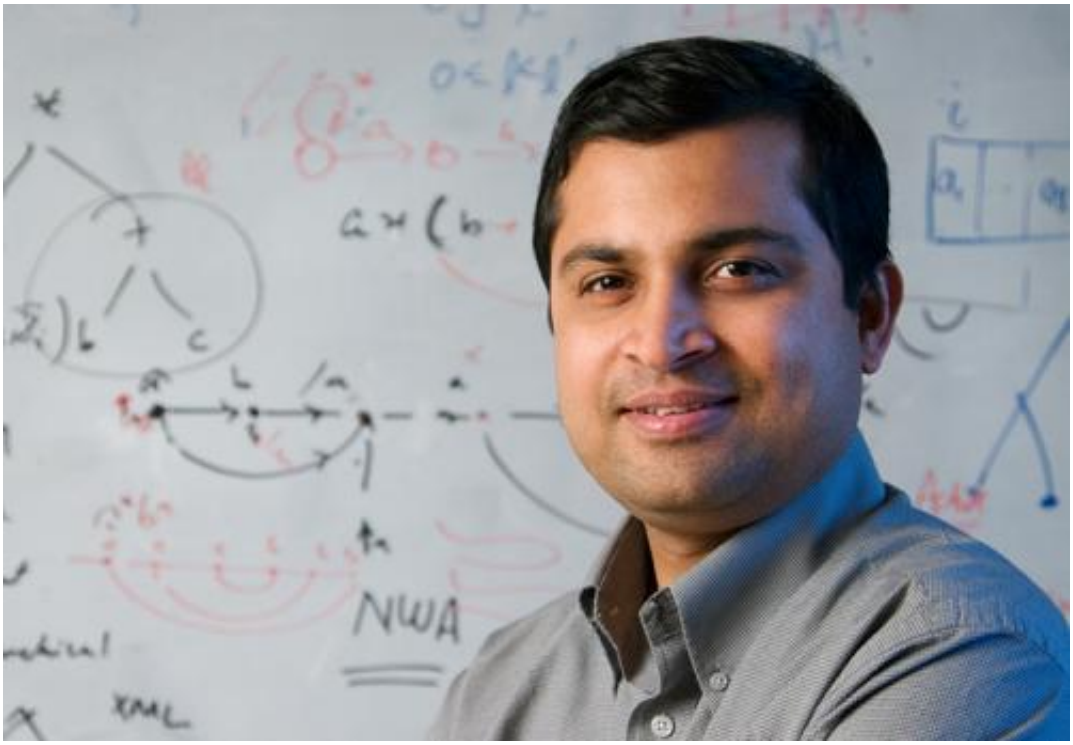
Different species share a 'genetic toolkit' for behavioral traits, study finds

December 1 2014



University of Illinois computer science professor Saurabh Sinha led the computational analysis of gene regulatory relationships conserved across three divergent species. Credit: L. Brian Stauffer

The house mouse, stickleback fish and honey bee appear to have little in common, but at the genetic level these creatures respond in strikingly similar ways to danger, researchers report. When any of these animals confronts an intruder, the researchers found, many of the same genes

and brain gene networks gear up or down in response.

This discovery, reported in the *Proceedings of the National Academy of Sciences*, suggests that distantly related organisms share some key genetic mechanisms that help them respond to threats, said University of Illinois cell and developmental biology professor Lisa Stubbs, who led the research with animal biology professor Alison Bell and entomology professor and Institute for Genomic Biology director Gene Robinson. Bell and Stubbs also are IGB faculty.

"We knew that a variety of animals share genes for some common physical traits. Now it appears that different organisms share a 'genetic toolkit' for behavioral traits, as well," Stubbs said.

The team used comparative genomics to look at changes in brain gene expression in the house mouse (*Mus musculus*), stickleback fish (*Gasterosteus aculeatus*) and honey bee (*Apis mellifera*) in response to intrusion by a member the same species.

"One of the striking findings is that elements of the brain gene-expression response to a territorial intrusion were common to all three species, despite vast differences in brain anatomy among the three," Bell said. "This is meaningful because it suggests that molecular similarities run deeper than brain structural similarities."

All three species saw changes in the expression of genes that regulate hormones and neurotransmitters that are known to influence behavior. Other shared responses involved genes that contribute to brain developmental processes; metabolic genes; genes related to muscle contraction and blood supply; and genes associated with the formation of synapses, the growth of neurons and the differentiation of glial brain cells.

"To find common sets of activated genes, in species that evolved their behavioral responses to intruders hundreds of millions of years apart from each other, gives hope that scientists will be able to make use of comparative genomics to better understand how the behaviors of different species relate to each other, and to ourselves," Robinson said.

More information: Neuromolecular responses to social challenge: Common mechanisms across mouse, stickleback fish, and honey bee, *PNAS*, www.pnas.org/cgi/doi/10.1073/pnas.1420369111

Provided by University of Illinois at Urbana-Champaign