**Supplementary figures**

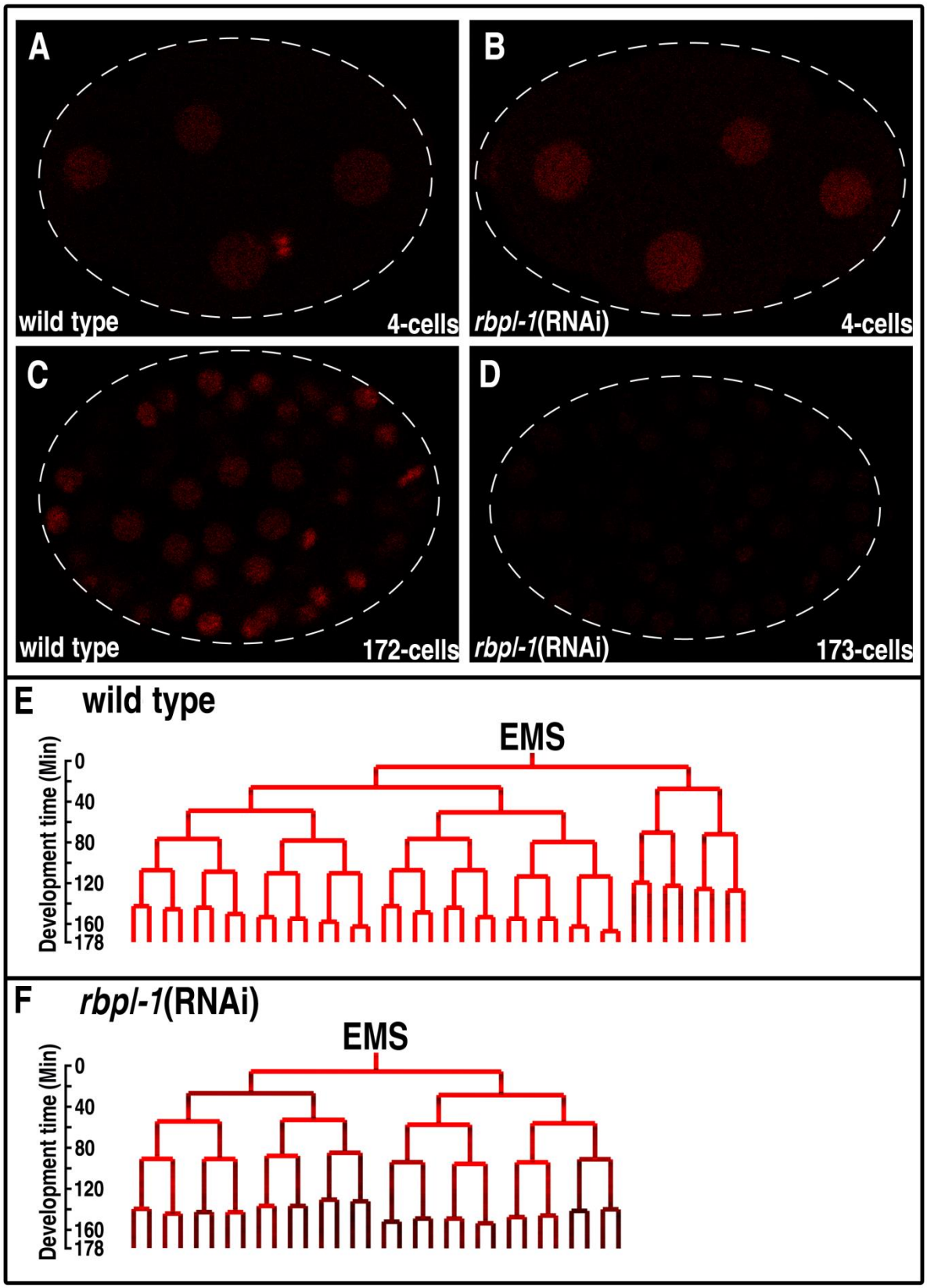

**Figure S1** Inhibition of zygotic expression of lineaging markers (*pie-1* promoter::H2B::mCherry, HIS-72::mCherry) caused by depleted RPBL-1 activities. A & B, fluorescence micrographs of wild type and RPBL-1 depleted embryos respectively at roughly the same stage (mid four-cell). E & F, expression of lineaging markers (red) of wild type and RBPL-1 depleted embryos respectively in EMS lineage. Note the maternal expression is barely affected while the expression at a later stage (primarily zygotic) is severely reduced.

