Figures and figure supplements

Lateral/caudal ganglionic eminence makes limited contribution to cortical oligodendrocytes

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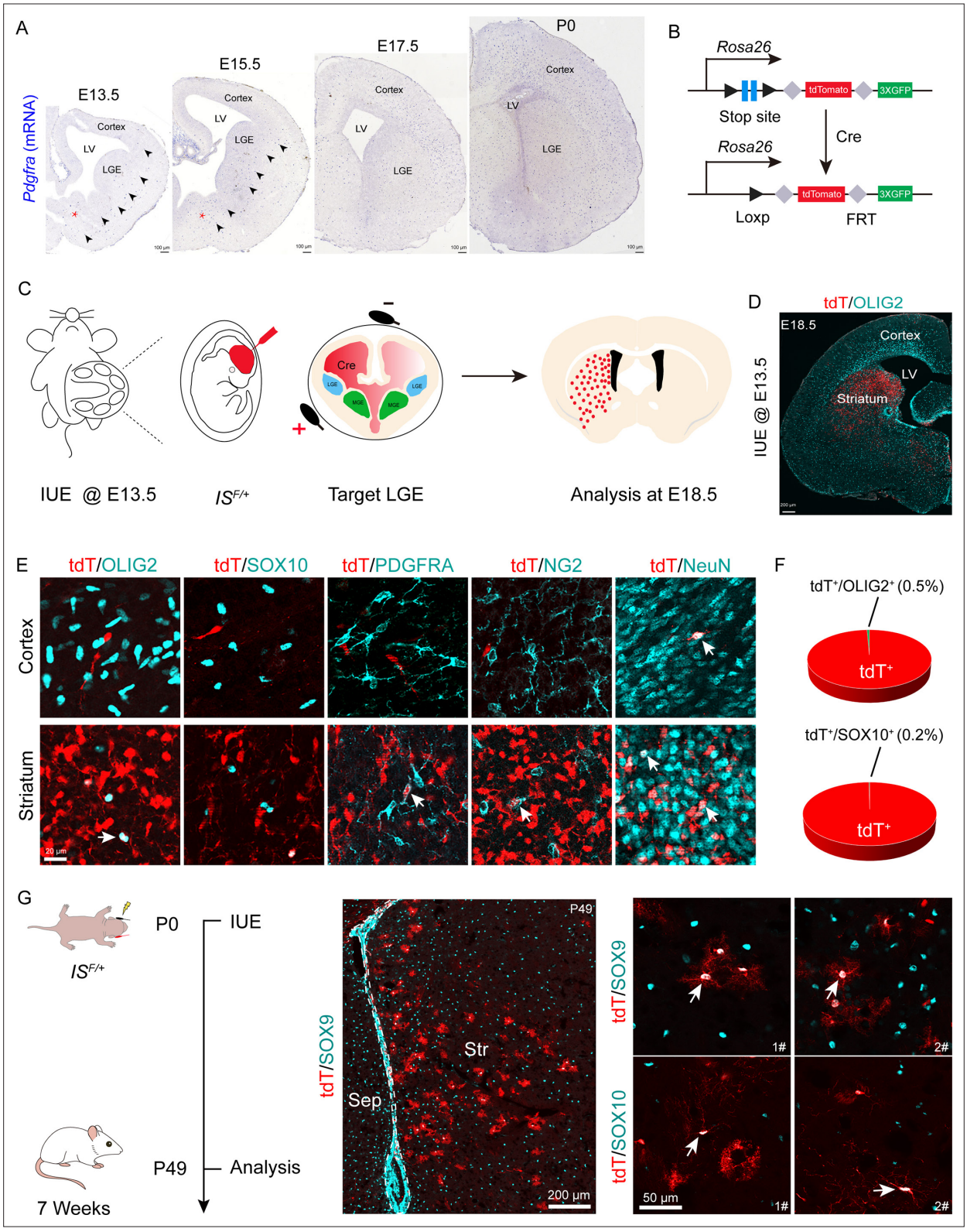

Figure 1. Fate mapping of lateral ganglionic eminence (LGE)-derived oligodendrocyte precursor cells (OPCs) by combining in utero electroporation (IUE) with a Cre recombinase-dependent IS reporter. (**A**) In situ hybridization showing *Pdgfra* expression from embryonic day 13.5 (E13.5) to postnatal day 0 (P0). Arrowheads indicated the *Pdgfra*$^+$ cell migration stream from the medial ganglionic eminence (MGE)/anterior entopeduncular area (AEP) to the cortex. (**B**) Scheme of the IS reporter lines. (**C**) Experimental schedule to trace LGE-derived OPCs. (**D**) Representative coronal sections showing the distribution of tdT$^+$ cells. (**E**) tdT$^+$ cells expressed NeuN but not OLIG2, SOX10, PDGFRA, or NG2 in the cortex. In contrast, the tdT$^+$ cells expressed all of

