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Brain-phenotypes and pheromone communication in leaf-cutting ants.

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Huge colonies with millions of polymorphic workers and fungus cultivation on collected leaf fragments impressively illustrate how evolutionary derived leaf-cutting ants are. We utilize the polymorphism and trait variations of brain structures to study olfaction and chemical communication in *Atta vollenweideri*. Within the worker caste, we described neuroanatomical phenotypes: Large workers that cut leaves and forage have an extremely large glomerulus in the first olfactory neuropil, the antennal lobe (AL). Many olfactory receptor neurons, which are specific and extremely sensitive to the releaser component of the trail pheromone, all converge in this glomerulus. Small workers have glomeruli all of the same size and the smallest workers show miniaturization and different connectivity within the AL. While the trail pheromone components are well known for many species of the genus *Atta*, very little is known about sex pheromones. Collecting odors in the field before and during mating flights allows us to identify chemicals that may play important roles during the multi-step process of aggregation and mating flight of alates. In order to combine pheromone communication, sensory physiology and the molecular basis of it, we analyzed the antennal transcriptome and identified members of different chemosensory related gene families (IRs, GRs, ORs, SNMPs, CSPs, OBPs). Across AL-phenotypes, several genes are differentially expressed: For example, two odorant receptor (OR) and four ionotropic receptor (IR) genes are highly expressed in males, and one OR gene is highly expressed in large workers. While the highly expressed OR genes are good candidates for sex and trail pheromone receptors, the role of the IRs is still elusive. Our aim is to reconstruct the possible evolution of pheromone communication and associated chemosensory related genes, and our preliminary phylogenetic analysis of the candidate pheromone receptor genes indicates common ancestry of these two pheromone systems.