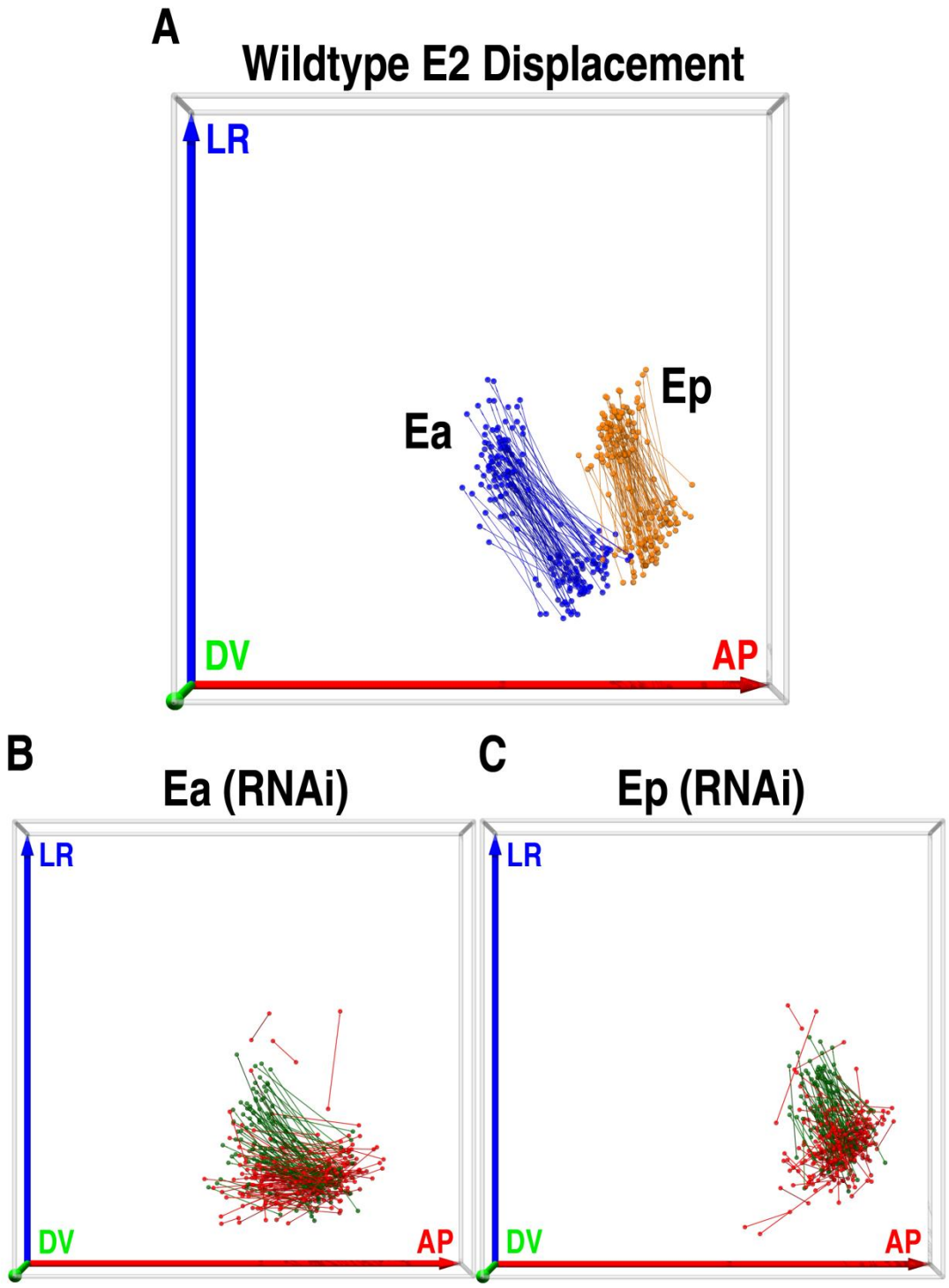


**Figure S2** Displacement of E2 cells in wild type and perturbed embryos. A, displacement of Ea (blue) and Ep (brown) respectively in 91 wild-type embryos. The displacement line is drawn by connecting the positions when the E2 cells are at its first and last time point. B and C, displacement of Ea and Ep respectively for embryos perturbed by 76 genes whose perturbation led to a significant reduction in E2 cell cycle length ($P<0.05$). Significant ($p<0.05$) and insignificant ($p>0.05$) deviations from wild type distribution of displacement are colored in red and green respectively. Division axes are defined in the same way as that in Figure 7.