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these markers (OLIG2, SOX10, PDGFRA, NG2, and NeuN) in the striatum. (**F**) The ratio of the $OLIG2^+$ and $SOX10^+$ cells of the electroporated cells in the cortex. N=4 mice per group. (**G**) Fate mapping of LGE-derived cells at P0. tdT^+ cells expressed SOX10 and SOX9 in the striatum at P49.

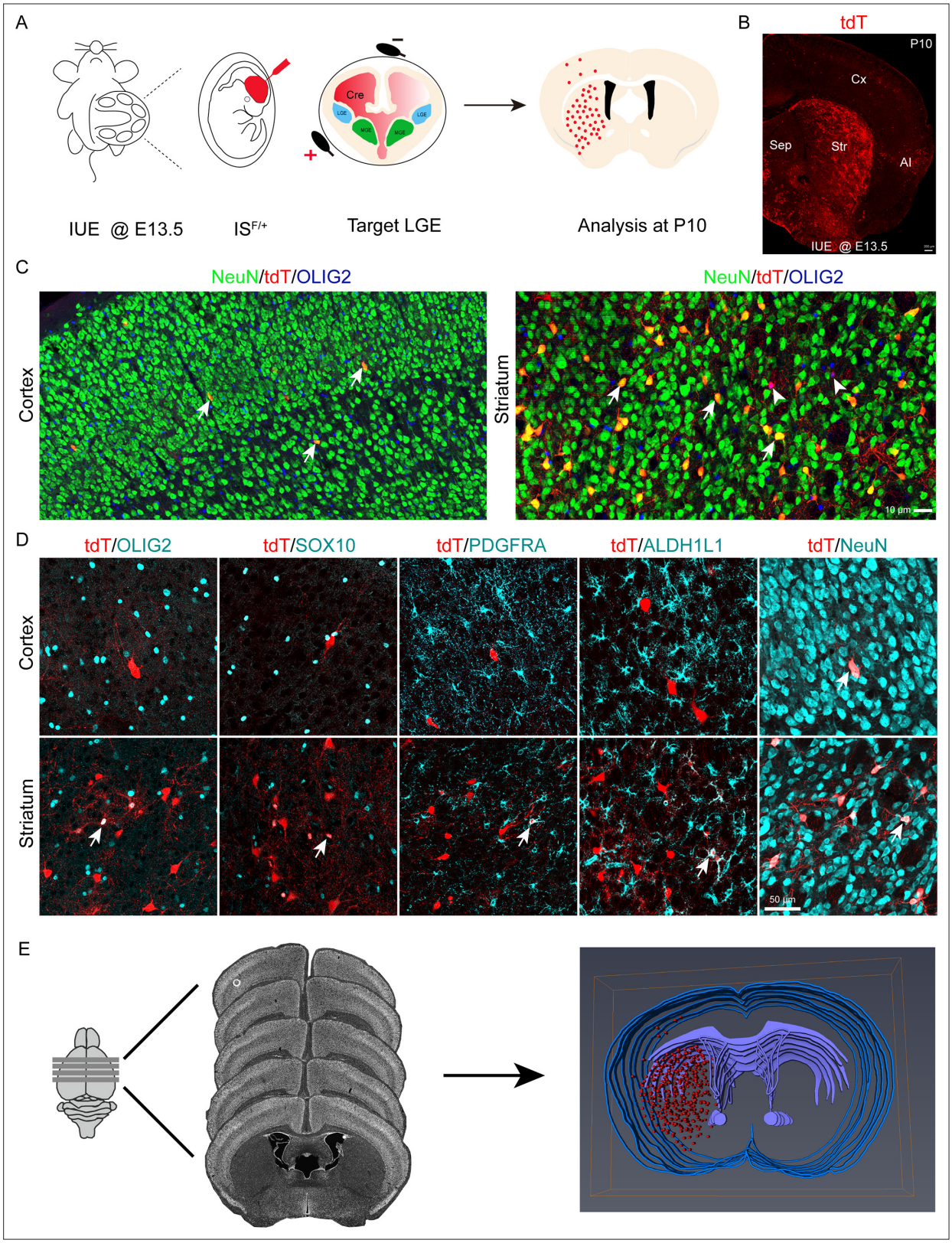

Figure 1—figure supplement 1. Lineage tracing of lateral ganglionic eminence (LGE)-derived oligodendrocyte precursor cells (OPCs) by combining in utero electroporation (IUE) with a Cre recombinase-dependent IS reporter. (**A**) Experimental schedule for fate mapping of LGE-derived OPCs. (**B**) Representative coronal sections showing the distribution of the tdT⁺ cells at P10. (**C**) Nearly all tdT⁺ cells expressed NeuN but not OLIG2 in the cortex. tdT⁺ cells expressed NeuN and OLIG2 in the striatum. (**D**) tdT⁺ cells did not express OLIG2, SOX10, PDGFRA, or ALDH1L1. Instead, they

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expressed NeuN in the cortex. In sharp contrast, tdT$^+$ cells in the striatum expressed OLIG2, SOX10, PDGFRA, ALDH1L1, and NeuN at P10. (**E**) 3D reconstruction of consecutive brain sections demonstrated that the traced cells were mainly located in the striatum. N=4 mice per group.

