Molecules and Cells

MiniResource

A practical guide to ordering *C. elegans* strains for biological research

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ABSTRACT

***Caenorhabditis elegans* (*C. elegans*) is a widely used model organism in biological research, contributing to our understanding of fundamental processes in areas such as development, neurobiology, and aging. Accessing the appropriate *C. elegans* strains is crucial for conducting experiments and advancing scientific knowledge. This work provides a comprehensive overview of the process of ordering *C. elegans*.**

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INTRODUCTION

Caenorhabditis elegans is an important model organism widely utilized in the field of biology (Brenner, 1974; Hodgkin and Brenner, 1977; Markaki and Tavernarakis, 2020). They are easily maintained in a laboratory and are genetically accessible, making them valuable models for various areas of study, including developmental biology, neurobiology, aging research, and disease modeling (Kim et al., 2024; Kimble and Nusslein-Volhard, 2022; Sengupta and Samuel, 2009). Understanding these organisms has not only provided crucial insights into the mechanisms underlying complex biological processes at the molecular, cellular, and organismal levels but has also aided in the development of therapeutic strategies in many human diseases (Bizat et al., 2021). Since researchers rely on access to specific genotypes and phenotypes of *C. elegans* to conduct their investigations, being able to efficiently obtain the necessary strains is crucial.

Here, we provide details on how to obtain *C. elegans* strains from these repositories, and we hope that researchers can efficiently acquire the strains needed for their studies.

C. ELEGANS STRAIN REPOSITORIES

The *C. elegans* research community actively contributes to and benefits from the Caenorhabditis Genetics Center (CGC, https://cgc.umn.edu/) located at the University of Minnesota in the United States, a central repository for *C. elegans* strains. Researchers around the world deposit their unique and often published strains at the CGC, ensuring the preservation and accessibility of these valuable genetic resources. The CGC catalogs and maintains a vast collection of *C. elegans* and related strains, including wild-type, mutant, and transgenic lines, as well as *Escherichia coli* strains, along with detailed strain information.

In addition, the National BioResource Project (NBRP, https://shigen.nig.ac.jp/c.elegans/) in Japan holds a wide range of *C. elegans* deletion mutants, further expanding the resources available to researchers (Mitani, 2009). CaeNDR (https://caendr.org/) is another valuable resource that collects, maintains, and shares wild-isolated strains of *C. elegans* and other *Caenorhabditis* species (Cook et al., 2017; Crombie et al., 2024). Thus, researchers can easily access and order strains from these repositories, enhancing the reproducibility, standardization, and robustness of *C. elegans* research. Moreover, researchers often share strains informally through direct requests.

C. ELEGANS NOMENCLATURE

The *C. elegans* research community utilizes a standardized naming system when referencing genes, alleles, and strains. *C. elegans* gene names consist of 3 (or 4) lowercase italicized letters followed by a number (eg, *unc-54*, *ins-1*) (Duret et al., 1998; MacLeod et al., 1977). The 3- or 4-letter prefix indicates the mutant phenotype or gene function (eg, *unc* for uncoordinated, *ins* for insulin-like gene), and the following number distinguishes different genes, often in chronological order of discovery.

The allele designation typically begins with a 1- to 3-letter lab-specific prefix or code, followed by a unique number in lowercase italics (eg, *e190* for the Brenner lab, now the Hodgkin

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lab) (Horvitz et al., 1979). Similarly, strain designations also start with a 2- or 3-letter lab-specific prefix or code, distinct from allele designations, followed by a number in uppercase non-italics (eg, CB190 for the Brenner, currently Hodgkin lab) (Epstein et al., 1986). Typically, each lab registers unique allele and strain designations with the CGC, and the numbering reflects the chronological order in which they were identified or created. Thus, CB190 *unc54*(*e190*) strain indicates that CB190 is the 190th strain from the Brenner (and Hodgkin) lab and carries the allele *e190* of the gene *unc-54*.

For the transgenic animals, such as extrachromosomal and integrated lines, the naming convention typically includes the lab allele code, *Ex* (for extrachromosomal line) or *Is* (integrated line), the number, and the transgene details enclosed in parentheses, describing the promoter and the gene of interest. For example, CB6603 *eIs102* [*egl-5*p::GFP::LIN-45] indicates the 6603rd strain from the Brenner (and Hodgkin) lab, carrying the 102nd integrated transgene, which consists of *egl-5* promoter driving expression of a fusion protein GFP-LIN45 (Huang and Sternberg, 2006).

These naming systems help researchers communicate details about their strains of interest with consistency and clarity. More details about the nomenclature of *C. elegans* resources are available in WormBase—Nomenclature guidelines (https://wormbase.org//about/userguide/nomenclature#l4g39hi210ad6m78efjbkc5-−10).

C. ELEGANS STRAIN ORDERING

To order strains from the CGC or NBRP, follow these steps:

1. **Create an Account**

- Researchers must have a registered account, known as a lab code, which is usually assigned to the principal investigator or research group.
- Visit the CGC (https://cgc.umn.edu/) or NBRP (https://shigen.nig.ac.jp/c.elegans/) website and follow the instructions for account creation and lab registration.

