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L3 stage C. elegans dissociation for FACS isolation and RNA-seq analysis of intestine-specific cells V.2

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Robert TP Williams¹, Erin Osborne Nishimura¹

¹Colorado State University, Fort Collins

Osborne Nishimura Lab



Robert TP Williams

Colorado State University, Fort Collins

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We use this protocol and it's working

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Abstract

This protocol is for generating a single cell suspension suitable for isolation of intestine-specific cells through Fluorescence Activated Cell Sorting (FACS) from L3 stage *C. elegans*. This protocol utilizes treatment with SDS-DTT solution and Pronase E to disrupt the cuticle. Worms are mechanically homogenized with a dounce homogenizer.



Materials

Strains:

- FACS control *C. elegans* strain, i.e. N2
- FACS sorting *C. elegans* strain, i.e. JM149 *cal/s71*[*elt-2p::GFP::HIS-2B::unc-54* 3'UTR + *rol-6*(su1006)]

Reagents:

L15-10 solution

- Leibovitz's L-15 Medium (Thermo 21083027)
- Fetal Bovine Serum (heat inactivated) (Thermo 10438026)
- 100X Penicillin Streptomycin solution (Thermo 15140148)
- Sucrose powder

Stock solutions for egg buffer

- 2M NaCl
- 2M KCl
- 1M CaCl₂
- 1M MgCl₂
- 1M HEPES pH 7.2

Enzymes

- Pronase E, Protease from *Streptomyces griseus* (Sigma P8811-1G)

SDS-DTT

- 1M DTT
- 10% SDS
- 1M HEPES pH8
- 60% sucrose

Consumables:

- standard 1.5 ml tubes
- Stericup 0.2 micron filter (Fisher S2GPU05RE)
- 20-micron mesh filter (Fisher Scientific NC1004201)
- 35-micron nylon mesh filter caps (Stellar Scientific FSC-FLTCP)
- 5 ml sterile polypropylene round-bottom tube (STEMCELL Technologies 38057)
- Bio-Rad TC20 automated cell counting slide (Bio-rad 1450011)

Equipment:

- Fixed angle rotor centrifuge (Eppendorf 5424)
- Swinging bucket rotor refrigerated centrifuge (eppendorf 5810R)
- 15 ml tube and 1.5 ml tube adapter (eppendorf 022638704, eppendorf 022638742)
- Fluorescent microscope
- Nutating mixer
- Bio-Rad TC20 automated cell counter
- 2ml dounce homogenizer with pestle A (Sigma-Aldrich D8938)

Troubleshooting

Before beginning

1 Prepare reagents in advance

L15-10 Buffer: Mix 500 ml Leibovitz's L-15 Medium, 50 ml Fetal Bovine Serum (heat inactivated), 50 µl of 100x Penicillin-Streptomycin solution and 7.7 g sucrose. Filter with 0.2 micron pore filter. Store at 4°C.

Egg Buffer: Mix 29.5 ml of 2M NaCl, 12 ml of 2M KCl, 1 ml of 1M CaCl₂, 1 ml of MgCl₂, 12.5 ml of 1M HEPES-NaOH pH 7.2 and 435 ml molecular grade water. Filter with 0.2 micron pore filter. Store at 4°C.

Pronase E solution (15 mg/ml): Weigh 150 mg of Protease from *Streptomyces griseus* (Sigma P8811-1G) into a 15 ml tube. Dissolve the enzyme in 10 ml of Egg Buffer. Nutate the solution for approximately 10 minutes until dissolved. Prepare 1 ml aliquots in 1.5 ml tubes. Store aliquots at -20°C.

SDS-DTT solution:

- To ensure treatment efficacy, the SDS-DTT solution is prepared fresh on the day of the experiment. Additionally, several aliquots of DTT powder in 1.5 ml tubes are prepared in advance and stored at -20°C.
- To prepare the SDS-DTT solution, first resuspend 154 mg of DTT powder with 1 mL of Egg Buffer on the day of the experiment. Then, combine the following reagents in a 15 ml tube (final concentrations in parenthesis): 100 µL of 1M HEPES pH8 (20 mM), 125 µL of 10% SDS (0.25%), 1 mL of 1M DTT (200 mM), 250 µL of 60% sucrose (3%), and 3.525 mL of molecular grade water for a final volume of 5 mL.
- The SDS-DTT solution is one of the most important reagents to ensure successful dissociation of post-embryonic worms. To check that the SDS-DTT solution is working properly, incubate worms in freshly prepared SDS-DTT solution under a dissection microscope. When prepared properly, worms should dissolve within ~10 minutes of observation.