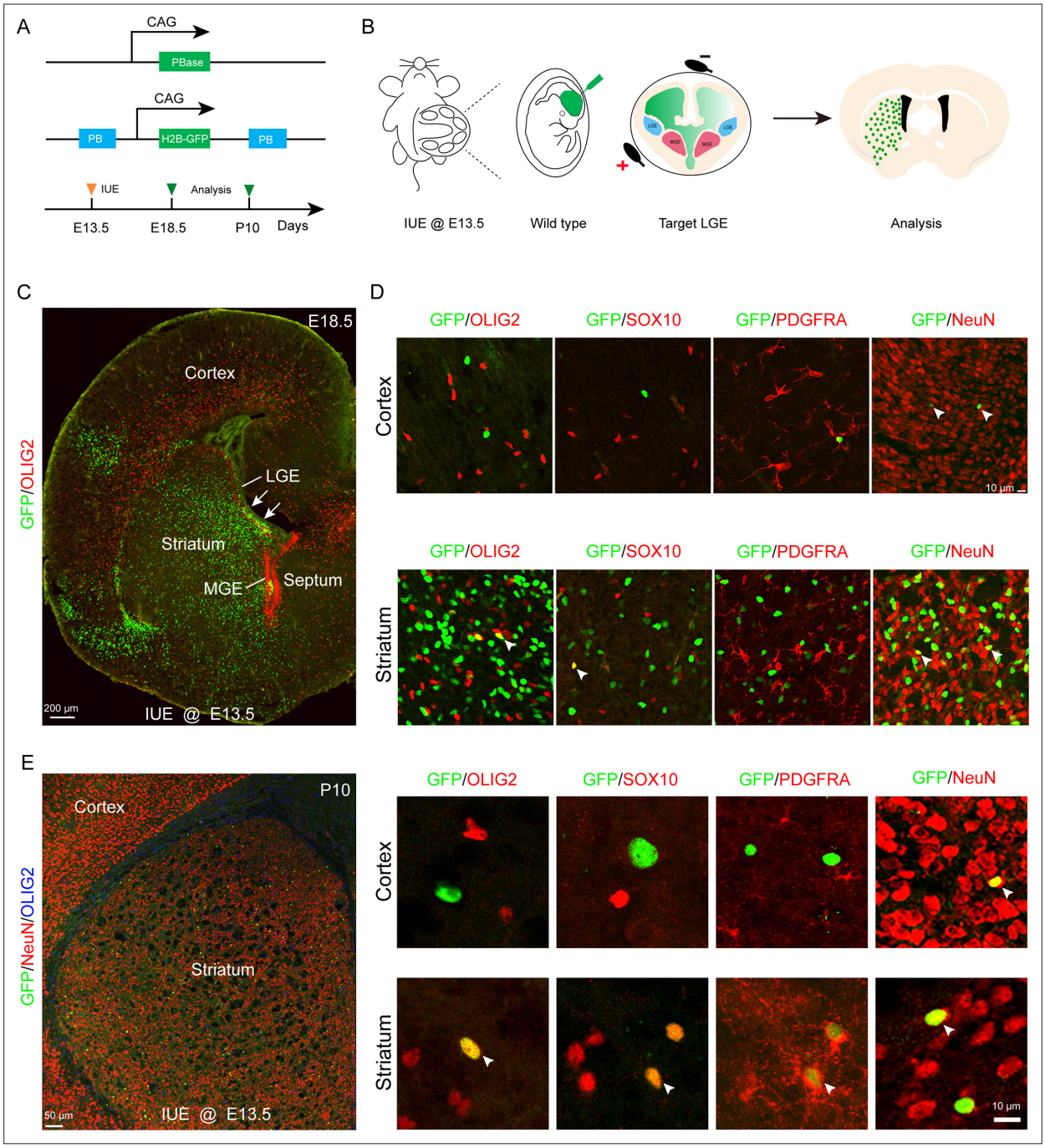

Figure 2. Fate mapping of lateral ganglionic eminence (LGE)-derived oligodendrocyte precursor cells (OPCs) by combining in utero electroporation (IUE) with PiggyBac transposon system. (**A**) Schematic of the PiggyBac transposon reporter system used in this study. (**B**) The experimental workflow. (**C**) Representative coronal sections showing the distribution of GFP$^+$ cells at embryonic day 18.5 (E18.5). (**D**) GFP$^+$ cells expressed NeuN but not glial cell markers, such as OLIG2, SOX10, and PDGFRA in the cortex. However, GFP$^+$ cells expressed NeuN, OLIG2, SOX10, and PDGFRA in the striatum. (**E**) GFP$^+$ cells expressed NeuN but not glial cell markers, such as OLIG2, SOX10, and PDGFRA in the cortex and GFP$^+$ cells expressed NeuN, OLIG2, SOX10, and PDGFRA in the striatum at postnatal day 10 (P10). N=4 per group.

