**Supplemental Figures and Legends**

**Figure S1 (Related to Figure 1). Deletion of *Arl13b* in interneurons. (A-B)** Interneurons were labeled with anti-Arl13b antibodies (red) in *Nkx2.1Cre; Arl13b$^{lox/+}$; Ai3* (A) and *Nkx2.1Cre; Arl13b$^{lox/lox}$; Ai3* (B) brains [E14.5]. (C, D) Arl13b is absent in *Nkx2.1Cre; Arl13b$^{lox/lox}$; Ai3* interneurons. Interneurons were co-labeled with anti-GFP, anti-Arl13b (red) and anti-ACIII (white) antibodies in *Nkx2.1Cre; Arl13b$^{lox/+}$; Ai3* (C) and *Nkx2.1Cre; Arl13b$^{lox/lox}$; Ai3* (D) brains. Arl13b is absent in the cilia (ACIII$^{+}$) of *Nkx2.1Cre; Arl13b$^{lox/lox}$; Ai3* interneurons (YFP$^{+}$). Arrowheads (C, D) point to primary cilia. Scale bar, 20μm (A-B); 9μm (C-D).

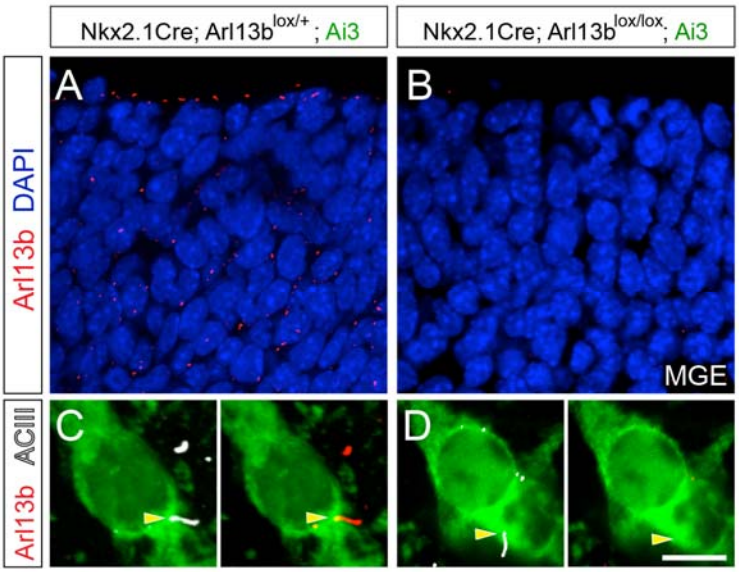


**Figure S2 (Related to Figure 1 and Figure 2). Deletion of *Arl13b* results in cortical interneuron morphological and synaptic defects.** (**A, B**) YFP$^{+}$ interneurons in the neocortex of *Nkx2.1Cre; Arl13b$^{lox/lox}$*; Ai3 brains show reduced morphological complexity compared to control. Insets (A, B) show high magnification images of YFP$^{+}$ neurons. (C, D) Labeling with anti-PV antibodies show PV$^{+}$ interneuron morphological defects in the hippocampal dentate gyrus (DG) of *Nkx2.1Cre; Arl13b$^{lox/lox}$* (D) mice [P30]. (E, F) Cortical interneurons were labeled with anti-PV or anti-GFP antibodies in *Nkx2.1Cre; Arl13b$^{lox/+}$; Ai3* (E) and *Nkx2.1Cre; Arl13b$^{lox/lox}$; Ai3* (F) brains. Cortical projection neurons were

counterstained with anti-NeuN antibodies. Arrowheads point to PV$^+$ or YFP$^+$ perisomatic synaptic boutons in control (E', E'') and mutant cortices (F', F''). (G, H) Quantification of PV$^+$/YFP$^+$ perisomatic bouton density (G) and size (H) in control and *Nkx2.1Cre; Arl13b$^{lox/lox}$; Ai3* cortices. Data shown are mean ± SEM. $^*P$<0.05 (Student's *t*-test, $p_{[G]}$ = 0.0001, $p_{[H]}$ = 0.0001). 42 cells from 4 different brains per group were analyzed. Scale bar, 88μm (A-B); 20μm (C-D); 12μm(E-F); 5.8μm (E', E'', F', F'').

