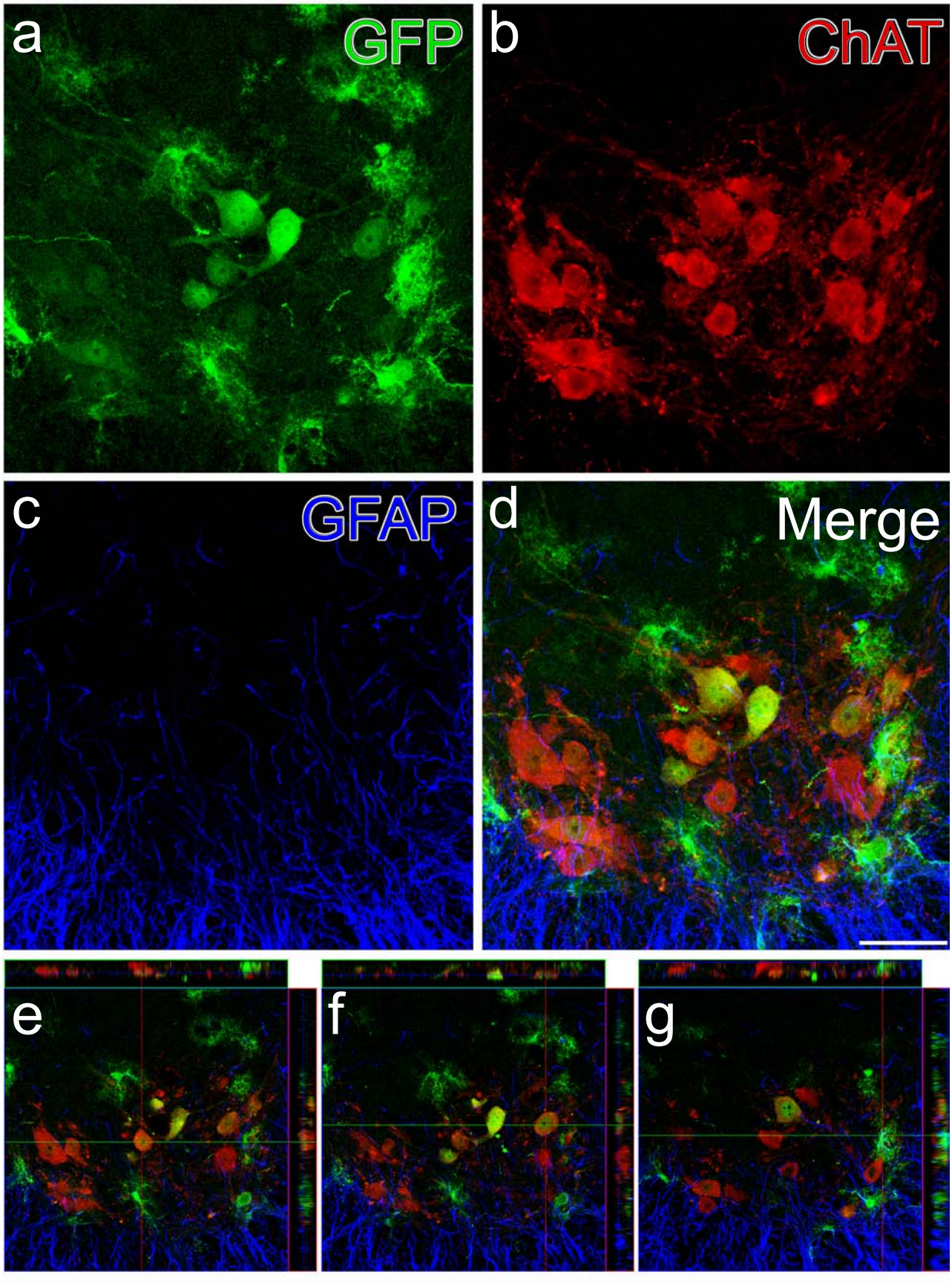
