

Fresh Façades for Rodent Homes: Revisiting Enrichment...Naturally

*Imagine that you are choosing a place to stay for the ideal anti-stress vacation. You have had a hard week at work, and you just want to get away and relax. You could choose a bare bones hotel with just a bed, blank walls, and a toilet, but such minimalist surroundings might **add** to your stress, not take it away! Instead you decide on an all-inclusive beachfront resort, where there is a luxury spa, the rooms have flat-screen televisions and Jacuzzi tubs, and the staff caters to your every whim, because that hotel will provide a more entertaining and pleasurable experience.*

Laboratory rodents live day after day in environments resembling that first hotel. There are no amenities and no activities for these animals; they are simply given food, water, and a place to sleep. This type of caging environment maximizes efficiency for the laboratory facility, minimizing cost and time needed for upkeep, but the collateral damage appears in the animals themselves. Barren cages raise stress levels, reduce brain function, and even alter normal physiological cycles, causing the animals to be active when they should be sleeping. These consequences of standard laboratory caging not only hurt the animals but also the research itself. Artificially high stress levels and abnormal behaviors can influence research results to the point where they barely resemble the results gleaned from a healthy animal.

To remedy this issue, researchers use environmental enrichment: devices or materials that allow animals to perform the behaviors they would in the wild. Providing enrichment—such as softer bedding, a running wheel, multiple types of nesting material, and a hut for climbing

and hiding—has proven to be effective for reducing anxiety and increasing cognitive functioning in laboratory rodents. Even this enrichment, though, is effective only to a point. After all, imagine if instead of soaking up the sun and frolicking in the surf on a beach in Jamaica, you had to swim at an indoor pool, where sand is replicated using bits of gravel and artificial waves simulate the natural movement of the ocean. It just wouldn't be the same as *really* laying on the beach, surrounded by palm trees. Currently, enrichment consists of a variety of plastic toys to promote natural behaviors, but why use artificial devices when you could use natural materials like the animals experience in their native environment? It only makes sense that natural enrichment devices would be even more effective at reducing stress than synthetic ones.

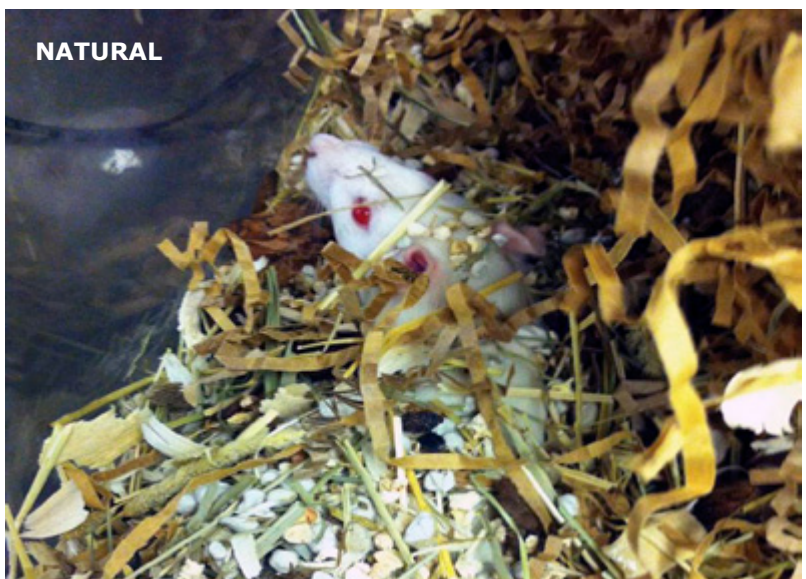
Of course, we are not able to exactly reproduce a laboratory animal's true environment as if it were living in the outside world, but our goal was to get even more creative and bring a little of the outside in—and so we did. We set out to test the effects of three different caging

Continued on page 10

environments for laboratory rats: standard, synthetic, and natural. Would one environment prove better than another? Would synthetic and natural be equivalent? Would natural be worse? These were some of the questions we set out to determine. We needed to know if we were making a helpful contribution to animal welfare. Thus we began the process of housing development, receiving all of our IACUC appropriate permits and zoning regulations along the way.

