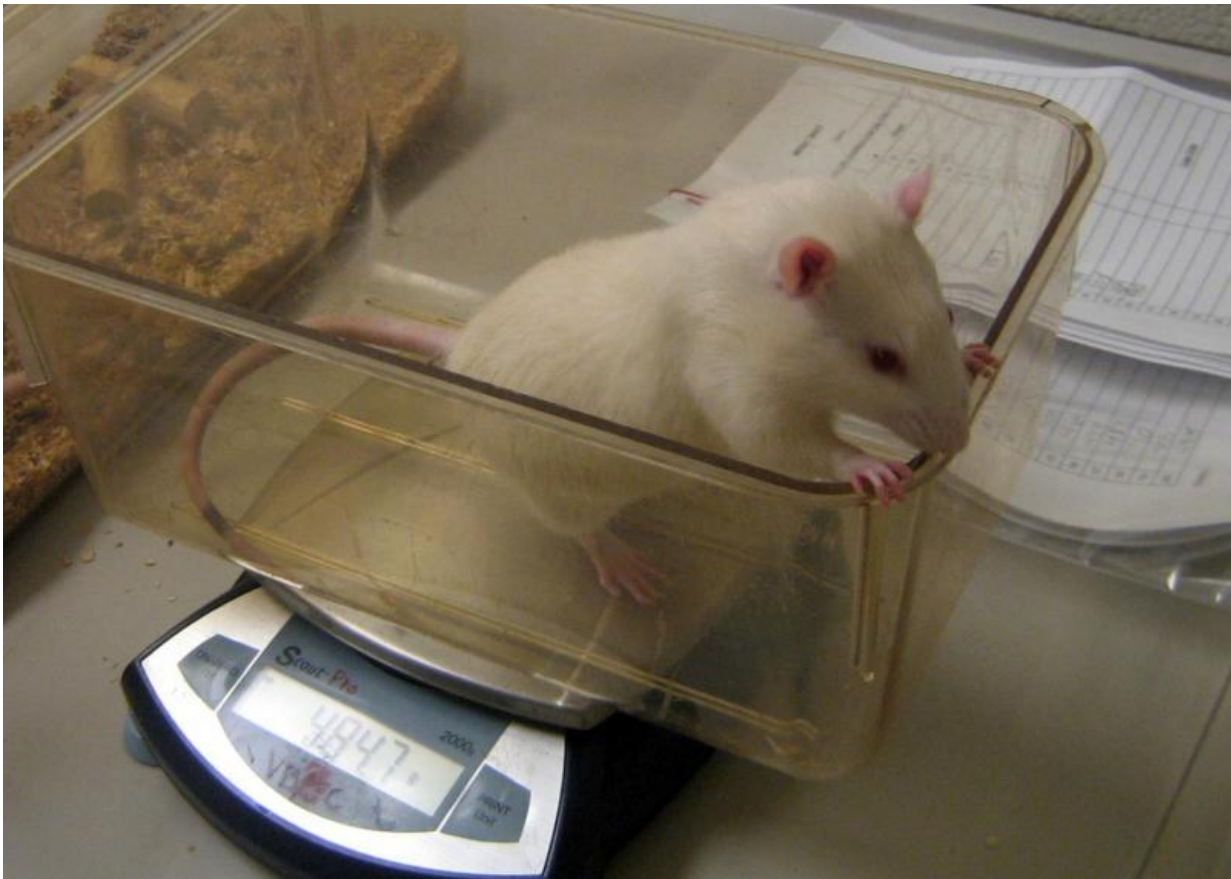


Stress in adolescence prepares rats for future challenges

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Mouse being weighed. Credit: Lauren Chaby/Penn State

Rats exposed to frequent physical, social, and predatory stress during adolescence solved problems and foraged more efficiently under high-

threat conditions in adulthood compared with rats that developed without stress, according to Penn State researchers. The results may provide insights into how humans respond to adolescent stress.

"Even though the stressed [rats](#) were really run through the gamut, they do not come out with an overall cognitive deficit," said Lauren Chaby, Ph.D. student in neuroscience and ecology, Penn State. "What they do have is this context-specific performance that's linked to the environment that they experienced during adolescence."

Researchers are interested in the effects of maltreatment and adverse environments during human adolescence, but this can be difficult to study. Chaby turned to rats to investigate this question because it is unethical to manipulate [stress](#) in humans and rats have a short lifespan, allowing her to study long-term effects more efficiently. She exposed adolescent rats to a range of unpredictable stressors, including smaller or tilted cages, social isolation or crowding, and predator scents or vocalizations.

"Unpredictable stress can have dramatic and lasting consequences, both for humans and for free-living animals," said Chaby. "Unpredictability is part of what can make stress so toxic. You don't have control over your environment, you don't have control over what's going to happen next, you're not able to predict it. So we tried to use a range of stressors so the rats couldn't predict which stressor was going to come next."

The researchers then tested adult animals to see if there were lasting effects of stress in adolescence. But Chaby noted that many studies investigating the consequences of stress during early life or adolescence test adult animals under standard conditions. Standard conditions usually reflect a safe environment—little noise or external threats and dim lighting that is preferred by these nocturnal rats.

"So you have this relaxed situation that they're trying to solve these tasks in," said Chaby. "But this isn't really fair, since some of the animals are used to this and some of the animals aren't. So we wanted to test them in conditions that were consistent with their rearing conditions to see if that impacted their ability to solve tasks."

Chaby tested the ability of 24 [adult rats](#) to solve problems while foraging for food under both standard and high-threat conditions—bright light, a taxidermy hawk swooping overhead, and hawk vocalizations. Adult rats then manipulated a variety of novel objects to obtain food rewards. The researchers published their results in a recent issue of *Animal Behavior*.

Under high-threat conditions, adult rats stressed during adolescence started foraging sooner, visited 20 percent more food patches, and obtained 43 percent more food than a control group of unstressed adult rats. These statistically significant results suggest that growing up in a stressful environment can prepare rats for a stressful, high-predation environment in the future.

Surprisingly, previously stressed rats did not show any costs of this enhanced performance. Under standard conditions, stressed rats took significantly longer —17 percent—to visit the first food patch due to initial wariness, but ultimately ate the same amount of food as unstressed rats who began foraging more quickly.

"And that's one of my favorite findings, because I always think that's so cool when you have animals that are doing things in two different ways but are coming to the same performance outcome," said Chaby.

There may still be a cost of this enhanced performance that occurs over a longer period of time, noted Chaby. For example, they could have a "live-fast die-young strategy."

Chaby hopes that studies like this can help direct how we study adolescent stress in humans.

"I think that addressing this empirically in a model where we have internal control can really allow us to at least understand what questions we should be asking about ourselves," said Chaby.

Provided by Pennsylvania State University

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