
Preface

Tractable models such as the nematode *Caenorhabditis elegans* provide profound insight into a wide range of biological phenomena. It is the objective of any scientific effort to understand a natural phenomenon. Considerable effort and ingenuity are dedicated towards developing novel methods and approaches that will enable breakthroughs and progress.

C. elegans has a short life cycle—it matures during three days at room temperature—and is easy to cultivate. Under standard laboratory conditions, hermaphroditic nematodes self-fertilize but mating with males can be induced for experimental purposes. Therefore, genetic manipulations and the maintenance of mutant strains are comparatively simple. *C. elegans* was the first animal to have its genome fully sequenced and to this day, the genome is being annotated with increasing detail and accuracy. Genetic, genomic, anatomical, physiological, and other data are curated in publically accessible databases including Wormbase, Wombatlas, Wormweb, Wormwiring, and Wormbook.

The simple anatomy of *C. elegans* is a key advantage in and of itself. Determining the cell lineage, which is mostly invariant between individuals, enabled fundamental discoveries in developmental biology and the determination of cell fate. Likewise, the nervous system of *C. elegans* is compact—a hermaphrodite has but 302 neurons. This enabled White and colleagues to construct an anatomical map of neuronal connectivity, colloquially referred to as the “Mind of a Worm.” The connectome of *C. elegans*—unique in its near completeness—is being refined since, and updated information is periodically made available to researchers in the field. It provides a powerful starting point for understanding how neuronal and molecular pathways regulate behavior. At the same time, the importance of nonsynaptic pathways is increasingly appreciated.

Novel experimental methods for genetic, cellular, and whole animal manipulations are being developed at a staggering rate. In recent years, reading an entire genome has become cost effective, writing or deleting genetic information in vivo has come to resemble editing text, the properties of optical reporters have improved dramatically, and the diversity of physiological parameters that can be monitored using unobtrusive measures has greatly expanded. Concurrent advances in computation, imaging, microfluidics, and prototyping enable bench-top experiments that were not previously possible. The number of addressable scientific questions scales rapidly with the number of available tools.

The aim of this volume is to provide a step-by-step guide for implementing a selection of these novel techniques in the lab. Each protocol in this volume is presented as a stand-alone chapter, specifically geared towards addressing practical needs without presuming prior knowledge of the technique at hand. We hope this volume can assist in addressing the subset of these questions that most intrigue you.

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C. elegans

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