Social immunity – the immune system of the superorganism?

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Living in social groups increases the risk of individuals contracting infectious disease. Whilst not restricted to social insects, this risk is particularly high due to the frequent and intimate social interactions they perform to e.g. feed the queen and brood and to establish a common colony odour. Social insects hence have evolved effective countermeasures to assure nest hygiene, reduce the risk of infection establishing in contaminated individuals, as well as removal of infected individuals if they become a threat for transmitting the disease to colony members. All this is possible by early detection of pathogen contamination and onset of disease, and may even be promoted by the infected individuals alerting their nestmates of their disease state. Similar to the “find me – eat me” signals emitted by infected cells in a vertebrate body attracting immune cells that will finally kill the infected cell, we find evidence that social insects produce chemical cues during the course of infection that induce their elimination from the colony. Signalling disease to others is predicted in both bodies and colonies, where selection acts at the reproductive entity of all cells or members. Hence, kin selection in social insects should promote altruistic self-sacrifice, if infected workers, by their removal, contribute to a higher overall fitness of the colony and hence increase their own indirect fitness. Relatively low cost and high benefits of giving its own live for the group are key characteristics of the superorganismal social insects, where workers are sterile or lifelong unmated, as in ants and honeybees, where we observe detectable cues of disease state. It is less clear, however, how far individuals should alert others to their disease when they can forego personal reproduction and gain fitness by a combination of direct and indirect fitness components, as e.g. in some termites or wasps, as well as in family and group life outside the social insects.