

Science Education Collection

# Anxiety Testing

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## Abstract

Anxiety is a commonly observed behavioral disorder that stems from fear. It is described as increased restlessness, or unpleasant feelings of fear over anticipated events. Experimenters often use rodent models to better understand anxiety disorders in humans. They use different paradigms, like exposing rodents to bright spaces or loud sounds, which are known to induce fear. These tests combined with other interventions such as surgery or drug-administration may assist researchers in pinpointing the neurobiological basis of anxiety disorders.

This video begins by providing common principles behind variety of anxiety tests. Then, two specific protocols, the Successive Alleys Test and the Hyponeophagia Test are discussed in detail. Lastly, variations of anxiety testing in rodents and humans will be explored.

## Transcript

Anxiety is one of the most commonly observed behavioral disorders, and therefore researchers are particularly interested in learning more about it.

One way scientists can accomplish this is by testing for anxiety in rodents using a variety of experimental setups, which can help them tease apart the neuroanatomical structures and pathways involved in this disorder.

This video provides a brief overview of the principles behind a variety of anxiety tests, and then discusses protocols for two of these paradigms. Lastly, we'll also explore a few current experiments involving anxiety testing in rodents and humans.

Let's begin by discussing principles behind anxiety tests. Normally, humans experience anxiety in certain situations, like while giving a speech in front of an audience. The fearfulness that we experience as part of anxiety is mainly mediated by the amygdala region in our brain.

When anxiety becomes elevated or persistent, it results in a variety of disorders, such as generalized anxiety disorder, panic disorder, and phobias. Thus, scientists are trying to better understand the basis of anxiety, so that these disorders can be treated more effectively.

To better understand these conditions in humans, researchers often test anxiety in rodents. Most tests capitalize on rodents' natural dislikes, which are similar to those of humans. For example, certain experimental setups, like the elevated plus maze or the successive alleys test, force rodents to be high above ground, inducing the fear of heights. Other tests, like the light-dark transition test or the open field test, involve exposed or bright spaces, which are aversive atmospheres for mice, and anxiety inhibits their exploration of these areas. Designs like the hyponeophagia test and social interaction test examine a rodent's tendency to reach for a positive reward, such as food, or interact with other rodents despite being in an unfamiliar environment. Lastly, loud noises, which induce a "startle" response, can also be used to test anxiety in rodents. Therefore, a battery of anxiety behavioral tests, each with a different basis, are at the disposal of behavioral science researchers today.

Now that you have some understanding of the principles behind different anxiety tests, let's go through the procedure for one of them called the successive alleys test.

Like its name suggests, this set-up involves four alleys that are successively connected, and raised high off the floor. All of these alleys are not the same width, they get narrower. In addition, the heights of the walls around the alleys are incrementally shorter. The apparatus is designed so that the narrowest alley is also the one with the shortest walls. To test anxiety, a rodent is first introduced into the alley with the highest walls. Then, the rodent is allowed to explore, and the amount of time the animal spends in each of the four different alleys during a session is recorded. If a rodent tends to spend more time in higher-walled regions, it indicates anxiety-like behavior.

After discussing a test based on the fear of heights, let's look at a paradigm called hyponeophagia, which involves rodents exploring an unfamiliar environment.

The "new" environment required for this test can be an open space or a small, confined container, like an inverted measuring cup. Vital to this experiment is a food source that rodents would find tasty. The idea is that the novel environment will induce anxiety in a rodent, preventing it from immediately eating the food that it would otherwise start to eat almost immediately.

Prior to this procedure, a rodent is food-deprived. This is a necessary step in the protocol, because researchers want to make sure that the rodent is not eating because of anxiety, not because it's full. After food deprivation, the next day the animal is introduced into the new environment, in which the tasty food has also been placed. Researchers then record the time a rodent takes to start eating. The latency to eat food in this novel environment defines anxious behavior-the greater is the latency, the higher the anxiety.

Now that you know about some of the protocols to test for anxiety in rodents, let's look at some of the current experiments in the field using different behavioral approaches.

As mentioned before, social interaction settings can be used to test anxiety in rodents. Here, researchers introduced mice into a new social situation to evaluate anxiety. They placed a mouse that could wander freely alongside a caged mouse, and recorded how much the mouse interacted with its caged counterpart. An anxious free rodent will tend to avoid any social interaction with the caged animal, and may also demonstrate increased obsessive behavior, such as grooming. In this particular experiment, scientists also demonstrated that a gene mutation affected anxiety behavior in this social interaction paradigm.

Researchers also test anxiety in rodents by exposing these animals to unpleasant stimuli, such as loud noises. This is the premise of the acoustic startle test. Here, rodents are placed in a chamber and exposed to a loud sound, such as a buzzer; this provokes an involuntary "startle" response. Equipment within the container can gauge the "amplitude" of the startle response. If the reaction of a certain rodent model to the noise is more pronounced compared to wild-type animals, then this may be an evidence of increased anxiety.

Finally, in addition to testing anxiety in rodents, some scientists are actively studying anxiety in humans as well. Here, researchers adopted and modified the acoustic startle test for human subjects. Scientists paired a set of pictures with a loud noise, which was followed by a mild electric shock for some of the subjects. The idea is that these stimuli could induce anxiety in humans by creating "anticipation" for a painful experience. Researchers then evaluated subjects' startle responses following noise exposure to determine their anxiety level.

You've just watched JoVE's video on testing anxiety. This video reviewed principles and protocols of different methods that researchers use to evaluate anxiety. We also explored how scientists use these tests to evaluate different facets of this commonly observed behavioral disorder. As always, thanks for watching!