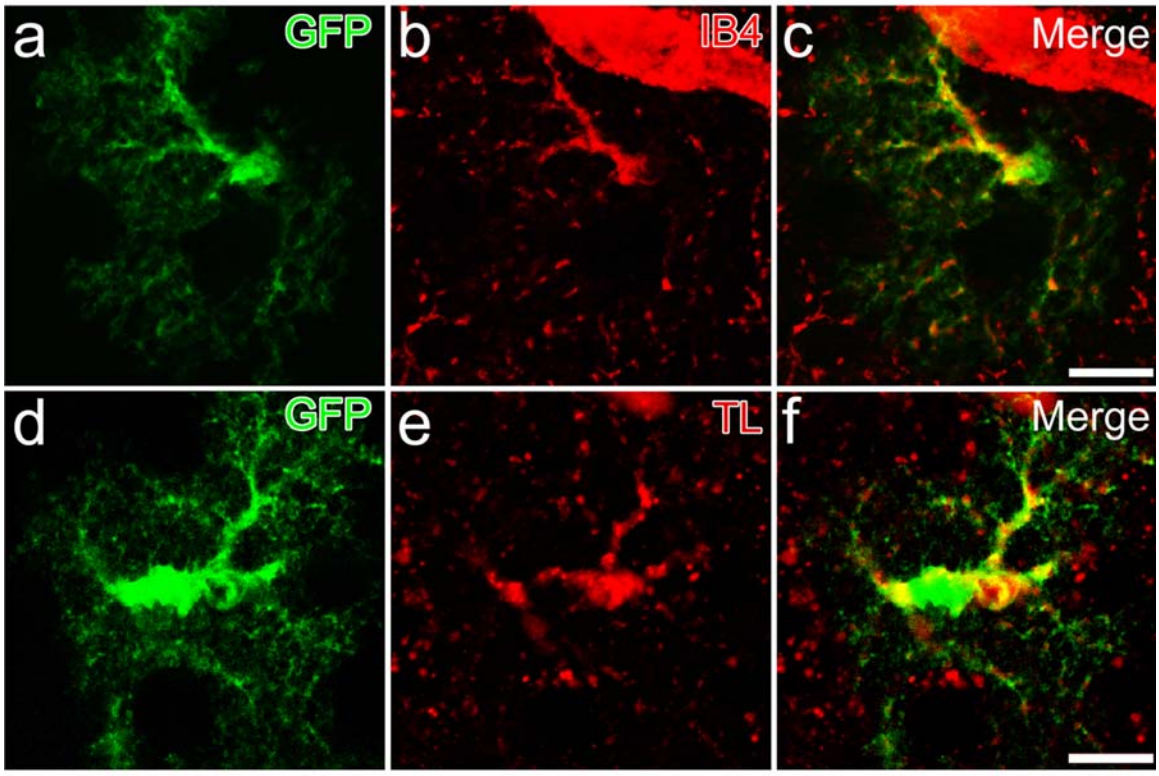
## Supplementary Figure 1




