Social bees have bigger brain area for learning, memory

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Megalopta bees exhibit a very primitive form of social behavior. Either a bee lives as a solitary queen, going out from her nest to forage for her own food or she can be a social queen -- a stay-at-home mom. Credit: Adam Smith

Who's in charge? Who's got food? The brain region responsible for learning and memory is bigger in social bee queens who may have to address these questions than in solitary queens, report scientists at the Smithsonian Tropical Research Institute who study the tropical sweat bee species, *Megalopta genalis* in Panama. Their study is the first comparison of the brain sizes of social and non-social individuals of the same species.

"The idea is that to maintain power and control in groups you need more information, so the bigger the group, the bigger individuals' brains need to be." says William Wcislo, Smithsonian staff scientist. "This is called the 'social brain hypothesis' also known as the 'Machiavelli hypothesis'."

Previous studies compared brain sizes among social and non-social animals. However, different animal species may be different in so many

ways that it's hard to make a direct connection between brain size and sociality. This study focuses on a single species in which some individuals are social and others are not.

Megalopta bees exhibit a very primitive form of social behavior. Either a bee lives as a solitary queen, going out from her nest to forage for her own food or she can be a social queen--a stay-at-home mom. In that case, one of her daughters goes out to forage for her, so she rarely leaves the nest. Her daughter's ovaries don't develop, and she never leaves her mother to become a queen.

"It was surprising to us that even thought the social queens don't have bigger brains overall, the fact that the area associated with learning and memory--the mushroom body-- was more developed in the social queens than in the solitary bees suggesting that social interactions are cognitively challenging, as predicted by the social brain hypothesis," said Adam Smith, postdoctoral fellow at STRI. "It's interesting to see that a characteristic like brain development changes so immediately, even with this simple mother-daughter division of labor."

This study was done in STRI's new insect neurobiology laboratory, built to take advantage of diverse tropical insect groups with a variety of brain sizes to understand how brain size and behavior are related.

These results, supported by Panama's National Secretariat for Science, Technology & Innovation, the Smithsonian Institution's Scholarly Studies Program, and the F.H. Levinson Fund are published online in the journal *Proceedings of the Royal Society B*.

More information: Smith AR, Seid MA, Jiménez L and Wcislo WT. 2010. Socially induced brain development in the mushroom body of the facultatively social sweat bee Megalopta genalis. Proceedings of the Royal Society of London, Series B.

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