Science Explains Why Meth Addicts Look The Way They Do

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Meth speeds up cell-level fat metabolism, which leads to the accelerated aging of people addicted to the drug. Meth speeds up cell-level fat metabolism, which leads to the accelerated aging of people addicted to the drug.

By now, most of us have seen the shocking before and after pics of people addicted to methamphetamines. Exactly what is happening inside each cell to cause such striking changes to a person's face and body? Meth, scientists from the Italian Institute of Technology and UC Irvine say, causes abnormalities in the fat metabolism of cells and this triggers a rise in a type of molecule which promotes cell death. Understanding this, they say they can prevent the drug's radical effects.

Physical Effects

Users say meth creates a feeling of euphoria along with increased energy and reduced appetite. A psychostimulant, meth is highly addictive despite, or perhaps, because of the fact that it causes profound and long-lasting damage to the brain. Post-mortem studies link the drug to diseases of aging, including coronary atherosclerosis (hardening of the arteries) and pulmonary fibrosis (scar tissue in the lungs). Something is happening at the cellular level to cause these strange physical effects, but what is it?

For the current study, experiments on rats and mice allowed the researchers, in their own words, "to investigate the molecular mechanisms of systemic inflammation and cellular aging related to methamphetamine abuse." Specifically, they focused on the ways meth induces abnormalities of lipid metabolism in select regions of the brain and peripheral organs and tissues. Through experimentation, the scientists observed how meth accelerated "cellular senescence" — arrested cell growth — and influenced inflammation and other processes of cell regulation.

The chemical cascade caused by meth within each cell involves a specific protein, known as nuclear factor kappa beta. Under healthy conditions, this protein helps regulate other proteins that keep our bodies functioning. However, as each individual cell is overwhelmed by meth-induced signaling, nuclear factor kappa beta begins its own excessive signaling, which triggers a dramatic increase in the production of ceramide. Normally, this lipid molecule regulates energy production and nutrient use within a cell, so when it's suddenly amplified, every aspect of metabolism speeds up as well.

"We found this signaling process to be key for advanced cellular aging," Dr. Daniele Piomelli, the Louise Turner Arnold Chair in the Neurosciences at UCI, stated in a press release.

Having identified meth's effects on cells, Piomelli and his co-researchers decided to figure out a possible way to prevent the drug's effects on the body. If we can stop nuclear factor kappa beta, they reasoned, by increasing the body's natural inhibitors of that protein, then we can limit the production of ceramide. This, in turn will prevent the harmful effects of meth — fast-forwarded

cell aging and systemic inflammation.

“These results suggest new therapeutic strategies to reduce the adverse consequences of meth abuse and improve the effectiveness of abstinence treatments,” said Piomelli, who is working with colleagues at the Italian Institute of Technology to create new drugs targeting the specific cellular mechanisms identified in this research.

Source: Astarita G, Avanesian A, Grimaldi B, et al. Methamphetamine Accelerates Cellular Senescence through Stimulation of De Novo Ceramide Biosynthesis. PLOS ONE. 2015.