**Supplementary Figure 1** Intravenous injection of AAV9 leads to widespread and long-term neonatal spinal cord transduction in lumbar motor neurons. Z-series confocal microscopy showing GFP-expression in 21-day-old mice that received $4x10^{11}$ particles of scAAV9-CB-GFP intravenous injections on postnatal day-1. Z-stack images of GFP (**a**), ChAT (**b**), GFAP (**c**) and merged (**d**) demonstrating persistent GFP-expression in motor neurons and astrocytes (**d**) for at least three-weeks following scAAV9-CB-GFP injection. Orthoganol views (**e-g**) further confirm co-localization between GFP and ChAT labeled cells (**e-f**) and a GFP and GFAP labeled cell (**g**). Scale bar, 20μm (**d**).

**Supplementary Figure 2**




**Supplementary Figure 2** Intravenous injection of scAAV9 CB GFP resulted in GFP expression within microglia 21 days after postnatal day-1 administration. Immunofluorescent detection of GFP (**a,d**) and isolectin $B_4$ (**b**) or tomato lectin (**e**) mediated labeling demonstrates AAV9 transduction of microglia (**c,f**) in the neonate. Scale bars, 10μm (**c** and **f**)

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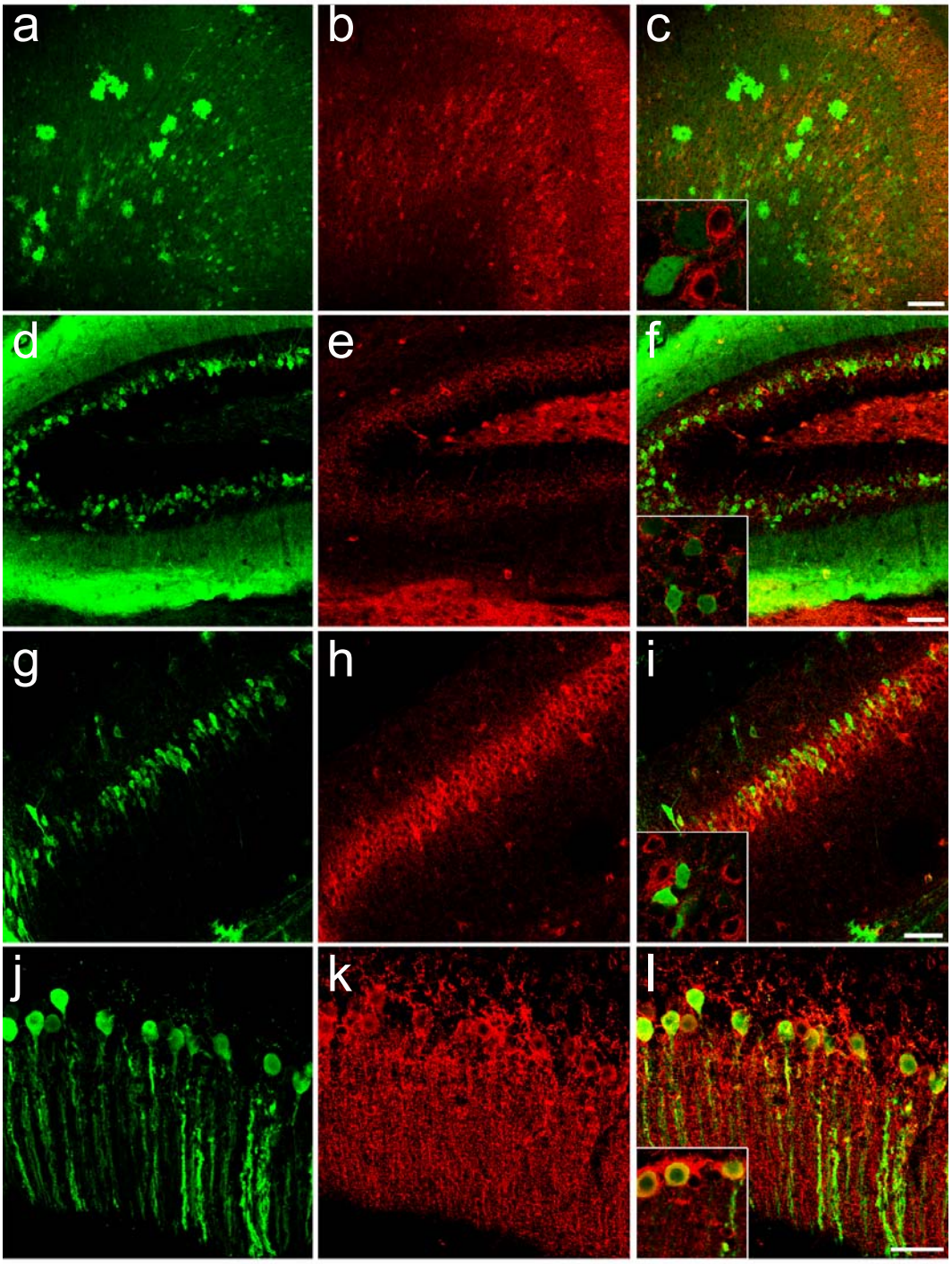
**Supplementary Figure 3**




**Supplementary Figure 3** Co-localization of GFP positive cells with GAD67. Immunohistochemical detection of GFP (**a**,**d**,**g**,**j**) and GAD67 (**b**,**e**,**h**,**k**) expression within select regions of mouse brain 21-days following postnatal day-1 injection of $4x10^{11}$ particles of scAAV9-CB-GFP. Merged images (**c**,**f**,**i**,**l**) and insets show limited co-localization of GFP and GAD67 signals in the cingulate gyrus (**a-c**), the dentate gyrus (**d-f**) and the hippocampus (**g-i**), but numerous GFP/GAD67 Purkinje cells within the cerebellum(**l**). Scale bars, 100μm (**c**), 50μm (**a-b**,**d-l**)