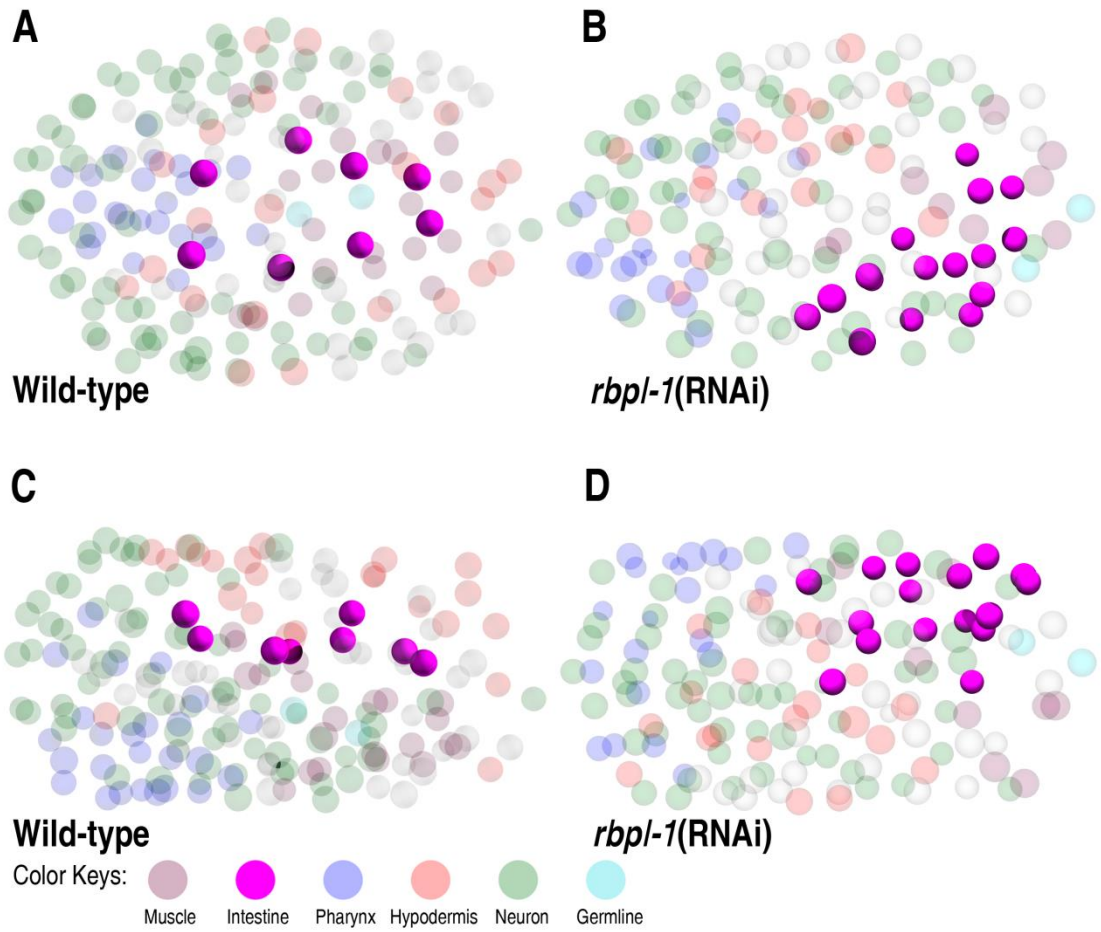


**Figure S3** Space-filling models of cell nuclei from a wild type and an RBPL-1 depleted embryo. A & C, wild type embryos; B & D, *rbpl-1* RNAi embryos. All embryos are orientated so that anterior to the left. A and B, ventral view; C and D, right view. Nuclei are color-coded based on their tissue type. E lineage is highlighted in purple. In contrast to wild-type, *rbpl-1* RNAi leads to an apparent failure in gastrulation with E progeny distributed on the surface of embryos.

## Supplementary videos

**Movie S1** A time lapse movie consisting of space-filling models as shown in Figure S3 A and C.

**Movie S2** A time lapse movie consisting of space-filling models as shown in Figure S3 B and D.