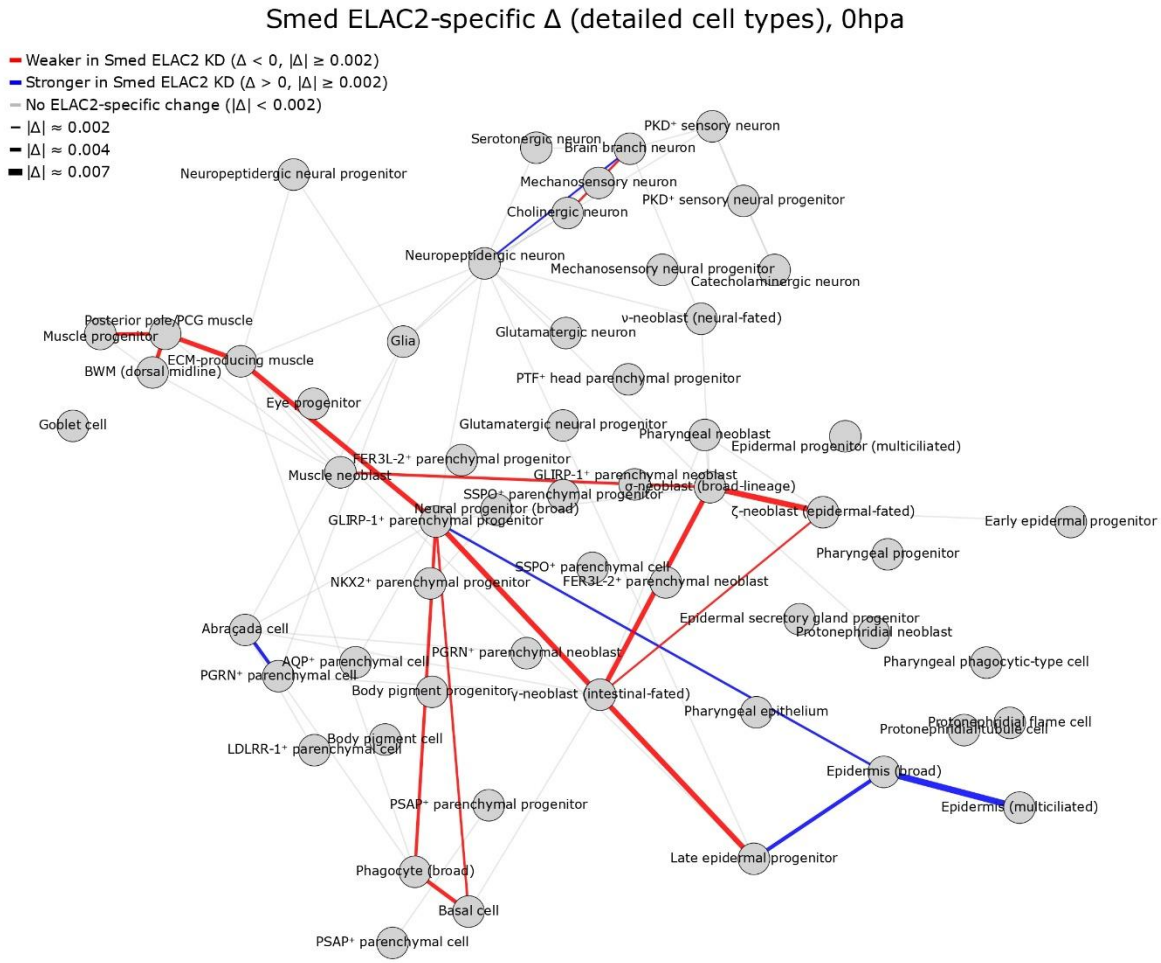
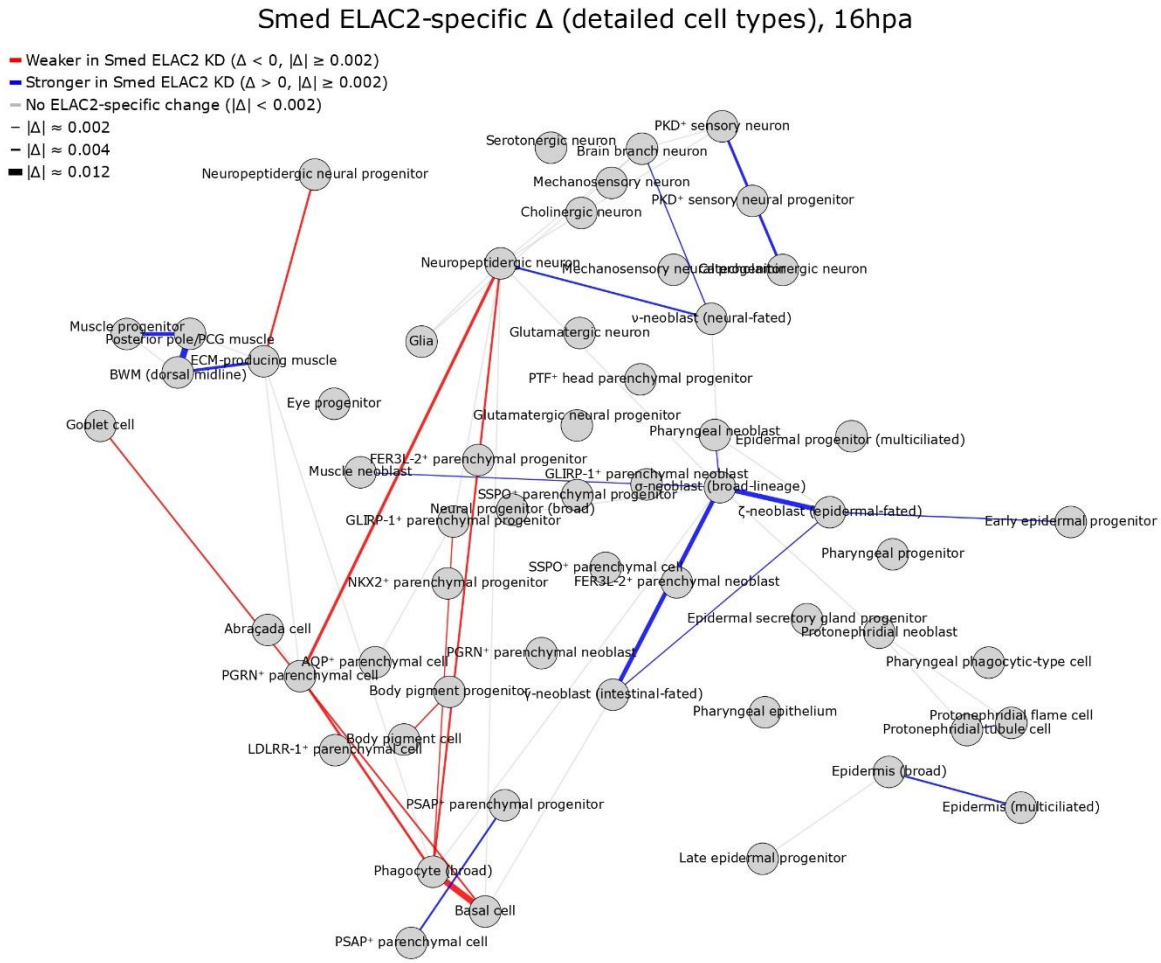
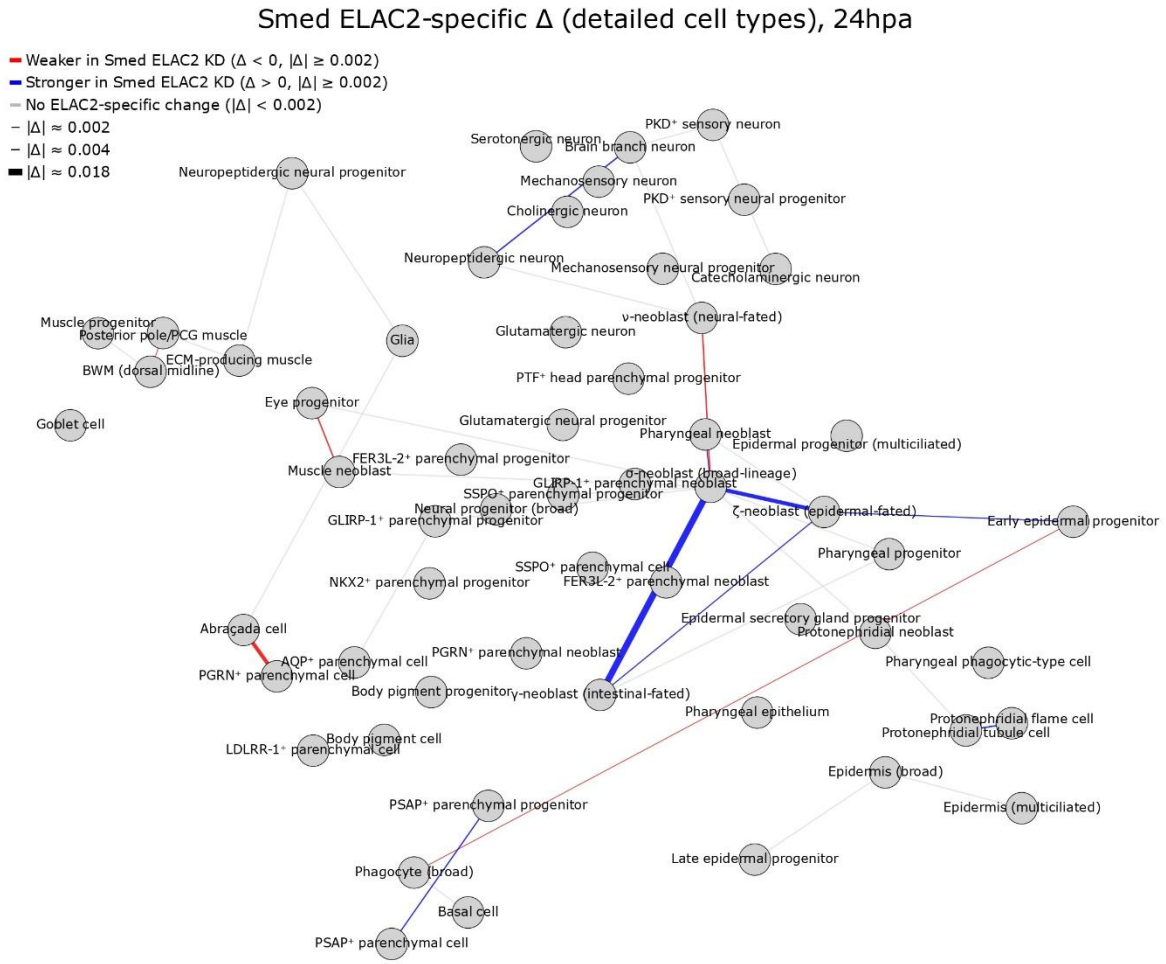


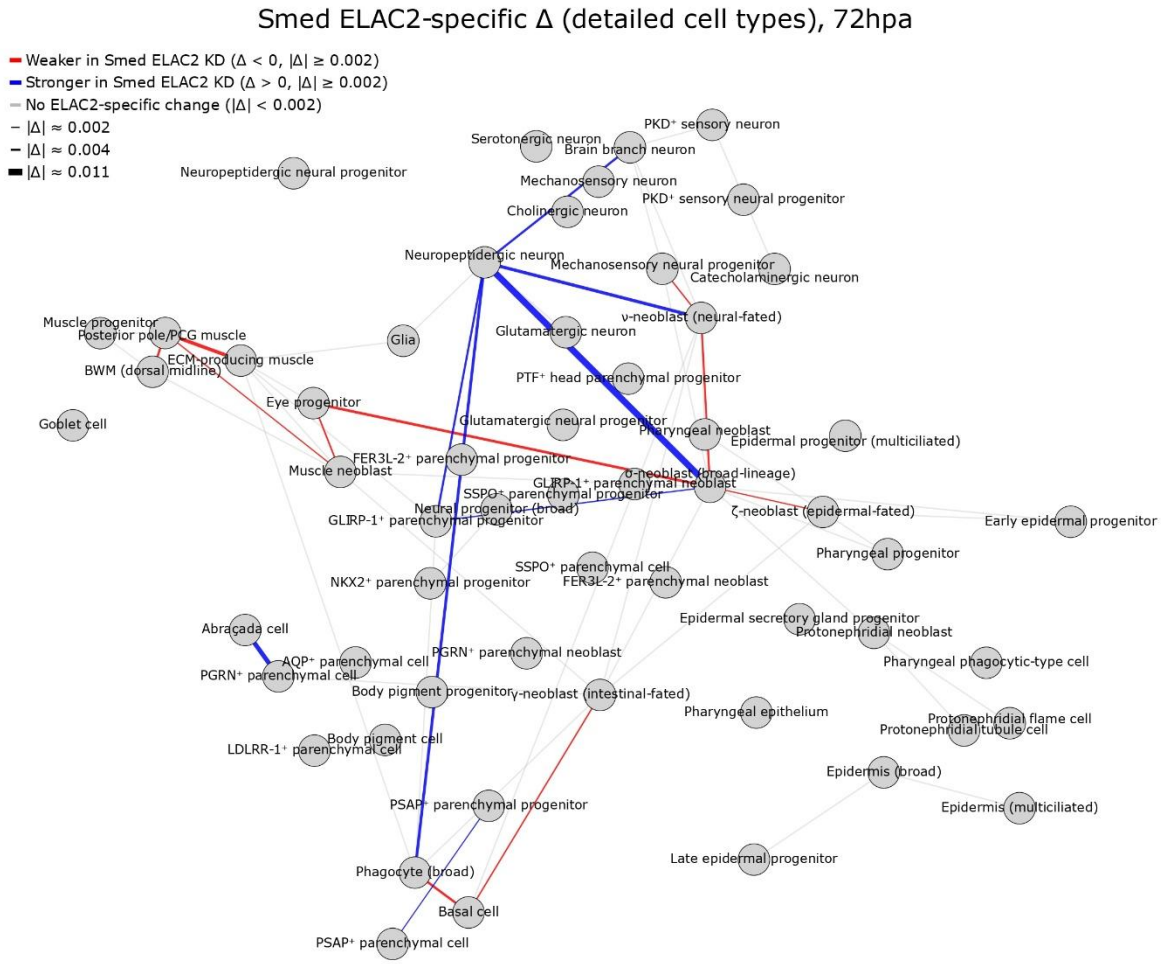
Supplementary Figure 1. *Smed ELAC2*–specific change in cell-level PAGA connectivity at 0 hpa. Nodes represent cells; edges represent PAGA connectivities. Colored edges show the *Smed-ELAC2*–specific delta connectivity, defined as Δ = connectivity (*Smed ELAC2* KD) – connectivity (controls), at the indicated time