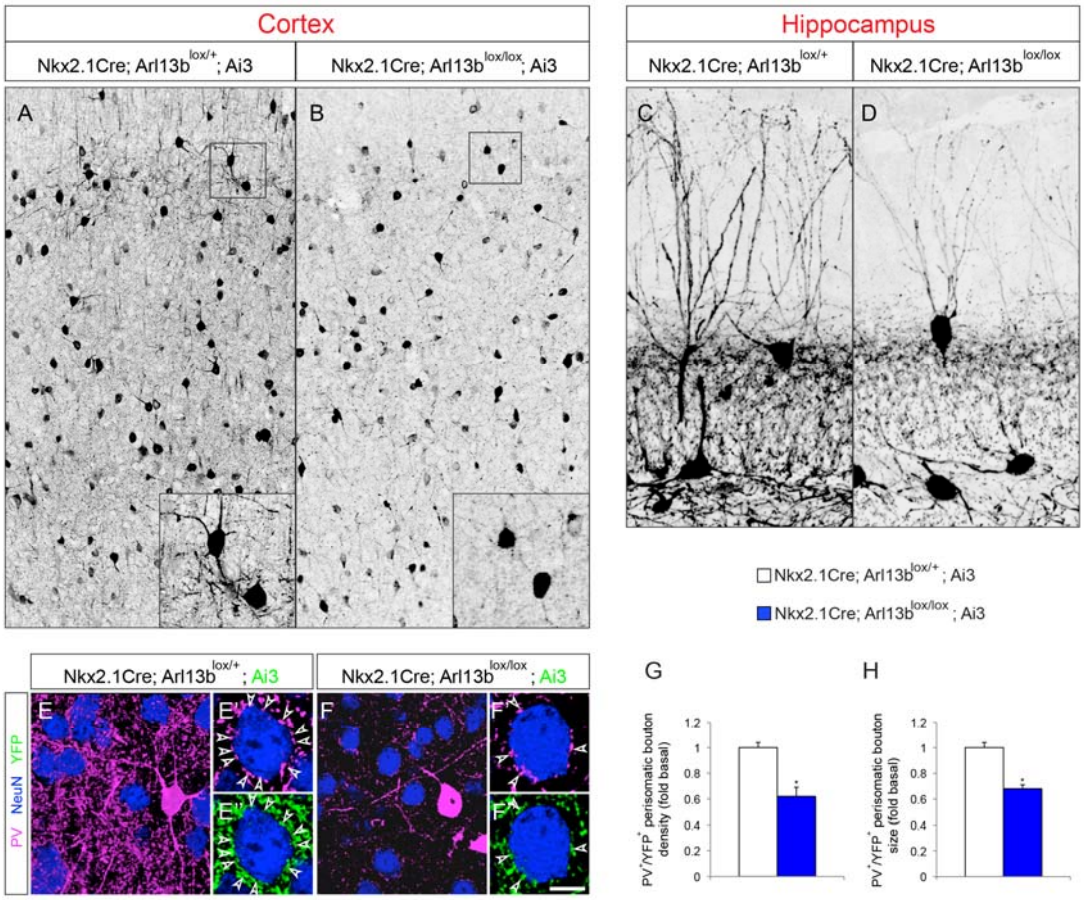


**Figure S3 (Related to Figure 1 and Figure 2). Deletion of *Arl13b* in postnatal PV$^+$ interneurons results in cortical interneuron morphological and synaptic defects.** (**A-B**) Co-labeling with anti-Arl13b (green) and anti-ACIII (blue) antibodies in the *ParvCre; Arl13b$^{lox/+}$; Ai9* (A) and *ParvCre; Arl13b$^{lox/lox}$; Ai9* (B) brains show loss of Arl13b in the cilia (arrowhead) of *ParvCre; Arl13b$^{lox/lox}$; Ai9* interneurons. (**C-F**) TdTom$^+$ PV interneurons in the cortex (D) and hippocampal CA1 (F) region

of *ParvCre; Arl13b$^{lox/lox}$; Ai9* brains show reduced morphological complexity compared to *ParvCre; Arl13b$^{lox/+}$; Ai9* (C, E) brains [P60]. (G-H) Arrowheads point to tdTom$^{+}$ perisomatic synaptic boutons in *ParvCre; Arl13b$^{lox/+}$; Ai9* (G) and *ParvCre; Arl13b$^{lox/lox}$; Ai9* (H) cortices [P60]. Cortical projection neurons were counterstained with anti-NeuN antibodies. (I, J) Quantification of tdTom$^{+}$ perisomatic bouton (arrowhead) density (I) and size (J) in control and *ParvCre; Arl13b$^{lox/lox}$; Ai3* cortices. Data shown are mean ± SEM. $^{*}P<0.05$ (Student's *t*-test, p = 0.0001). 22 cells from 4 different brains per group were analyzed. Scale bar, 11.8μm (A-B); 52μm (C-F); 5μm (G-H).