2. **Search for Strains**

- Use the CGC or NBRP website to browse or search for available strains. You can search by strain name, genetic mutation, or WormBase ID. The websites also provide detailed information about the strains, including genotype, phenotype, and references.
- You can also use WormBase (https://wormbase.org) to search for *C. elegans* strains, which provides direct links to the CGC for ordering. However, WormBase does not directly link to the NBRP for *C. elegans* strains.

3. **Select Strains and Place an Order**

- Once you have identified the strains you want to order, add them to your cart.
- Review the ordering details, including any shipping fees or handling costs.
- Complete the order form, ensuring that all shipping information and account details are correct.
- Submit the order via the CGC or NBRP online platform.

4. **Payment and Order Confirmation**

- CGC typically charges a nominal fee for strain handling and shipping. NBRP provides strain shipping options depending on your location. Review the payment options provided on the website.
- Once the order is placed, you will receive an email confirmation with your order details.

Both CGC and NBRP make the ordering process user-friendly, with online catalogs that allow researchers to access comprehensive strain information and easily navigate the ordering system.

Strain Handling Upon Receiving

Upon receiving *C. elegans* strains, proper handling and care are essential to ensure the health and viability of the worms. Follow these steps to ensure proper handling of the strains.

1. **Inspect the Package and Strain Plates**

- Carefully open the package containing the strains, which will usually arrive on small agar plates.
- Check the condition of the plates for any signs of contamination (bacteria, fungi, and mites) or damage during shipping. Ensure that the worms are alive and present on the plate. Often, the worms are starved or in dormant dauer stage.

2. **Transfer Worms to Fresh Plates**

- Transfer the worms (pick a few worms with a sterile platinum wire or chunk out an agar stab with a spatula) to fresh agar plates as soon as possible after arrival. The worms should be transferred to Nematode growth medium plates seeded with *E. coli* strain OP50, their standard food source. Ensure that no contaminants are transferred during the process.

3. **Incubate Plates and Monitor Contamination**

- After transferring the worms, incubate the new plates at the appropriate temperature, usually 20°C for *C. elegans* cultivation.
- Within 2 to 3 days at 20°C, the worms should reach reproductive maturity and be ready for experiments.
- Check the plates regularly for signs of contamination, such as fungal or bacterial overgrowth. If contamination occurs, there are 2 methods for eliminating it. The first method is bleaching. This involves treating the worms with a hypochlorite solution (5% solution of sodium hypochlorite), which kills contaminants. This method can be applied to the entire plate or to a single adult hermaphrodite (Stiernagle, 2006). The second method is to transfer worms to a new plate as quickly as possible to prevent the spread of the contaminant.

Fig. 1. Summarized steps of ordering *C. elegans* strains. First, create an account of principal investigator (PI) or research group in CGC, NBRP, and CaeNDR. You can search for strains of interest by visiting the respective repositories' websites. And review the ordering options and follow each repository's procedures for ordering, shipping methods, and payment. After receiving the strains, check the conditions of the plates and confirm the genotype to ensure it meets your research requirements. By following these simple steps, researchers can efficiently access the *C. elegans* strains required for their investigations.

Note that you should repeat many times until the contaminant is removed.

4. **Check Genotype (Optional but Recommended)**

- If the strain carries specific mutations, it is strongly recommended to confirm both the phenotype and the genotype. If the ordered strain has observable phenotypes—such as behavior, fluorescent markers, or morphology—these should be checked first. Genotyping using PCR, DNA sequencing, or other genetic assays is then required to verify the presence of the desired mutation.
- If the strains were especially isolated from mutagenesis or other gene editing processes, unintended mutations may accumulate in the background genome. Thus, it is recommended to backcross mutant strains with wild-type N2 strain used as the clean genetic background at least 4 to 6 times (Ahringer, 2006).
- Depending on your experimental timeline, you may need to transfer worms to new plates every few days or freeze them for long-term storage (see http://www.wormbook.org/chapters/www_strainmaintain/strainmaintain.html#d0e920).

CONCLUDING REMARKS

Here, we introduce the major repositories and sources for *C. elegans* strains, such as the CGC and NBRP. We also provide details on ordering strains from these repositories and maintaining strains upon receiving the strains (Fig. 1). To ensure the efficient ordering and management of *C. elegans* strains, researchers should familiarize themselves with the available strain repositories and ordering procedures. The availability of well-characterized *C. elegans* strains from reputable repositories enables researchers to focus on their research goals rather than the challenges of strain generation and maintenance.

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AUTHOR CONTRIBUTIONS

Kyuhyung Kim: Writing – review & editing, Writing – original draft, Funding acquisition, Conceptualization. **Yeon-Ji Park:** Writing – review & editing, Writing – original draft, Conceptualization. **Kyeong Min Moon:** Writing – review & editing, Writing – original draft, Conceptualization.

DECLARATION OF COMPETING INTERESTS

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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