point. Red edges denote weaker connectivity in *Smed ELAC2* KD (Δ < 0), blue edges denote stronger connectivity in *Smed ELAC2* KD (Δ > 0); only edges with $|\Delta| \geq 0.003$ are highlighted. Edge width is proportional to |Δ|, and gray edges show the underlying family connectivity network for context.



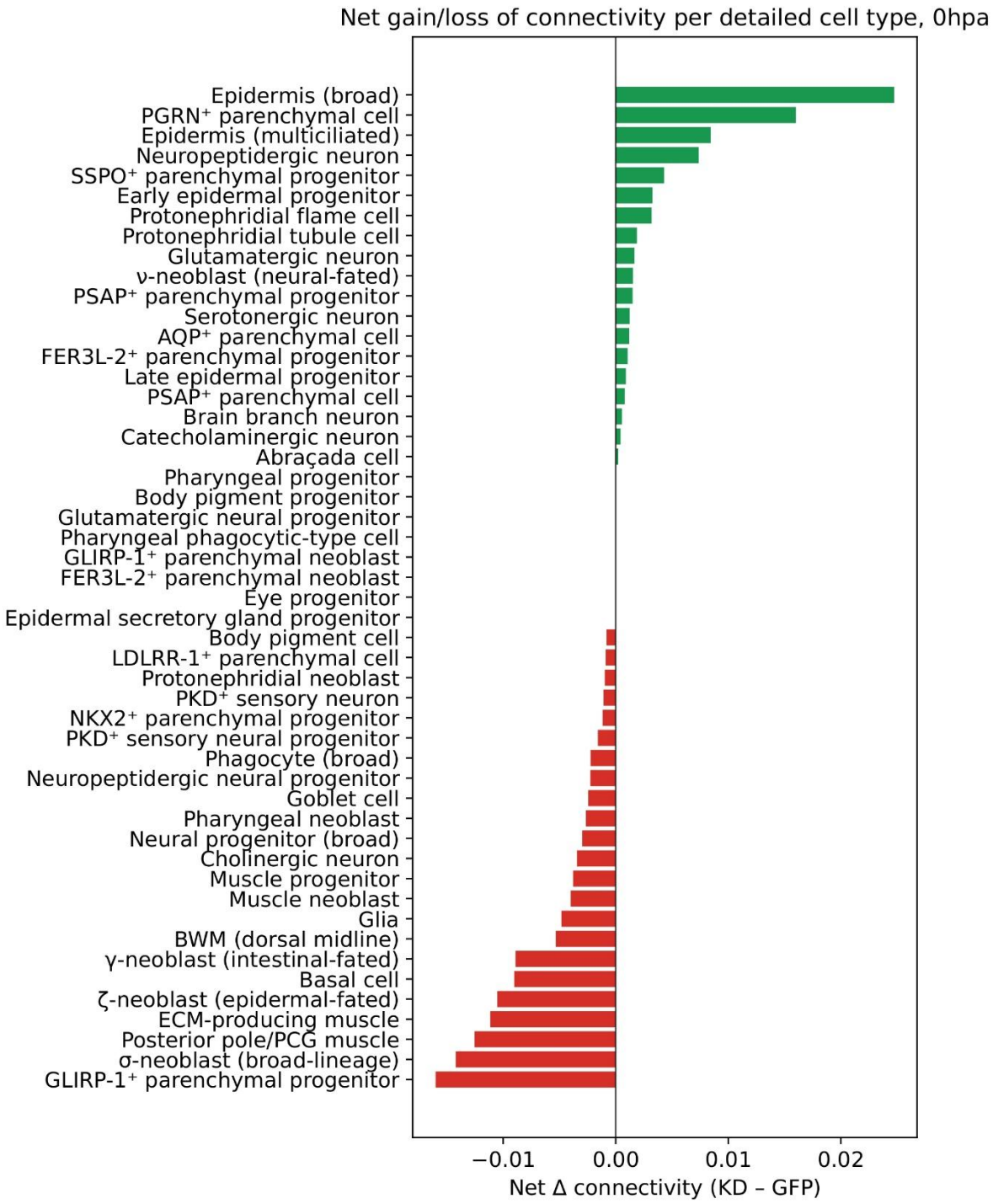
Supplementary Figure 2. *Smed ELAC2*–specific change in cell-level PAGA connectivity at 16 hpa. Nodes represent cells; edges represent PAGA connectivities. Colored edges show the *Smed-ELAC2*–specific delta connectivity, defined as Δ = connectivity (*Smed ELAC2* KD) – connectivity (controls), at the indicated time point. Red edges denote weaker connectivity in *Smed ELAC2* KD (Δ < 0), blue edges denote stronger connectivity in *Smed ELAC2* KD (Δ > 0); only edges with $|\Delta| \geq 0.003$ are highlighted. Edge width is proportional to |Δ|, and gray edges show the underlying family connectivity network for context.