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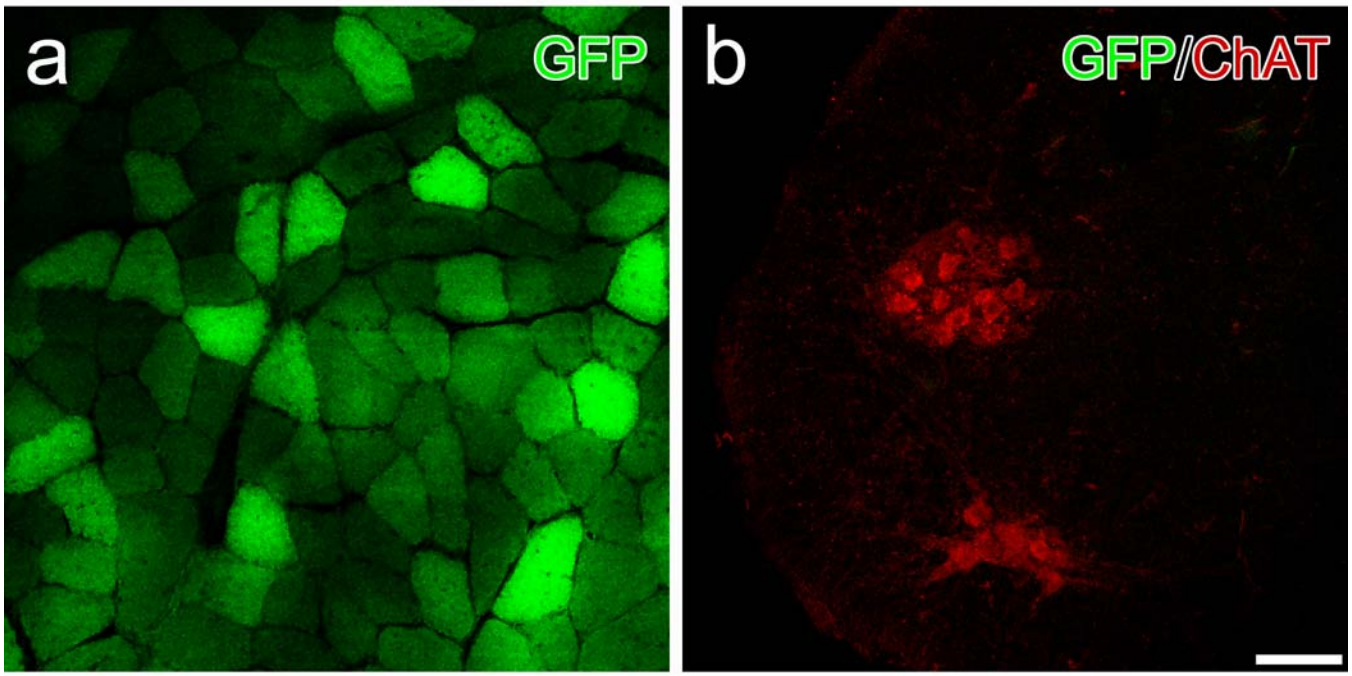
## Supplementary Figure 4




**Supplementary Figure 4** Intramuscular injection of scAAV9 CB GFP resulted in robust GFP expression in the injected muscle (**a**) but a lack of expression within innervating lower motor neurons (**b**). Tissues were harvested two-weeks post intramuscular injection of $5x10^{10}$ particles of scAAV9 CB GFP. Scale bar, 100μm (**b**)

