

## Asthma medicine shows promise for Down syndrome in mice tests [Updated]

By Geoffrey Mohan

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*[This post has been corrected. See note at bottom.]*

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A federally approved drug already being inhaled by asthma patients may make mice with Down syndrome smarter, according to a new study.

Researchers chose to test the widely manufactured bronchodilator, Formoterol, because it also acts on a brain chemical crucial to memory-based learning.

Earlier research had shown a similar compound successfully stimulated production of that brain chemical, called a neurotransmitter, which then improved neuron formation and cognition in mice that had been genetically altered to show symptoms of Down syndrome, according to Dr. Ahmad Salehi, a Stanford University neurobiologist who led the study, published Tuesday in the journal *Biological Psychiatry*.

Researchers focused on a region of the brain that helps integrate memories for “contextual” learning.

“If you go to a shopping mall, you don’t just remember where Starbucks is because of where it is located,” Salehi said. “You remember the sound; you remember the light; you remember the passersby. All these together help you to build some kind of contextual learning. This is the main role of the hippocampus.

**[VIDEO: "Loving Louise": A woman with Down's syndrome celebrates her 50th birthday.](#)**

The hippocampus, however, can’t perform that kind of calculation without norepinephrine, a neurotransmitter supplied to it by the locus coeruleus, another target of the study.

“That area undergoes significant atrophy and shrinkage in people with Down syndrome,” Salehi said. “This area is the sole provider of norepinephrine for the whole hippocampus.”

When the researchers examined the brains of mice that had received formoterol, they found that new neurons produced in the hippocampus were surprisingly robust, with thousands of branches that give the neuron far more ability to connect with other areas of the brain. (Those mice also had performed better in field tests that rely on memory-based learning.)

“You have a ginormous number of spines and these ginormous number of spines enables you to build complex contextual learning,” Salehi said.

Alberto Costa, a neurobiologist at Case Western Reserve University in Cleveland, has seen similar changes in neuron function in the same mutated mice, using an antidepressant that works on a different neurotransmitter, serotonin. He called Salehi’s study “well conceived and well carried out.”

Any revelations about Down syndrome are expected to carry implications for those suffering from Alzheimer’s disease.

“We know that every person with Down syndrome will show pathology absolutely similar to that of Alzheimer’s disease by the age of 40,” Salehi said.

Nonetheless, the experiment was just a “proof of concept,” Salehi cautioned. The dose was far above the quantity deemed safe for asthma use in humans. Before even considering human trials, researchers will have to reduce that dosage and see if its positive effects remain. Still, the path to prescription could be shorter because of the drug’s approval for other uses. Drug companies also could be inspired by the findings to create even better long-acting compounds that influence norepinephrine, Salehi said.

“Making a drug in a lab and taking it into a treatment for people, these days, is going to cost \$1 billion and at least something like 10 years,” Salehi said. “Being approved doesn’t mean it’s a great drug, but at least it’s been studied much more thoroughly compared with other drugs that we have in the lab.”

Caused by a duplicate chromosome, Down syndrome causes cognitive delays, as well as cardiopulmonary problems, the top cause of death among those with the genetic disorder. Medical advances have lengthened and improved the lives of those with Down syndrome, leaving researchers seeking a way to treat cognitive function and prevent cognitive decay in such adults, who now are living into their 60s.

**[Corrected at 11:18 p.m.:** An earlier version of this post misspelled the name of the drug as Formaterol.]