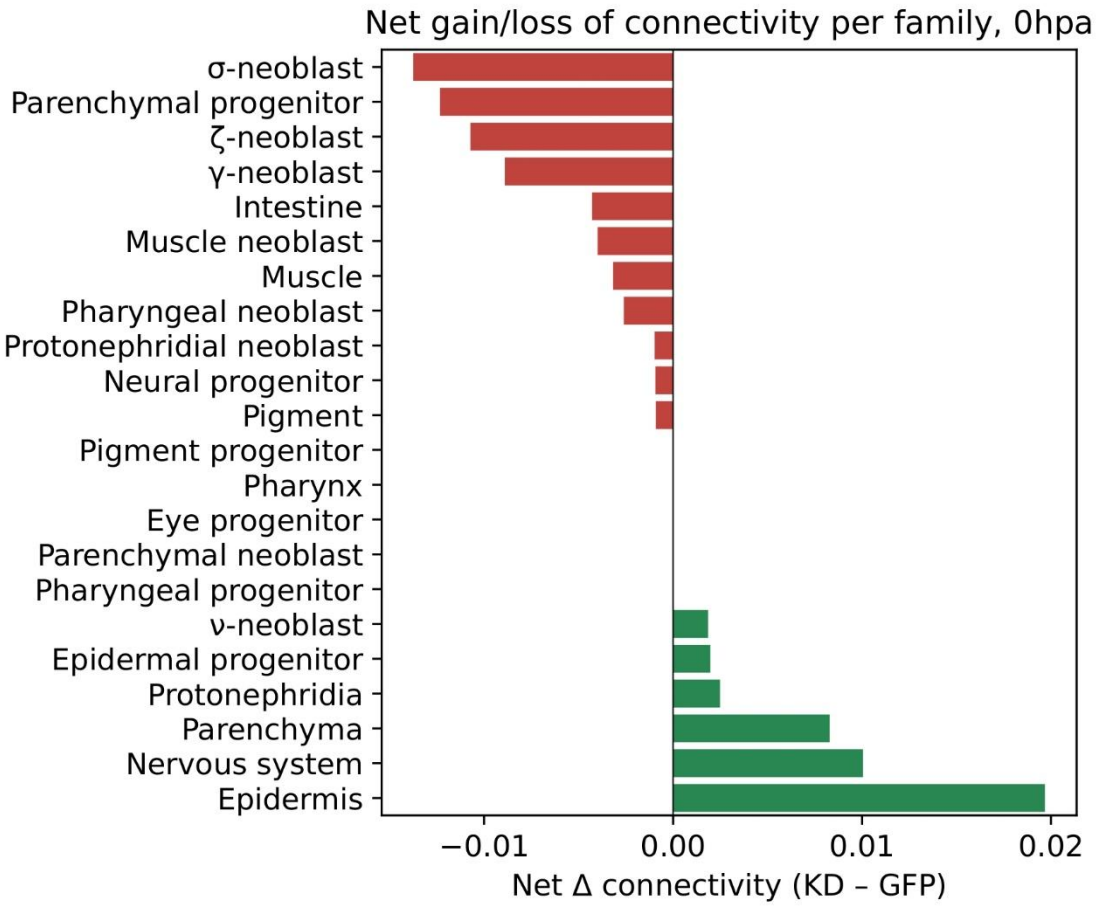
Supplementary Figure 3. *Smed ELAC2*–specific change in cell-level PAGA connectivity at 24 hpa. Nodes represent cells; edges represent PAGA connectivities. Colored edges show the *Smed-ELAC2*–specific delta connectivity, defined as Δ = connectivity (*Smed ELAC2* KD) – connectivity (controls), at the indicated time point. Red edges denote weaker connectivity in *Smed ELAC2* KD (Δ < 0), blue edges denote stronger connectivity in *Smed ELAC2* KD (Δ > 0); only edges with $|\Delta| \geq 0.003$ are highlighted. Edge width is proportional to |Δ|, and gray edges show the underlying family connectivity network for context.