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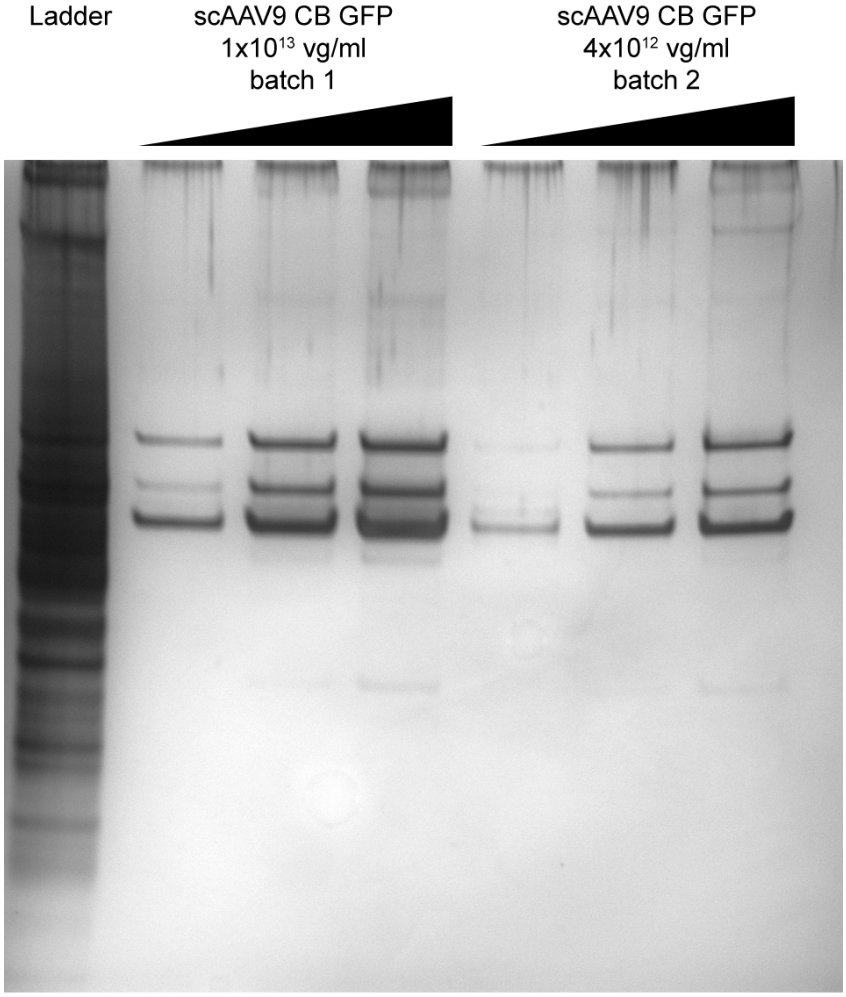
# Supplementary Figure 5




**Supplementary Figure 5** Gel Electrophoresis and silver staining of various AAV9-CB-GFP vector preparations demonstrates high purity of research grade virus utilized in studies. Shown are 2 vector batches at varying concentrations demonstrating the predominant 3 viral proteins (VP); VP1, 2, 3 as the significant components of the preparation. 1µl, 5µl, and 10µl were loaded of each respective batch of virus.