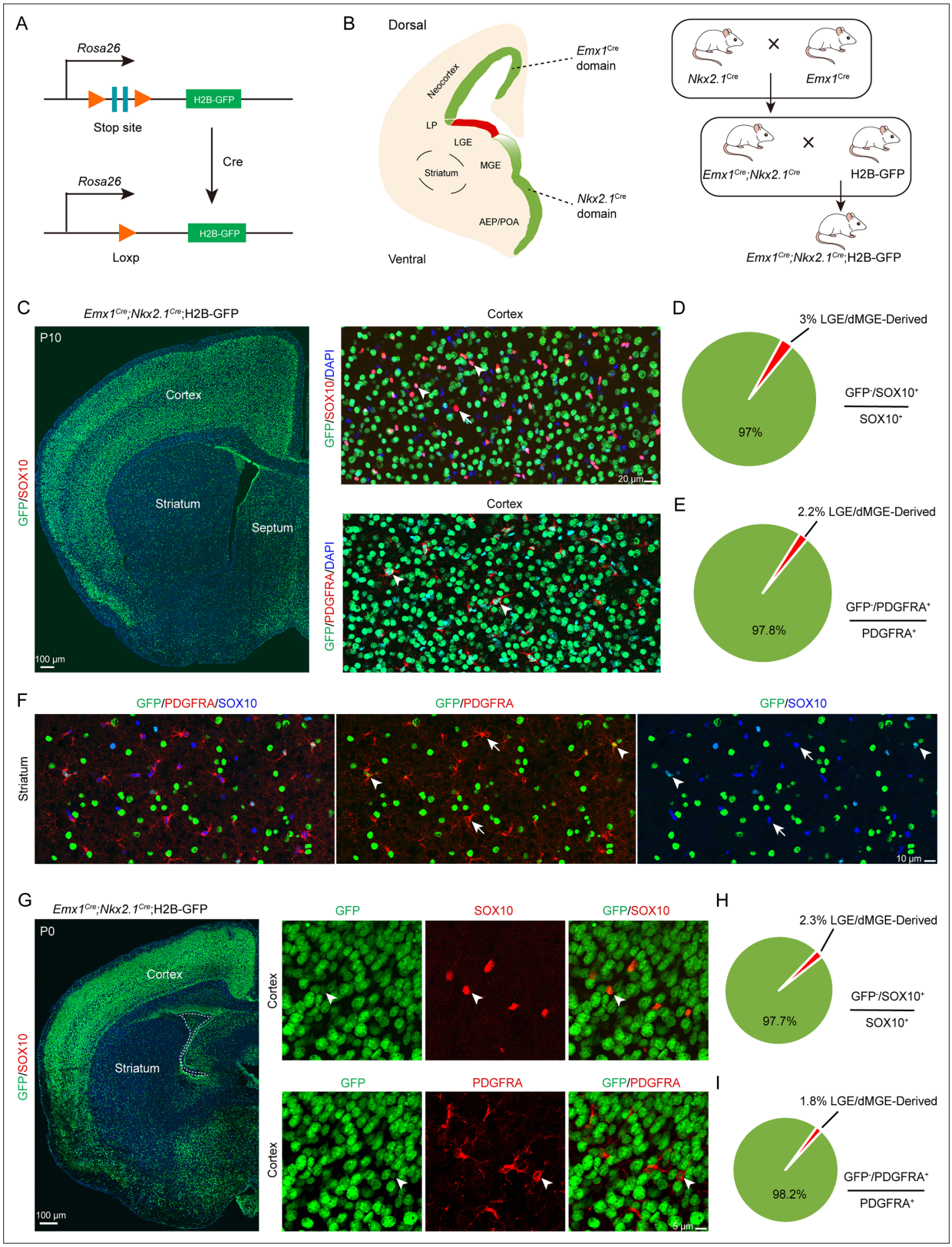

Figure 3. An exclusion strategy showed that lateral/caudal ganglionic eminence (LGE/CGE) contribution to cortical oligodendrocyte precursor cells (OPCs) is minimal. (**A**) Scheme of the H2B-GFP reporter lines. (**B**) Experimental design of the exclusion strategy to trace the lineage of LGE radial glial cells (RGCs). (**C**) Representative coronal sections showing the traced cells in the forebrain. The majority of SOX10- and PDGFRA-positive cells were GFP$^+$ cells in the cortex at postnatal day 10 (P10). (**D–E**) The pie chart shows that the percentage of LGE/dMGE-derived cortical OPCs was approximately 3%.