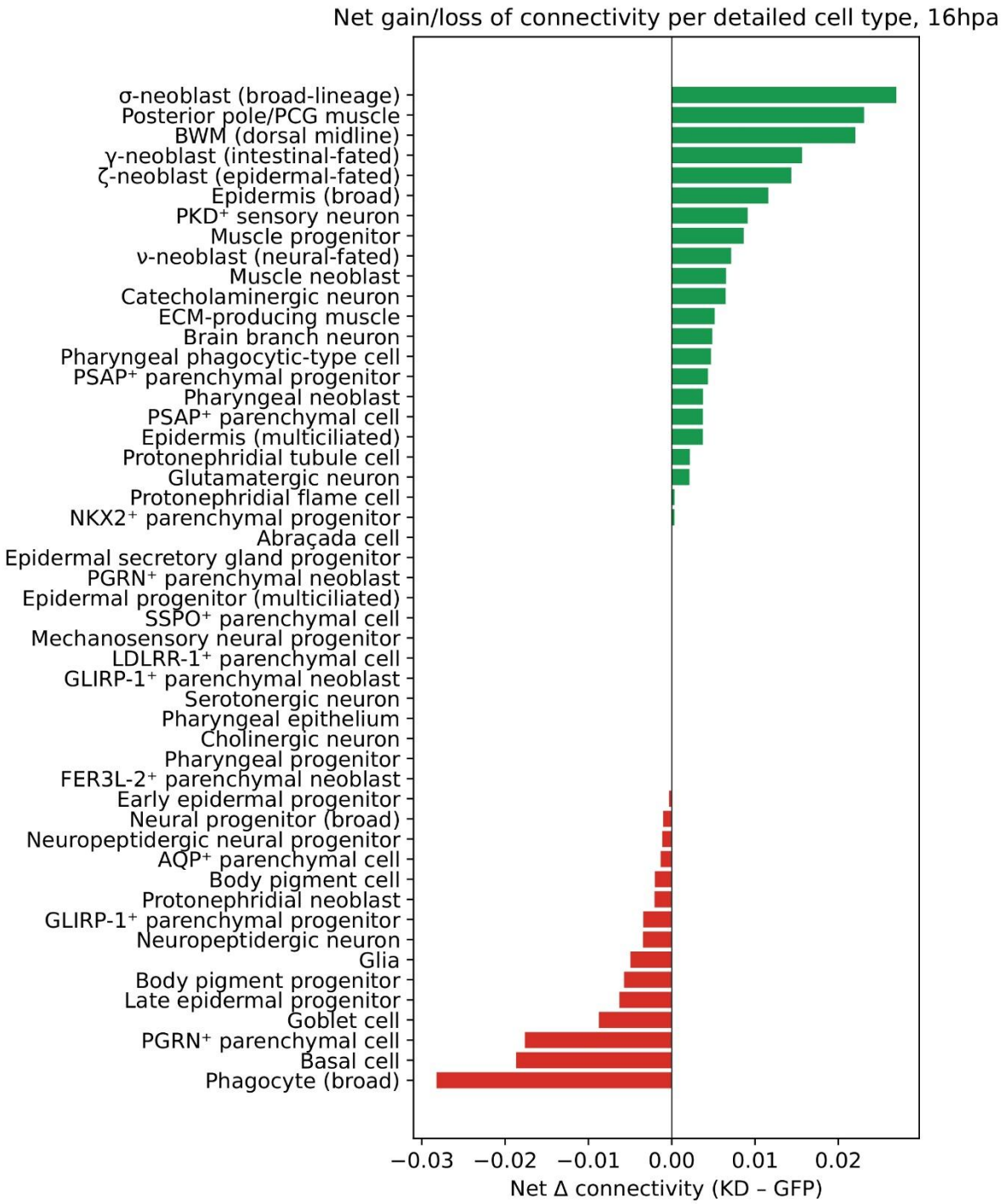
Supplementary Figure 4. *Smed ELAC2*–specific change in cell-level PAGA connectivity at 72 hpa. Nodes represent cells; edges represent PAGA connectivities. Colored edges show the *Smed-ELAC2*–specific delta connectivity, defined as Δ = connectivity (*Smed ELAC2* KD) – connectivity (controls), at the indicated time point. Red edges denote weaker connectivity in *Smed ELAC2* KD (Δ < 0), blue edges denote stronger connectivity in *Smed ELAC2* KD (Δ > 0); only edges with $|\Delta| \geq 0.003$ are highlighted. Edge width is proportional to |Δ|, and gray edges show the underlying family connectivity network for context.



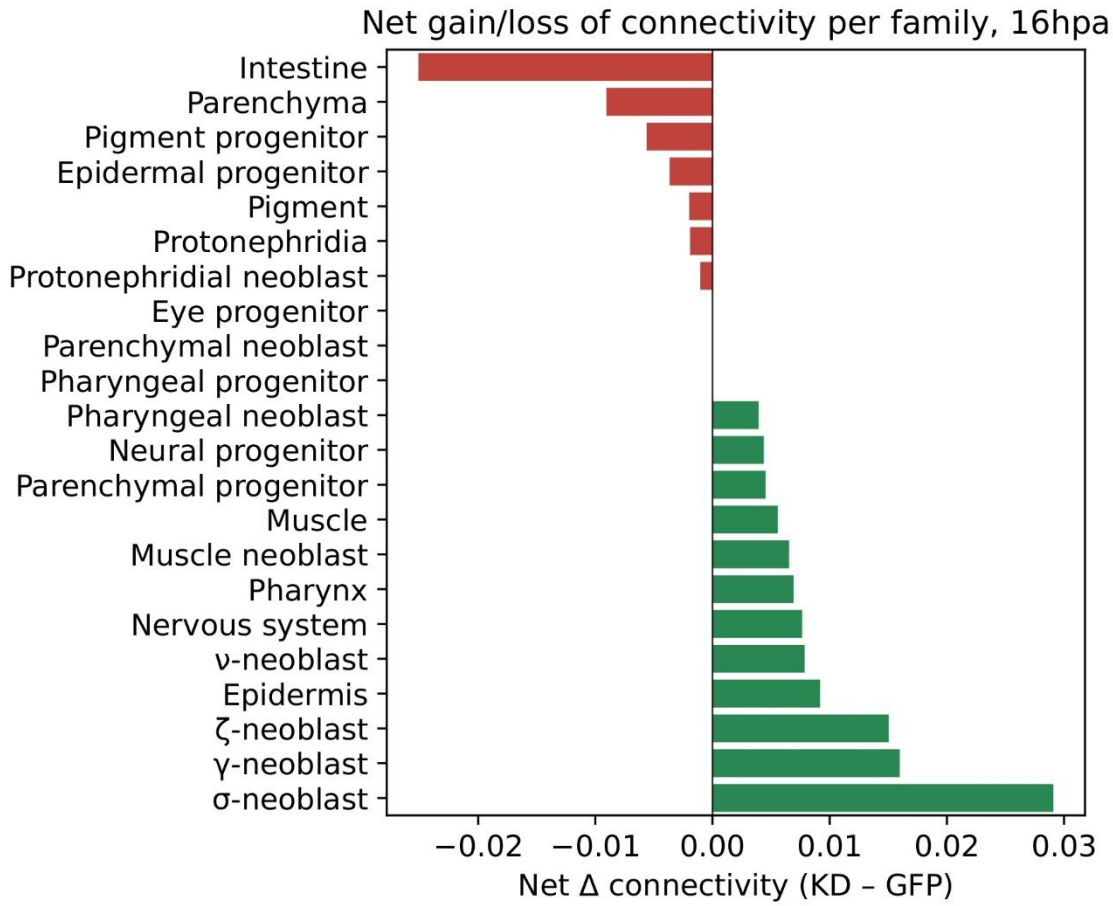
Supplementary Figure 5. Net change in PAGA connectivity per detailed cell type at 0 hpa. Horizontal bars show the net difference in node connectivity between *Smed ELAC2* KD and GFP control (KD – GFP) for each curated detailed population at 0 hpa. For each node, "net connectivity change" summarizes the gain or loss of total graph connectivity (edge-weight sum) in KD relative to GFP; positive values indicate higher connectivity in KD and negative values indicate lower connectivity in KD.



