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| Title: | Chemotaxis of C. elegans toward unknown bacterial strains |
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| Abstract: | Various types of bacteria play a pivotal role in causing infections in both animal and human populations. This diverse spectrum of microbial organisms underscores the complexity of infectious diseases across different species. Caenorhabditis elegans (C. elegans), a nematode residing in soil ecosystems, serves as a valuable model organism for investigating host-pathogen interactions. Its utilization in scientific research provides insights into the intricate dynamics between hosts and pathogens, offering a platform to unravel fundamental principles of infection biology. This enigma underscores the intricate nature of host-pathogen interplay, necessitating continued exploration to uncover the underlying mechanisms governing these occurrences. For this research endeavor, we gathered a diverse array of bacterial samples randomly obtained from the ecosystems surrounding IISER Mohali. Our hypothesis postulated that subjecting these cultures to antibiotic selection pressure would induce changes in their virulence and biofilm production levels when compared to mixed parent cultures. Moreover, it was anticipated that the worms would demonstrate the clearance of antibiotic-selected bacterial strains while preserving the integrity of their pharynx without any damage. We also expected that certain bacteria could trigger the worms' immune responses early on, which could improve their chances of survival compared to when they consume their regular food, E. coli OP50. This anticipation aligns with the understanding that different bacterial strains can evoke varying responses from the host organism. Moreover, exploring these interactions sheds light on the complex mechanisms underlying host-microbe relationships, contributing to our understanding of immunity and infection dynamics. Understanding these mechanisms could offer profound insights into the intricate interplay between microbes and host organisms, paving the way for novel discoveries in ecological dynamics. C. elegans boasts a sophisticated chemosensory system comprising 302 neurons, which includes gustatory neurons responsible for detecting water-soluble cues, as well as olfactory neurons specialized in sensing volatile substances that either attract or repel. This intricate neural network enables the worm to perceive and respond to a wide array of environmental stimuli, reflecting the remarkable complexity of its sensory capabilities. Understanding the [6]intricacies of this sensory system not only sheds light on the biology of C. elegans but also provides valuable insights into broader principles of neurobiology and sensory perception across diverse organisms. The functionality of these chemosensory neurons is indispensable for various vital tasks, including locating food sources, steering clear of potentially harmful substances, facilitating the development of larvae, and even aiding in the process of mating. Such multifaceted roles underscore the pivotal importance of the chemosensory system in orchestrating diverse behaviors essential for the survival and reproductive success of C. elegans. Positioned within both the head and tail regions, these neurons are intricately organized into specialized sensory structures known as amphids, phasmids, as well as inner and outer labial structures. These sensory organs serve as essential hubs for receiving and processing external chemical cues, enabling C. elegans to navigate its environment effectively. The spatial arrangement of these neurons within distinct sensory organs reflects the remarkable complexity of the nematode's sensory architecture, highlighting the precision and sophistication of its chemosensory system. Understanding the organization of these sensory structures provides valuable insights into how C. elegans perceives and responds to its surroundings, offering a glimpse into the intricate workings of its nervous system. We expected that specific bacterial strains exhibited greater attractiveness compared to the standard E. coli OP50 food source within the initial 1-2 hours of exposure. This suggests that certain bacterial cues may elicit stronger chemotactic responses from the worms, potentially influencing their foraging behavior and dietary choices. Unraveling the factors contributing to these olfactory preferences not only sheds light on the sensory mechanisms governing nematode behavior but also provides valuable insights into the dynamics of host-microbe interactions within the soil ecosystem. Moreover, extended exposure to infectious conditions may led to a decreased aversive response to certain bacterial strains, while concurrently displaying an augmented associative learning response compared to E. coli OP50. This observation suggests that prolonged exposure to pathogens may alter the nematode's behavioral responses, potentially reflecting adaptive changes aimed at optimizing survival in challenging environments. Investigating the mechanisms underlying these altered behavioral responses provides valuable insights into the dynamic interplay between host organisms and pathogens, offering a deeper understanding of adaptive strategies employed in response to infectious threats. In essence, our study delves into the intricate interplay between chemosensory neurons and bacterial signals, elucidating how these interactions 7shape the behavioral adaptations of C. elegans. By unraveling these mechanisms, we gain valuable insights into the nuanced dynamics of host-pathogen interactions, offering a deeper understanding of how microbial cues influence nematode behavior. This enhanced understanding not only enriches our knowledge of fundamental biological processes but also holds implications for pathogen dissemination within host organisms. |
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