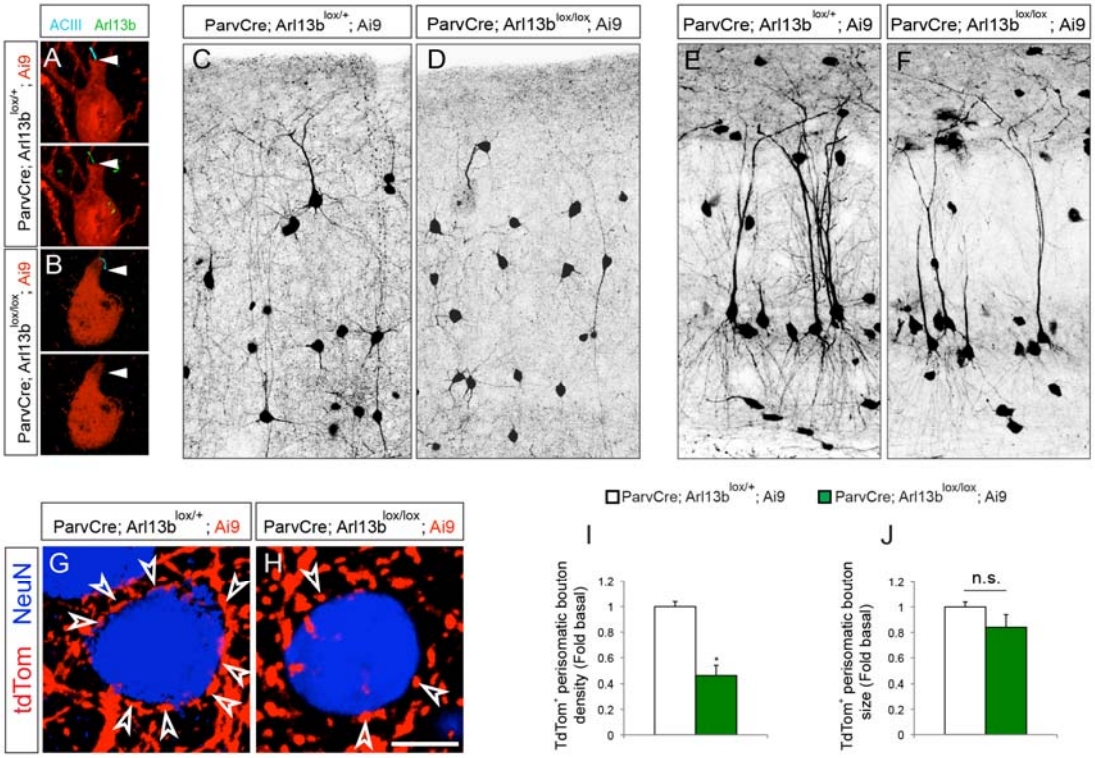


**Figure S4 (Related to Figure 2). Morphological and synaptic defects of Arl13b deficient interneurons *in vitro*.** (A-B) Dissociated interneurons from *Nkx2.1Cre; Arl13b$^{lox/+}$; Ai9* (A) and *Nkx2.1Cre; Arl13b$^{lox/lox}$; Ai9* (B) brains [E14.5] were cultured for 4 weeks and labeled with anti-VGAT antibodies. (A', B') Representative high-magnification images of VGAT$^{+}$ inhibitory presynaptic boutons along control (A') and Arl13b deficient (B') tdTom$^{+}$ interneuron axons. (C, D) Quantification of VGAT$^{+}$

bouton density (C) and size (D) along control and mutant interneuron axons. Data shown are mean ± SEM. 12 cells per group from 3 independent experiments were analyzed. $^{*}P<0.05$ (Student's *t*-test, $p_{[C]} = 0.003$, $p_{[D]} = 0.01$). Scale bar, 20μm (A-B); 4.7μm (A'-B').

