market and segment within the overall amphibian and reptile hobby and industry!

Optional Step: "Kick-Start" Your Beneficial Bacteria!

One also has the option of waiting for these beneficial forms of bacteria to grow naturally on their own in the drainage layer of your bioactive enclosure, OR, for a faster means of adding these beneficial bacteria to the enclosure, one can consider "kick-starting" introduction of these bacteria through fish aquarium filters. Colonies can be kickstarted by squeezing out the filtration media from existing established filtration. These colonies can then be introduced into the drainage layer of the substrate in the bioactive enclosure.

Congratulations! Your first (or maybe not so) bioactive and naturalistic enclosure and setup has all the components set up, and is ready for your reptile or amphibian inhabitants! Keep in mind that there is far from only "one way" or "one set of materials" one can use to set up or put into a bioactive enclosure, and you can usually to oftentimes tailor or customize your own depending on whatever your preferences, needs, or desires may be.

While this tutorial was only an introduction to setting up a basic bioactive enclosure, there are many other landscaping or large scale changes or modifications one can also make with your next bioactive enclosure once the basics are learned and understood. Create a waterfall or other "macro feature" for your next setup! Or perhaps add even more types of plants for your next one! There are so many more cool things which YOU can do with YOUR bioactive enclosure! Make your bioactive enclosure not only visually and aesthetically pleasing, and suitable for your plants and animals to live in, but also, ultimately, "your own"!