

Which aspects of behavior are defined by fixed genetic and developmental programs? How does the brain generate flexible responses to the environment based on context and experience? The nematode *C. elegans* has a small, genetically hard-wired nervous system, yet its preferences for odors, food sources, and other animals vary based on environmental conditions, internal states, and genetic variation. These factors converge on common neuronal circuits. Analysis of the circuits for flexible behaviors shows that highly detailed wiring diagram of *C. elegans* is both incomplete and ambiguous, because modulatory inputs that are invisible in the anatomical wiring can fundamentally change the flow of information.