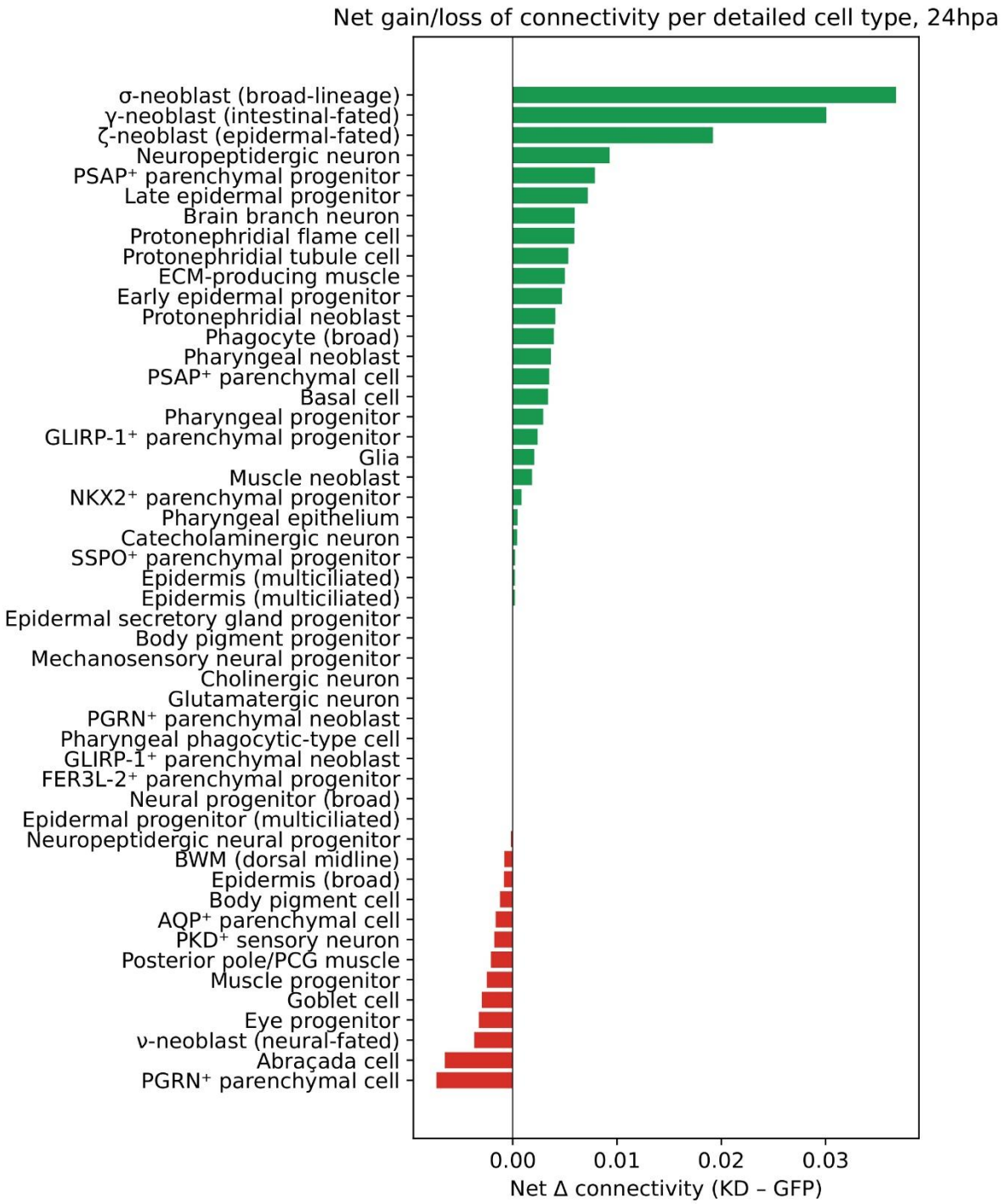
Supplementary Figure 6. Net change in PAGA connectivity per cell-family at 0 hpa
Horizontal bars show the net difference in node connectivity between *Smed ELAC2* KD and GFP control (KD – GFP) at the level of broad cell families at 24 hpa. Values summarize whether each family becomes more or less connected to the rest of the lineage graph under KD, based on the family-level PAGA graph.