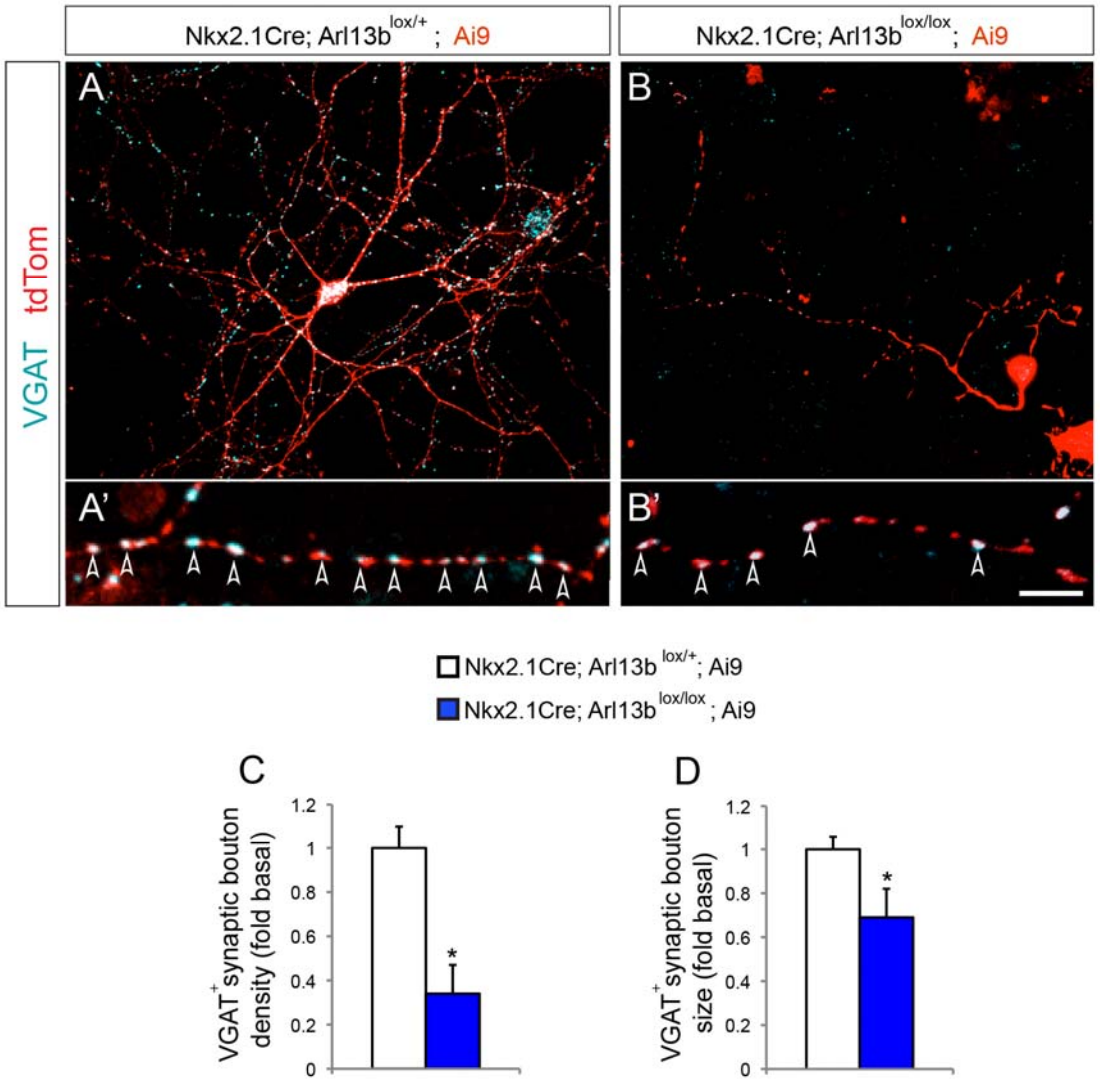


**Figure S5 (Related to Figure 5). Induced expression of Sstr3 in Arl13b deficient primary cilia rescues interneuron defects *in vitro*.** (A-C) Dissociated tdTom$^{+}$ INs from *Nkx2.1Cre; Arl13b$^{lox/+}$; Ai9* (A), *Nkx2.1Cre; Arl13b$^{lox/lox}$; Ai9* (B), *Nkx2.1Cre; Arl13b$^{lox/lox}$; Sstr3-GFP; Ai9* and (D) *Nkx2.1Cre; Arl13b$^{lox/lox}$; Ai9* + *D124E-Sstr3* brains were cultured for 3 weeks. Inset (C-D) shows high-