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N=6 mice per group. (**F**) Many GFP$^+$ cells expressed SOX10 and PDGFRA in the striatum at P10. (**G**) Nearly all SOX10 and PDGFRA expressed GFP in the cortex at P0. (**H–I**) The pie chart shows that the percentage of LGE/dMGE-derived cortical OPCs was less than 3%. N=6 mice per group.

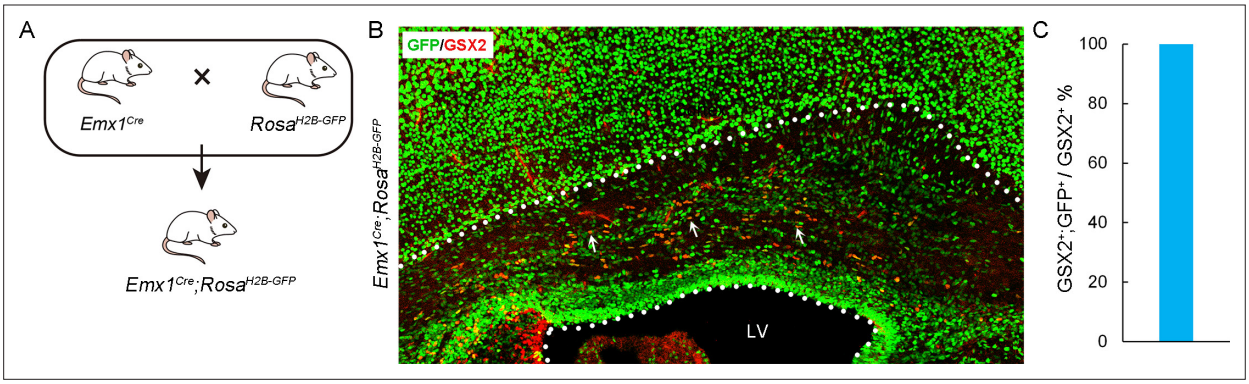

Figure 3—figure supplement 1. Lineage tracing of *Emx1*^{Cre} derived cortical cells. (**A**) Experimental design for the generation of *Emx1*^{Cre}; H2B-GFP mice. (**B**) Double immunostaining of GSX2 with GFP in the *Emx1*^{Cre}; H2B-GFP cortex at postnatal day 0 (P0). (**C**) The statistics show that nearly all GSX2^{+} cells co-labeled with GFP in the cortical SVZ. N=4 per group.

