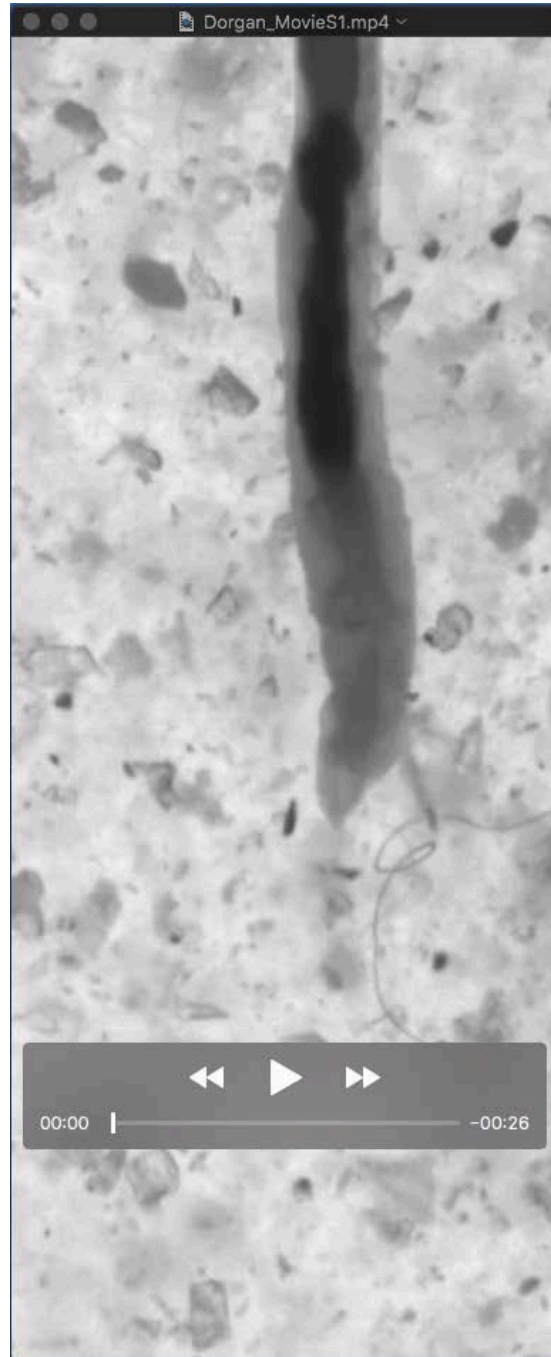


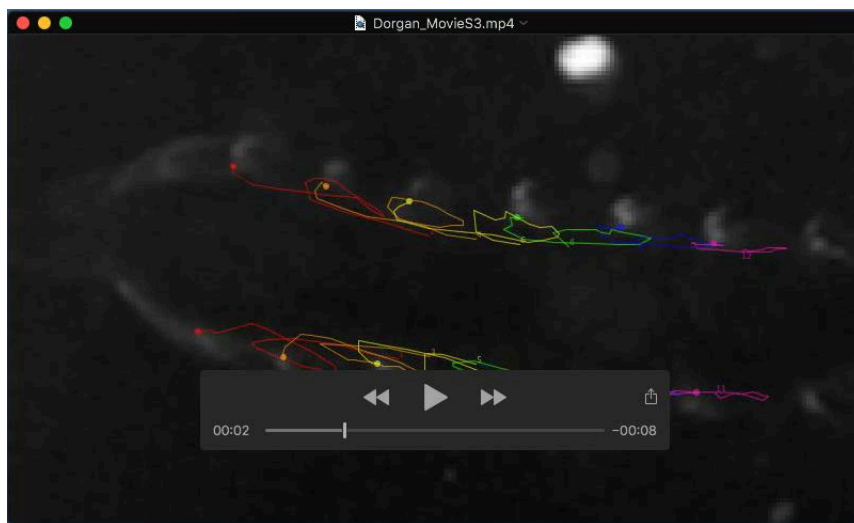
Supplementary material: Movies



Movie 1: 0:00-0:07: Dorsal view of *Thoracophelia mucronata* burrowing in cryolite (sequence in Figure 2A-H). 0:08-0:26: Dorsal view of *Thoracophelia mucronata* burrowing in cryolite (sequence in Figure 2I-K). Forward gut movements accompanied by anterior region expansions occur at 2, 3, 5, 7 11, and 16 s.



Movie 2: 0:00-0:15: Two worms attempting to burrow in a heterogeneous mixture of 500 μm glass beads and fragments of concentrated gelatin. Although worms appeared to burrow effectively through the regions with more glass beads (not shown), they slipped backwards as well as laterally when burrowing through the less dense gelatin fragments. The lateral ridge can be seen expanded and slipping backwards as the lower worm attempts to burrow upward. 0:16-0:31: *Thoracophelia mucronata* burrowing into glass beads. Behaviors appear similar to those in cryolite, but considerable movement of beads occurs around the worm. Some vibration of the camera occurred during this video but can be distinguished as movement of the entire field of view rather than of the region of grains around the worm.



Movie 3: *Thoracophelia mucronata* burrowing in a shallow petri dish of cryolite with chaetal-body wall contact tracked. Chaetae fluorescence appears white against a dark background of cryolite. Different colored tracked positions correspond to different setigers, with setiger 3 in red and setiger 8 in magenta. Sequence in Figure 3A-H. Worm width is ~0.27 mm.