

Pathway	Validation (Hit or No Hit)	Novel or Not	Matched Ground Truth Pathway	Annotation Term
Axon Guidance and Neurite Outgrowth	Hit	Common	Axon guidance KEGG:04360	Axon Guidance and Neurite Outgrowth
Synapse Formation and Plasticity	No Hit	Novel	Myelination and Glial Function	Hit
Myelin sheath	GO:0043209		Neural Differentiation and Neurogenesis	No Hit
Neural Development	Hit	Common	Extracellular matrix organization	REAC:R-RNO-1474244
Neuronal Signaling and Neurotransmitter Processing	No Hit	Novel	Cytoskeletal Dynamics and Intracellular Transport	No Hit
				Novel

Summary of Findings:

The evaluation indicates that several of the identified pathways align well with established ground truth processes in neural development. For instance, “Axon Guidance and Neurite Outgrowth” matches the “Axon guidance” pathway (KEGG:04360), and “Myelination and Glial Function” corresponds to the “Myelin sheath” process (GO:0043209), both of which are common and well-documented biological processes. Additionally, “Extracellular Matrix Remodeling and Cell Adhesion in Neural Development” is validated through its match with “Extracellular matrix organization” (REAC:R-RNO-1474244), underscoring its importance in tissue architecture and neural development.

On the other hand, several pathways—namely “Synapse Formation and Plasticity,” “Neural Differentiation and Neurogenesis,” “Neuronal Signaling and Neurotransmitter Processing,” and “Cytoskeletal Dynamics and Intracellular Transport”—did not have direct equivalents in the provided ground truth set. These pathways may be considered novel or underrepresented in current databases like g:Profiler. Their absence from the ground truth could be due to their specificity, emerging recognition, or simply that they represent more nuanced aspects of neural function that are not captured by broader annotation terms in the existing resource.

Overall, while the validated hits underscore classical processes in neural development, the unmatched pathways suggest areas for further exploration, highlighting potential opportunities to extend current pathway databases with more detailed neural-specific mechanisms.

Full pathway list with genes: Axon Guidance and Neurite Outgrowth: Ntn1, Robo2, Slit2, Srgap1, Nrp1, Nrp2, Sema4f, Sema3g, Dpysl5, Dpysl3, Plxnb1, Efna5, Cxcl12 Synapse Formation and Plasticity: Cntn6, Synpr, Sipa111, Lrrtm3, Septin4, Septin5, Sncg, Ppfia4, Slitrk6 Myelination and Glial Function: Mag, Mpz, Prx, Pmp22, Mal, Gldn, Cldn19, Gpnmb Neural Differentiation and Neurogenesis: Id2, Msi1, Nes, Dyrk1a, Atf3, Atf5, Klf9, Mef2c, Ebf1, Numb, Runx3, Aldh1a1, Peg3, Igfbp3, Alpl, Lifr, Poglut1, Aff3, Olfm2, Vash1, Ghr, Lef1, Mybl1, Pals1, Hmx3, Wnt5a, Olfm1 Extracellular Matrix Remodeling and Cell Adhesion in Neural Development: Hapln1, Col9a3, Col20a1, Col15a1, Ltbp1, Adamts17, Adamtsl3, Adamtsl1, Chst2, Hs6st1, Hs6st2, Cdh13, Sbspon, Emilin1, Matn3, Bgn, Qsox1, Marveld1, Pxdn, Efemp2, Cd9, Tspan4, Mfap5, Itga7, C1qtnf1, Timp1, Has2, Fut10, Col11a1, Col8a2 Neuronal Signaling and Neurotransmitter Processing: Prss12, Pcsk5, Cpe, P2ry2, Grb14, Gnai1, Ryr3, Itpril1, Ecel1, Serpinf1, Serpini1, Ptgfr, Tf, Scn7a, Piezo2, Gprc5b, Gprc5a, Frs1, Tnik, Prkd3, Prkar2b, Sgpl1, Phldb2, Gja1, Tpcn1, Ppm1f, Fth1, Vrk1, Fam20c, Inpp5a, Tnfrsf1a, Bace2, Igf2bp2, Stk39, Gtf2e1, Eif2ak2, Apod Cytoskeletal Dynamics and Intracellular Transport: Tuba4a, Tubb4a, Kif1a, Myo1d, Pfn2, Rab10, Septin4, Septin5, Drp2, Fhod3, Acap2, Chmp2b, Vps8, Snx4, Stard13, Rhoj, Asap1, Vps26c, Snx6