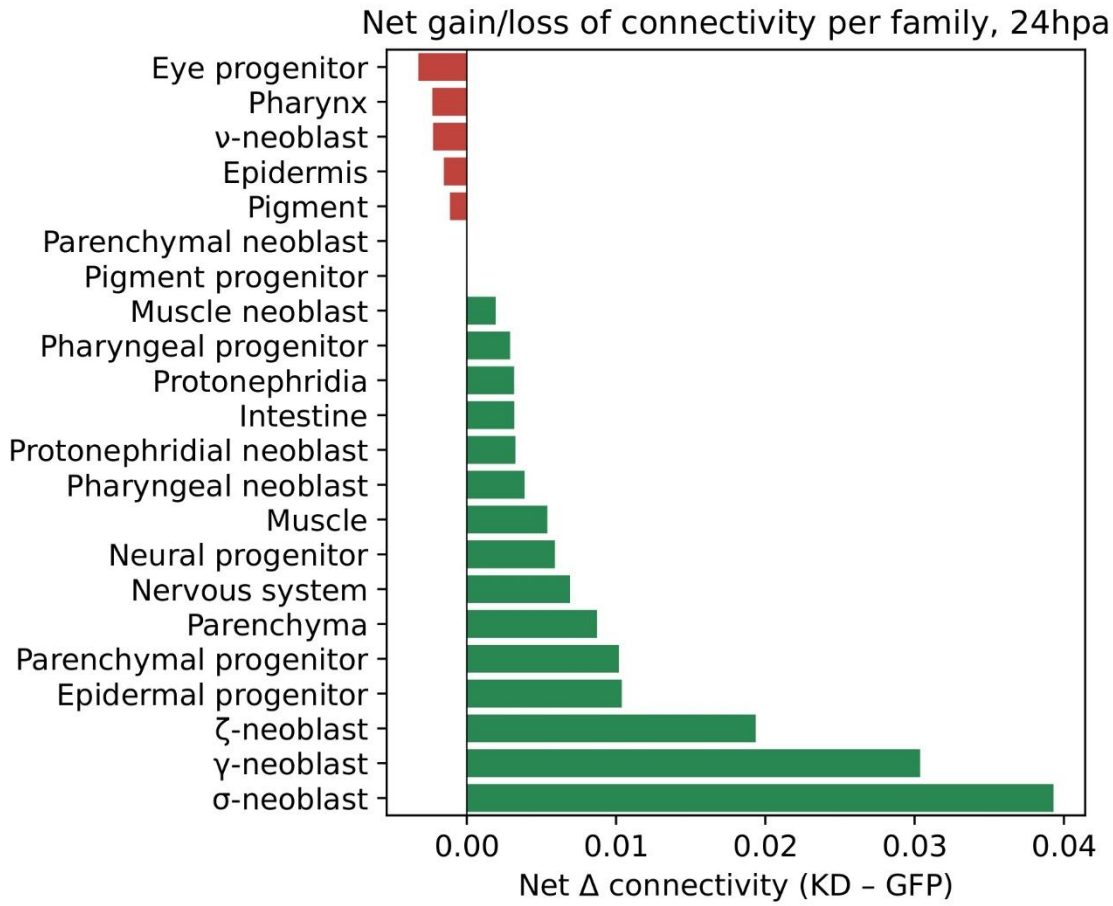
Supplementary Figure 7. Net change in PAGA connectivity per detailed cell type at 16 hpa. Horizontal bars show the net difference in node connectivity between *Smed ELAC2* KD and GFP control (KD – GFP) for each curated detailed population at 0 hpa. For each node, "net connectivity change" summarizes the gain or loss of total graph connectivity (edge-weight sum) in KD relative to GFP; positive values indicate higher connectivity in KD and negative values indicate lower connectivity in KD.



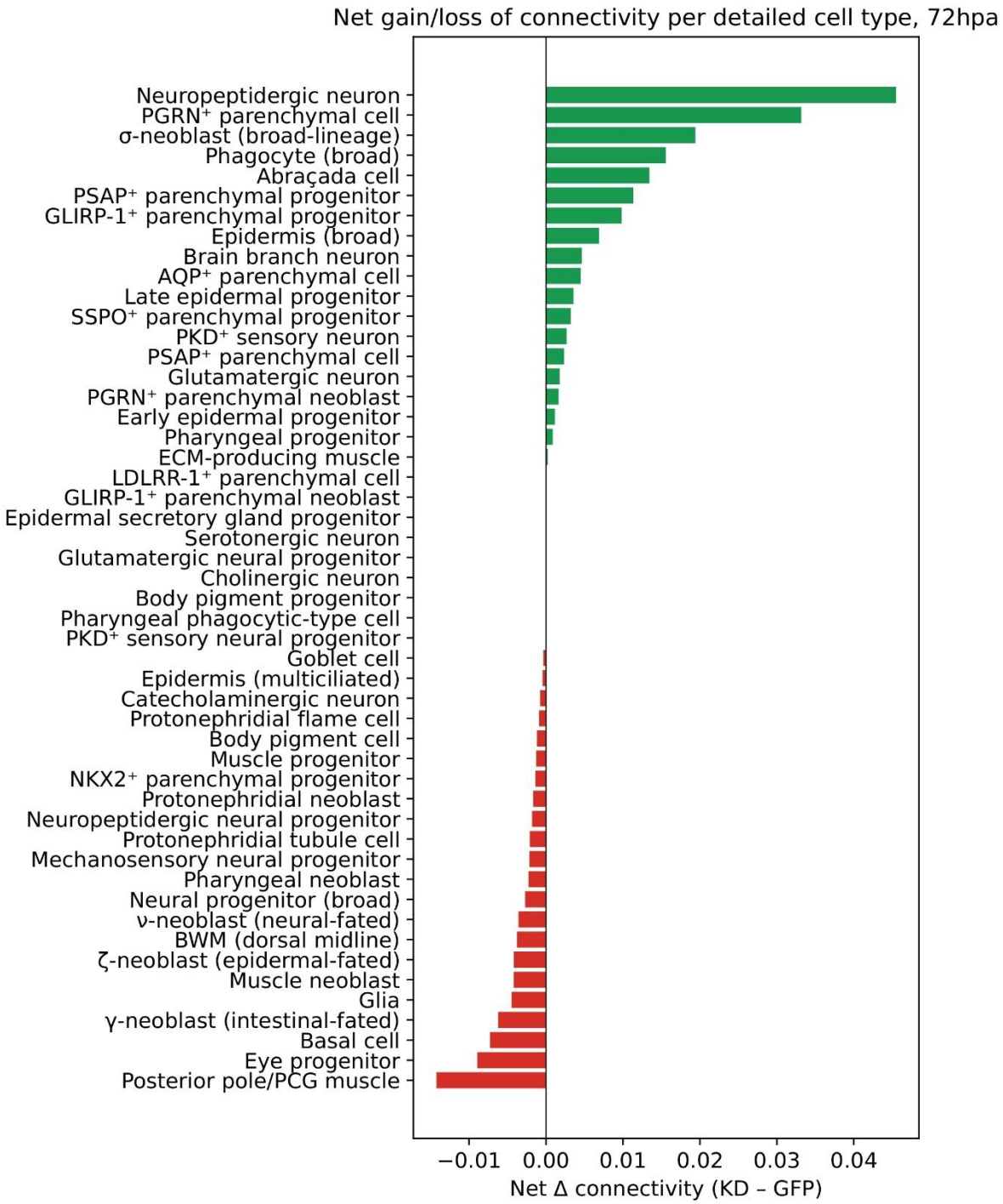
Supplementary Figure 8. Net change in PAGA connectivity per cell-family at 16 hpa
Horizontal bars show the net difference in node connectivity between *Smed ELAC2* KD and GFP control (KD – GFP) at the level of broad cell families at 24 hpa. Values summarize whether each family becomes more or less connected to the rest of the lineage graph under KD, based on the family-level PAGA graph.



