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*The neuroecology of social organization in the Australian Weaver Ant* Oecophylla smaragdina

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Collective arboreal nest construction and territorial defense have earned the Australian Weaver Ant, *Oecophylla smaragdina*, the reputation of being the 'pinnacle of ant social evolution'. Division of labor between worker subcastes underscores collective sophistication and serves a significant role in weaver ant ecology and social organization. Small minor workers specialize in brood care and larger major workers forage and defend territory when mature. Cognitive capabilities are thus distributed among workers according to their size and age. The impact of division of labor on weaver ant worker social brain evolution is not known, nor is the phylogenetic origin of neurobiological traits associated with their advanced social complexity. We tested the hypothesis that relative investment in neural processing decreases with increased behavioral specialization, and macroscopic neuroanatomy, synaptic organization in visual and olfactory processing regions, and neurochemical differentiation mirror division of labor as neurobiological responses to ecological and social challenges of task performance. Our results suggest that majors invest more in primary visual input regions than minors and increase investment in mushroom bodies, a region of sensory integration, with maturation. Microglomeruli, synaptic complexes in the mushroom bodies, are affected by experience during development: light deprivation leads to synaptic pruning in the visual input region although brood deprivation increases microglomeruli densities in the olfactory input region. Brain octopamine titer is positively correlated with territorial aggression, a prominent behavior of majors. Neuroanatomical comparisons between *O. smaragdina* and a sister clade species *Formica subsericea*, which represents a social phenotype characterized by less social complexity, show differences in investment in sensory systems and integrative regions correlated with their disparity in collective organization. Results support the hypothesis that brain architecture reflects behavioral phenotype and the corresponding sensory and processing requirements of workers, and neurochemicals modulate subcaste-related task performance.