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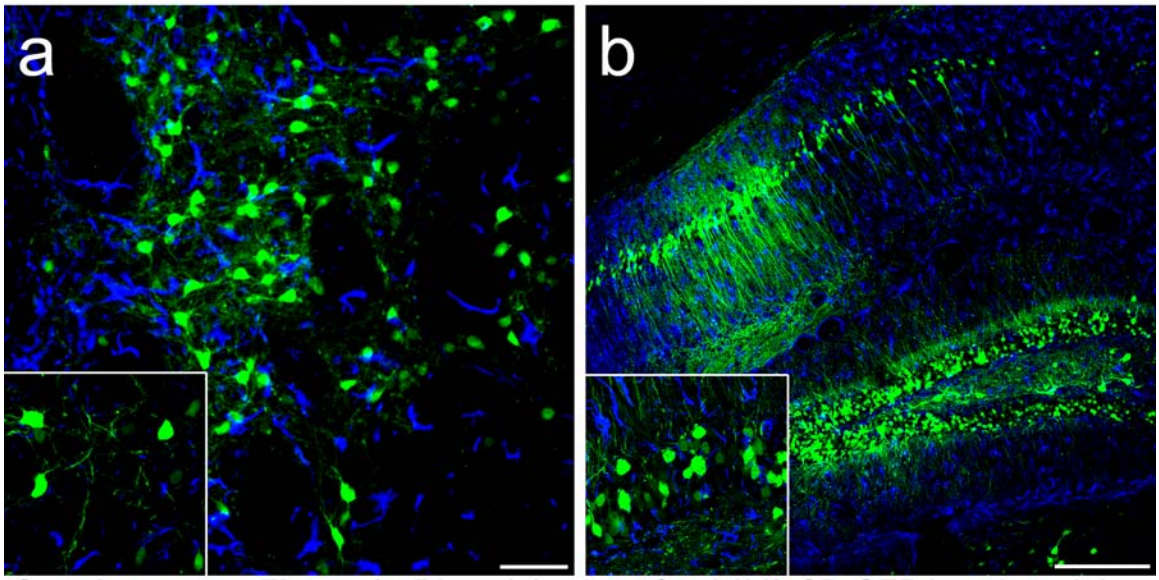
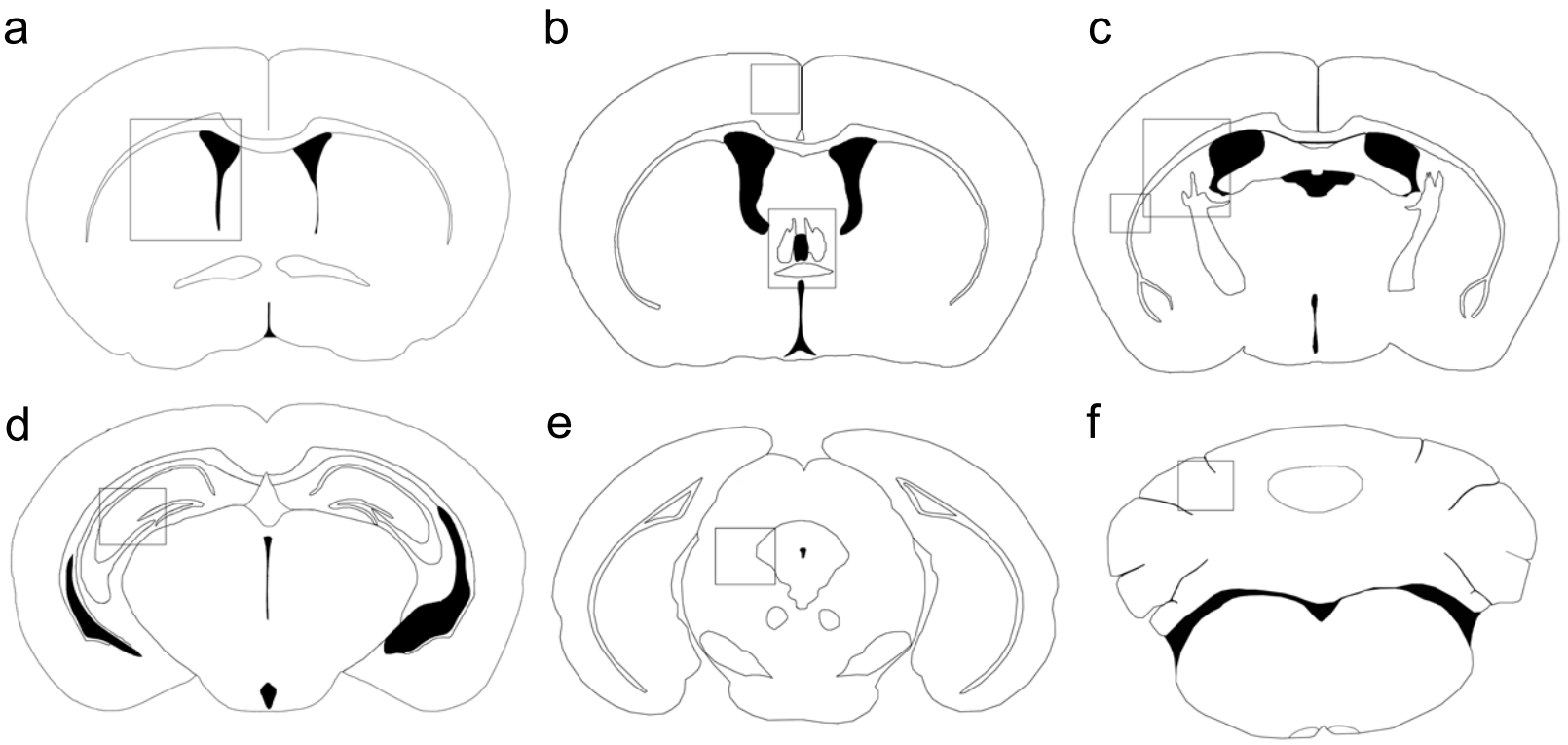
## Supplementary Figure 6