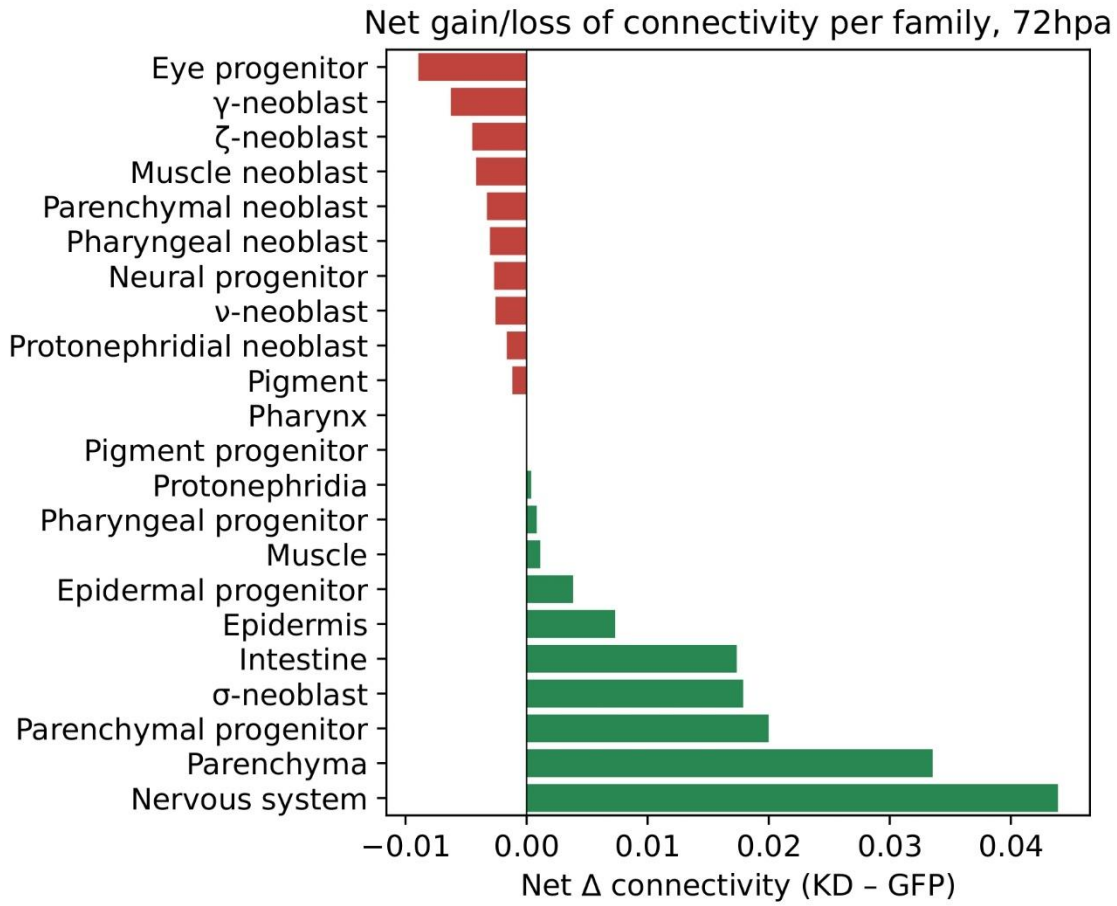
Supplementary Figure 9. Net change in PAGA connectivity per detailed cell type at 24 hpa. Horizontal bars show the net difference in node connectivity between *Smed ELAC2* KD and GFP control (KD – GFP) for each curated detailed population at 0 hpa. For each node, "net connectivity change" summarizes the gain or loss of total graph connectivity (edge-weight sum) in KD relative to GFP; positive values indicate higher connectivity in KD and negative values indicate lower connectivity in KD.



Supplementary Figure 10. Net change in PAGA connectivity per cell-family at 24 hpa
Horizontal bars show the net difference in node connectivity between *Smed ELAC2* KD and GFP control (KD – GFP) at the level of broad cell families at 24 hpa. Values summarize whether each family becomes more or less connected to the rest of the lineage graph under KD, based on the family-level PAGA graph.



Supplementary Figure 11. Net change in PAGA connectivity per detailed cell type at 72 hpa. Horizontal bars show the net difference in node connectivity between *Smed ELAC2* KD and GFP control (KD – GFP) for each curated detailed population at 0 hpa. For each node, "net connectivity change" summarizes the gain or loss of total graph connectivity (edge-weight sum) in KD relative to GFP; positive values indicate higher connectivity in KD and negative values indicate lower connectivity in KD.



Supplementary Figure 12. Net change in PAGA connectivity per cell-family at 72 hpa
Horizontal bars show the net difference in node connectivity between *Smed ELAC2* KD and GFP control (KD – GFP) at the level of broad cell families at 24 hpa. Values summarize whether each family becomes more or less connected to the rest of the lineage graph under KD, based on the family-level PAGA graph.