Honey bee genome holds clues to social behavior

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By studying the humble honey bee, researchers at the University of Illinois at Urbana-Champaign have come a step closer to understanding the molecular basis of social behavior in humans.

"The honey bee (Apis millifera) has been called a model system for social behavior," said Saurabh (pronounced SAW-rub) Sinha, a professor of computer science and an affiliate of the university's Institute for Genomic Biology. Using that model system, Sinha led a team that searched the honey bee genome for clues for social cues – a form of bee pressure that can cause bees to change jobs in response to needs of the hive.

"We want to learn how the honey bee society influences behavior in individual honey bees," said Sinha, who is lead author of a paper that will be posted online this week ahead of regular publication by the *Proceedings of the National Academy of Sciences*. "By studying the social regulation of gene expression, we hope to extrapolate the biology to humans."

Adult worker bees perform a number of tasks in the hive when they are young, such as caring for eggs and larvae, and then shift to foraging for nectar and pollen as they age. However, if the hive has a shortage of foragers, some of the young nurse bees will switch jobs and become foragers.

The job transition, whether triggered by age or social cues, involves

changes in thousands of genes in the honey bee brain; some genes turn on, while others turn off.

Genes are switched on and off by short strings of DNA that lie close to the gene. The strings serve as binding sites for particular molecules, called transcription factors. For example, when the correct transcription factor latches into the binding site, the gene may be switched on. If the transcription factor breaks away from the binding site, the gene is switched off.

To search for genes that might play a role in social behavior, Sinha and his colleagues used the newly sequenced honey bee genome to scan the binding sites of transcription factors known to function in the development of fruit flies (Drosophila melanogaster) from a single cell to an adult.

A computer algorithm written by the researchers scanned nearly 3,000 genes. Statistical techniques were then used to investigate whether particular transcription factors correlated with genes that were differentially expressed (turned on or off) between nurse bees and foragers.

"We found five different transcription factors that showed a statistically significant correlation with socially regulated genes," Sinha said. "It appears that genes involved in nervous-system development in fruit flies are re-used by nature for behavioral functions in adult honey bees."

Their findings, Sinha said, suggest that honey bees will be useful in elucidating the mechanisms by which social factors regulate gene expression in brains, including those of humans.

Source: University of Illinois at Urbana-Champaign