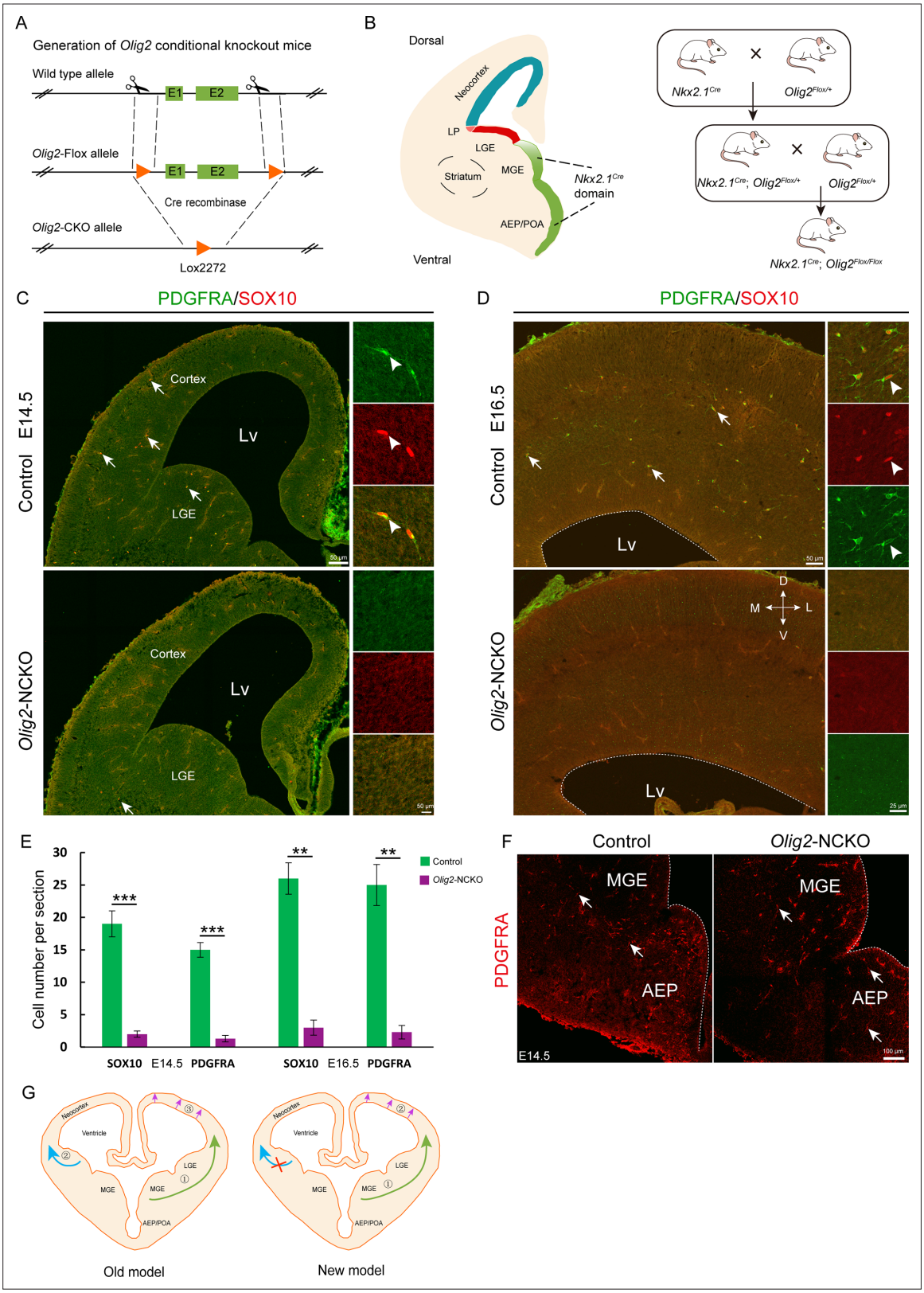

Figure 4. The medial ganglionic eminence (MGE) may be the sole ventral source of cortical oligodendrocyte precursor cells (OPCs). (**A**) The CRISPR/Cas9 technique was used to generate an *Olig2* conditional knockout allele. (**B**) Experimental design for the generation of *Olig2*-NCKO mice. (**C–D**) The expression of SOX10 and PDGFRA was significantly reduced in the cortex of *Olig2*-NCKO mice compared with that of control mice. (**E**) The number of SOX10- and PDGFRA-positive cells was significantly reduced in *Olig2*-NCKO mice compared with control mice. Student's t-test, **p<.01, ***p<.001,

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N≥5 mice per group, mean ± SEM. (**F**) Few PDGFRA-positive cells were detected in the MGE/anterior entopeduncular area (AEP) of the *Olig2*-NCKO mice. (**G**) A new model of the developmental origins of cortical OPCs.