

Would you like a Merlot with that Big Mac? Compound in red wine stops obesity related memory loss

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Abstract

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The mechanisms by which our environment affects cognition are increasingly yielding to new genomics and epigenetic approaches, providing support for maxim “you are what you eat”. With that culinary theme, we kicked off a new project in the Genetics Graduate Program, a student-hosted **Genetics Journal Club**. Genetics studies at Michigan State University covers a wide spectrum, from neuroscience to agriculture to microbiology, so I decided to focus on a topic that would appeal to many of our Ph.D. students.

Of particular interest in an age of “super-sized” industrial food is the association between obesity in adults and increased risk of dementia (Whitmer et al. 2005; Cournot et al. 2006). Dr. David Sweatt’s neuroepigenetics lab at the University of Alabama Birmingham focuses on determining the molecular mechanism underlying memory. As a genetics student studying the neuroepigenetics of drug addiction, I was interested in sharing his recent article on this topic, foreshadowing our upcoming May 10th Genetics Minisymposium, “The Epigenetics of Animal Behavior” (<https://genetics.natsci.msu.edu/events/symposia/2016-epigenetic-mechanisms-of-animal-behavior>), where Sweatt is an invited speaker.

In Heyward et al. 2016, Sweatt and colleagues demonstrate that after 20 weeks on a high-fat diet, mice display hippocampal-dependent memory impairments. The hippocampus is important for the formation and consolidation of spatial memories. Seeking epigenetic markers that may underlie this effect, they show that this memory impairment was associated with increased DNA methylation and decreased DNA hydroxymethylation at a few gene promoters important for energy metabolism and memory. Importantly, introduction of resveratrol into the diet partway through the 20 weeks preserves hippocampal-dependent memory. Resveratrol is found in red wine, grapes, and chocolate, and may be acting to preserve the memory by activating an important epigenetic regulator, the Sirt1 NAD⁺-dependent deacetylase. The expression of this enzyme was found to be downregulated in hippocampus after consumption of the high fat diet. Resveratrol appeared to restore Sirt1 activity, which may be the mechanism by which the hippocampal-memory was preserved.

Giving us food for thought, certainly before you dig into your next meal, this paper provides the first evidence that high-fat diet induced obesity has an impact on epigenetics in hippocampal neurons. It is still unclear whether the observed effect of dietary resveratrol are mediated through alterations in the

DNA methylation of memory related genes, which would presumably affect their expression. Future studies will have to determine the exact mechanism by which resveratrol is acting to preserve hippocampal-dependent memories without enhancing them. Furthering our understanding of how a high-fat diet can induce changes not only in adipose tissue, but also in other organs, such as the brain, will allow for more treatment development, as there are many diseases also associated with obesity. But for now, just make sure you have a glass of red wine with your next hamburger and fries to keep your memory sharp.

Paula Gajewski is a fourth-year graduate student in the laboratory of Dr. AJ Robison at Michigan State University. She enjoys leading Genetics Program activities (@MSUGenetics), and can be found on Twitter @gajewski_paula.

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