**Supplementary Figure 6** Direct injection of scAAV9-CB-GFP into the adult brain demonstrates predominant neuronal transduction. Injection of virus into the striatum (**a**) and hippocampus (**b**) resulted in the familiar neuronal transduction pattern as expected (*n*=3). Co-labeling for GFP (green) and GFAP (blue) demonstrate a lack of astrocyte transduction in the injected structures with significant neuronal cell transduction. Insets of striatum (**a**) and dentate gyrus (**b**) show high magnification merged images of GFP (green) and GFAP (blue) labeling futher confirming a lack of astrocyte transduction. Scale bars, 50μm (**a**), 200μm (**b**)

## Supplementary Figure 7




**Supplementary Figure 7** Diagrams of coronal sections throughout the mouse brain corresponding to the approximate locations shown in **figure 3**(**a-h**) for postnatal day-1 injected neonatal mouse brains. The box in (**a**) corresponds to the location of (**Fig. 3a**). The smaller box in (**b**) corresponds to (**Fig. 3b**) and the larger box to (**Fig. 3c**). The larger box in (**c**) corresponds to (**Fig. 3d**) while the smaller box in (**c**) represents (**Fig. 3e**). Finally, (**d-f**) correspond to (**Fig. 3 f-h**) respectively.

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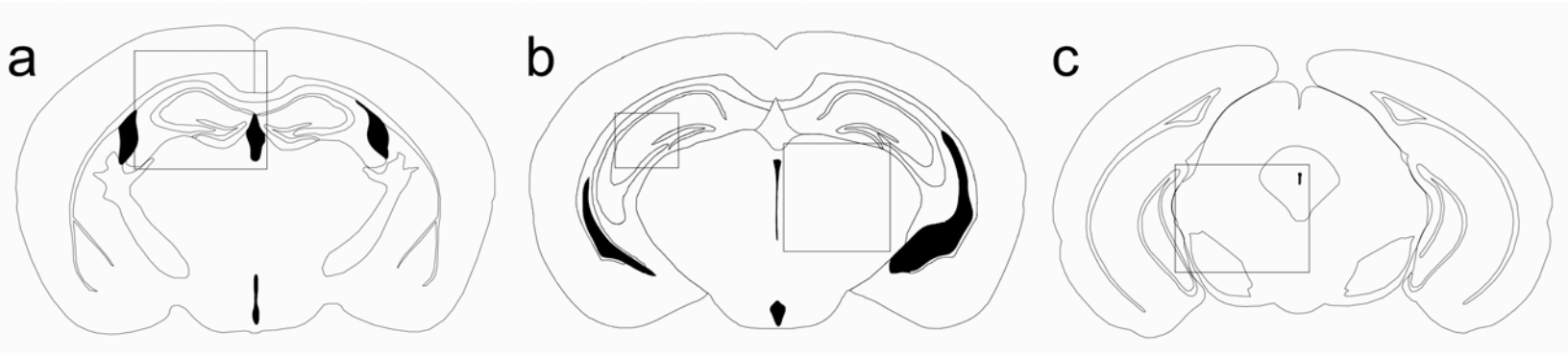
## Supplementary Figure 8




**Supplementary Figure 8** Diagrams of coronal sections throughout the mouse brain corresponding to the approximate locations shown in (**Fig. 5m-p**). The box in (**a**) corresponds to the location shown in (**Fig. 5m**). The smaller box in (**b**) corresponds to (**Fig. 5n**) and the larger box to (**Fig. 5o**). Finally, the approximate location of (**Fig. 5p**) is shown in (**c**).

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