With those ideas as blueprints, we went about constructing our rat community. The first housing block showcased basic models outfitted with a standard laboratory setup consisting of corncob bedding and a cardboard tube—relatively unexciting for animals that naturally burrow, climb, and forage, but very affordable starting homes for first time buyers. Our second subdivision featured additional laboratory amenities such as plastic devices, ripped paper, and cotton bedding, all of which are often used for environmental enrichment. To complete the housing development, our third complex utilized more eco-friendly living quarters. These homes had similar upgrades, except they were made of wood instead of plastic, alfalfa to supplement the ripped paper, and extra layers of natural bedding (wood pulp, wood chips, and straw). To top it all off, unlike most homeowners associations, we provided utilities whenever needed for all three tiers.

This design truly encouraged the animals to be themselves, allowing the rats to enjoy the enrichment whichever way they desired throughout their housing experience. We analyzed their behavior through a number of methods, and though no individuals were bound by contract, we saw very little disagreement from our rodent clients. The first evaluation was a measure of spatial memory, allowing the rats to make successive choices



to determine if they remember the previous choices they made.

There's more to discover in previously un-chosen maze segments, and so alternation between choices suggested memory of prior trials. The second evaluation measured overall anxiety and exploration levels, where each animal was placed in an open arena and allowed to explore. Since rodents cling to walls as a safety mechanism, if they stayed close to the walls of the arena, they were considered to have higher anxiety. Additionally, if the rats moved around to a higher degree, they were considered to have increased exploratory behavior. The last evaluation was a measure of activity, where each animal was allowed to run on a wheel for 15 minutes and the number of rotations of the wheel was recorded. Exercise is an important part of a healthy lifestyle, and thus activity is a crucial measure of well-being. By using a combination of different evaluations, we were able to assess if and how enrichment had any beneficial effect. Simply through the nature of these tests we were also able to offer attractive perks to the residents, including open spaces, an exercise room, and memory games. We support interactive communities.

After our guests completed their evaluations, their feedback yielded some interesting information. The memory test showed that living in the natural environment significantly improved perception and information storage over non-enriched and synthetically enriched rats. Even more interesting is that the synthetic enrichment did not have any beneficial effect whatsoever. The test of anxiety showed the same result, with the natural environment emerging as the clear winner for least stress. So it seems that even in the lab, going green is the new trend. Synthetic enrichment did significantly increase exploratory behavior during the first few days of



testing, but the effect faded over time, with natural enrichment showing the greatest increase in exploration. Lastly, though the activity wheel showed no significant differences between housing groups, the data did show slight increases in activity for animals living in the natural setting. What can we say? Exercise isn't always popular.

From these three tests it appears that our initial assumptions were correct: you get what you pay for! Two out of three basic evaluations clearly

showed that a natural environment is the optimal choice, extending benefits not only for the animals but for the experimental results as well. Even the activity wheel, though not always the popular choice, showed similar trends despite a lack of statistical significance. We believe that this effect may largely be the result of the luxury bedding materials added to the natural caging environment; with more layers of bedding, the rats were able to practice their natural burrowing instinct, not to mention get an incredible night's sleep. Surprisingly, in most cases, we observed that synthetic enrichment did not provide any noticeable benefits, which is very different from what we expected to see, since this type of enrichment has proven to be beneficial in the past. This is a classic case of modern construction versus natural design. Our evaluations demonstrate that even the most common enrichment devices fail to provide the animals with necessary stimuli. The plastic devices we used are the same ones used in many major laboratory facilities worldwide to decrease stress levels and enhance exploration and cognition. If this enrichment truly is not helping to accomplish that goal, then standard enrichment protocols may have to be reviewed and modified. Using natural materials instead of synthetic devices could be the key to effective environmental enrichment. Without it, scientific research may pay the price. Be sure to make an appointment with your natural enrichment realtor soon—you may be pleasantly surprised.