magnification images of Sstr3-GFP (C) and D124E-Sstr3 (D) expression in primary cilium (arrowhead). (A'-D') Axons of tdTom$^+$ interneurons were co-labeled with anti-VGAT antibodies. Arrowheads point to VGAT$^+$ synaptic boutons along tdTom$^+$ axons. (E, F) Quantification of VGAT$^+$ synaptic bouton density (E) and size (F) in tdTom$^+$ interneuron axons. Data shown are mean ± SEM. $^*P$<0.05 (One-way ANOVA: $F_{3,116\ [E]}$ = 47.3; $p_{[E]}$ = 4.8E-20; post-hoc $p_{[E,\ lox/+\ vs.\ lox/lox]}$ = 3.1E-13, post-hoc $p_{[E,\ lox/lox\ vs.\ lox/lox\text{-}Sstr3]}$ = 6.5E-10, post-hoc $p_{[E,\ lox/lox\ vs.\ lox/lox\text{-}D124E\text{-}Sstr3]}$ = 0.82; $F_{3,116\ [F]}$ = 24.1; $p_{[F]}$ = 3.3E-12; post-hoc $p_{[F,\ lox/+\ vs.\ lox/lox]}$ = 2.94E-08, post-hoc $p_{[F,\ lox/lox\ vs.\ lox/lox\text{-}Sstr3]}$ = 1.97E-07, post-hoc $p_{[F,\ lox/lox\ vs.\ lox/lox\text{-}D124E\text{-}Sstr3]}$ = 0.34). Number of cells per group =30. Scale bar, 20μm (A-D); 5μm (A'-D').

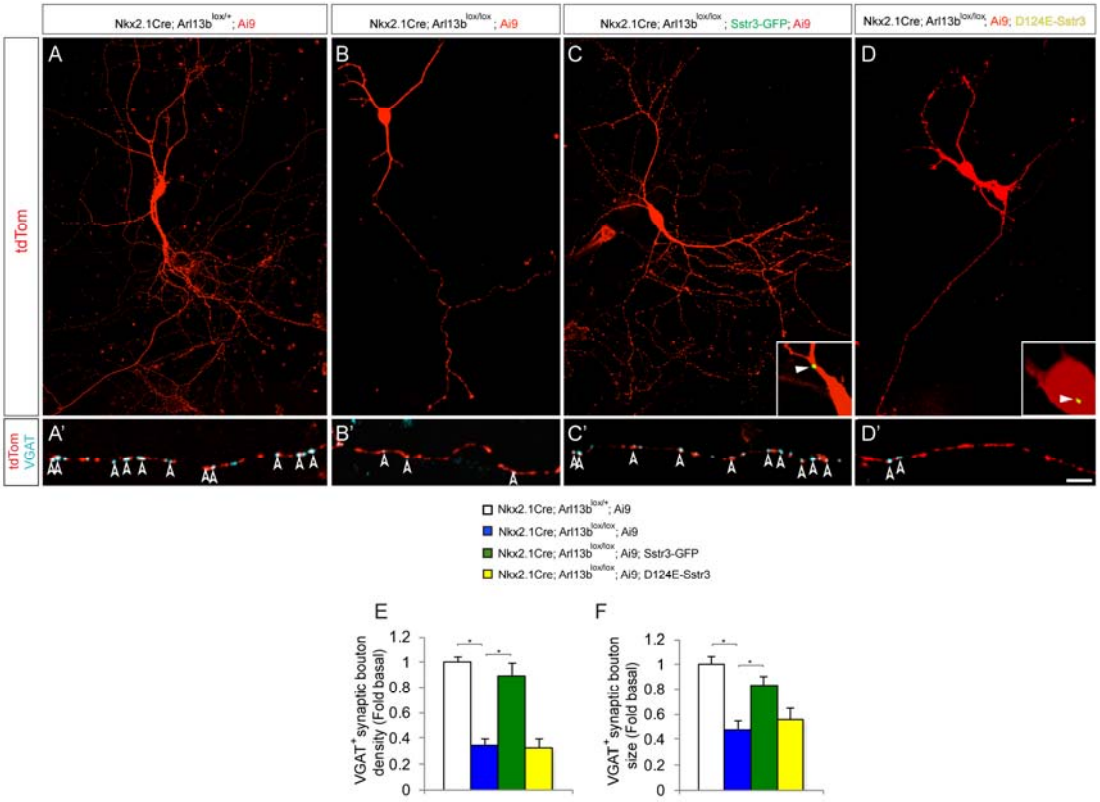


**Figure S6 (Related to Figure 6). Cilia-targeted expression of hM3D$_q$ DREADD.** (A) Wild type MEFs were transfected with Cilia-hM3D$_q$ and labeled with anti-GFP and anti-Arl13b antibodies. Nuclei were counterstained with DAPI. (B) DREADD (GFP$^+$) ratio in cilia vs. cytosol was measured and used as cilia localization index. The expression of Cilia-hM3D$_q$ is highly enriched in primary cilium. Data shown are

mean ± SEM. (C) Cilia-hM3D$_q$ expression did not significantly affect ciliary length when compared to control cells. Data shown are mean ± SEM. (Student's *t*-test, p > 0.05). Number of cells per group =16. Scale bar, 2.5μm.