2 On day of protocol:

Cool swinging bucket centrifuge to 4°C

Thaw pronase aliquots at room temperature

Place L15-10 and egg buffer on ice

Wash and sterilize dounce homogenizer and pestle A (1ml H₂O, 1ml 70% EtOH)

3 Starting material:

Worm suspension in 15 ml tube (material generated from [this protocol](#))



Strains: N2, fluorescent sorting strain

Perform this protocol on both strains in parallel

Note: The volumes for chemical and enzymatic treatments in this protocol require an L3 pellet less than 200 uL. If L3 pellet exceeds 200 ul, utilize 2x the L3 pellet volume.

Harvest L3 worms

- 4 Harvest the synchronized L3 worms by washing the plates with fresh M9
- 5 Pass the worm suspension through a 20 micron filter. All L3 stage worms will be retained on the filter, while any contaminating worms younger than the L3 stage will pass through the filter. This step will also quickly remove a majority of contaminating E. coli.
- 6 Invert the filter and collect the retained L3 worms into a fresh 50 ml tube
- 7 Transfer the filtered L3 worms to a 15 ml tube
- 8 Pellet the worms in a 15 ml tube for 1 min at 2,000 rcf. Discard the supernatant and repeat M9 washes until the supernatant is free of visible E. coli.

SDS-DTT Treatment

- 9 Once the worm suspension is free of E. coli, centrifuge worm suspension at 2,000 rcf for 1 minute
- 10 Resuspend the worm pellet in 1 ml of M9 and transfer to a 1.5 ml tube.
- 11 Pellet the worms again at 2000 rcf for 1 minute.
- 12 Transfer 10 ul of L1 worm pellet to 1ml of Qiazol and store at -80°C for downstream RNA analysis



- 13 Resuspend the worm pellet in 200 ul of fresh SDS-DTT solution
- 14 Incubate for 2 min room temperature
NOTE:
 - Worms should look ruffled, and pharynx should change from thin and elongated to short and round
 - Incubation exceeding 2 min will damage the sample
- 15 Quench reaction by adding 800 ul of ice cold egg buffer
- 16 Pellet worms at 13,000 rcf for 15 seconds at 4°C
- 17 Decant the supernatant and replace with 1 ml of ice-cold egg buffer
- 18 Repeat the egg buffer wash for a total of 5 washes

Pronase E Treatment

- 19 Resuspend the SDS-DTT treated worms in 200 ul of 15 mg/ml Pronase E
- 20 Incubate for 30 minutes at room temperature nutating to digest the cuticle
- 21 Quench the Pronase E treatment by adding 1 ml of L15-10
- 22 Pellet the worms at 13,000 rcf for 15 seconds at 4°C
- 23 Decant the supernatant and resuspend the worms in 1 ml of L15-10
- 24 Pellet the worms at 13,000 rcf for 15 seconds at 4°C



25 Resuspend the worms in 1ml of L15-10

Cell dissociation

26 Transfer the worm suspension to a 2 ml glass dounce homogenizer

27 Perform 100 strokes with dounce pestle A to generate a worm slurry

28 Visually confirm worm dissociation by viewing a 2 ul sample of worm slurry on a fluorescent microscope

29 Harvest the cells

29.1 Transfer worm slurry to 1 ml centrifuge tube

29.2 Pellet undissociated worms at 20 rcf for 1 minute at 4°C in swinging bucket centrifuge



NOTES:

- This step will separate the dissociated cells from intact worms
- Cells will remain in the supernatant
- Intact and partially dissociated worms will remain in the pellet
- Ensure your cell type of interest is not lost during this step.
- Visually confirm fluorescent cells **are present** in the supernatant.
- Visually confirm fluorescent cells **are not present** in the pellet.
- You may need to reduce the centrifuge speed and/or time if fluorescent cells are in the pellet of this step.

29.3 Aspirate 1 ml of the cell-containing supernatant. Keep the pipette away from the pelleted worm debris.

29.4 Dispense the cell suspension through a 35-micron nylon mesh filter into a 5 ml flow cytometry tube

30 Resuspend remaining worm slurry in 1ml of L15-10



- 31 For the sorting strain, perform an additional round of dissociation and cell harvest (Steps 26-30). You will perform a total of two to three homogenization cycles, until few intact worms remain.

Total cell suspension volumes:

- Control strain = 1ml
 - Sorting strain = 2-3ml
- 32
- Transfer 70 ul of cells to 1 ml of Qiazol and store at -80°C for downstream RNA analysis
 - Continue to step 31
 - Retain the remaining ~2ml of cells for **FACS**

Measure approximate cell concentration

- 33 Load 10 ul of cell suspension to a Bio-Rad TC20 automated cell counting slide. Also can use a hemocytometer.
- 34 This protocol should yield between 2×10^6 to 4×10^6 total cells
- 35 Dilute the sample to $1 \times 10^6 \frac{\text{cells}}{\text{ml}}$ if above this concentration with L15-10
- 36 Microscopically confirm fluorescent cells are present in the cell counting slide
- 37 If the total cell yield is less than 1×10^6 cells and many intact worms remain, repeat the SDS-DTT, Pronase E and dounce homogenization steps
- 38 Move on to **FACS protocol**