The neural basis of odor-driven behavior in skin-penetrating parasitic nematodes

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My lab studies chemosensory neural circuits in the context of human parasitism. We use skin-penetrating parasitic nematodes as a model system for understanding how parasites use chemosensory cues to locate and infect hosts, and how differences between the chemosensory systems of parasitic and free-living animals enable parasitic behaviors. Skin-penetrating parasitic nematodes are intestinal endoparasites that infect approximately one billion people worldwide and are responsible for some of the most common neglected tropical diseases. The infective larvae of skin-penetrating nematodes are thought to search for hosts using sensory cues, yet their host-seeking behavior is poorly understood. We recently conducted an in-depth analysis of host seeking in the skin-penetrating human threadworm *Strongyloides stercoralis*, and compared its behavior to that of other parasitic nematodes. We found that *S. stercoralis* is highly mobile relative to other parasitic nematodes and actively cruises for hosts to infect. *S. stercoralis* shows robust attraction to a diverse array of human skin and sweat odorants, most of which are also mosquito attractants. The respiratory byproduct carbon dioxide (CO_2) is not attractive for *S. stercoralis*, but is required for parasite development inside the host. Olfactory preferences of *S. stercoralis* vary across life stages, suggesting a mechanism by which host seeking is limited to infective larvae. A comparison of odor-driven behavior in *S. stercoralis* and six other nematode species revealed that parasite olfactory preferences reflect host specificity and infection mode rather than phylogeny, suggesting an important role for olfaction in host selection. Building on these results, we are now elucidating the neural circuitry that mediates odor-driven host seeking. We are comparing the functional architecture of the *S. stercoralis* olfactory circuit to that of the free-living worm *Caenorhabditis elegans* to gain insight into how similar neural circuits support different behaviors, and how the specific features of the *S. stercoralis* olfactory circuit enable human parasitism. Our results may enable the development of new strategies for combating harmful parasitic nematode infections.