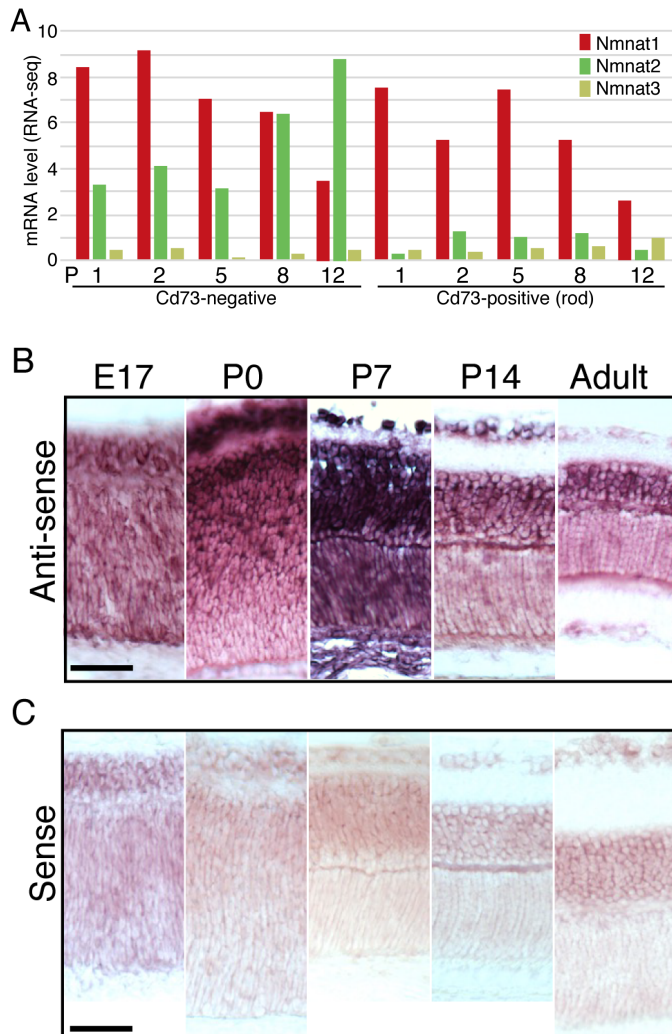
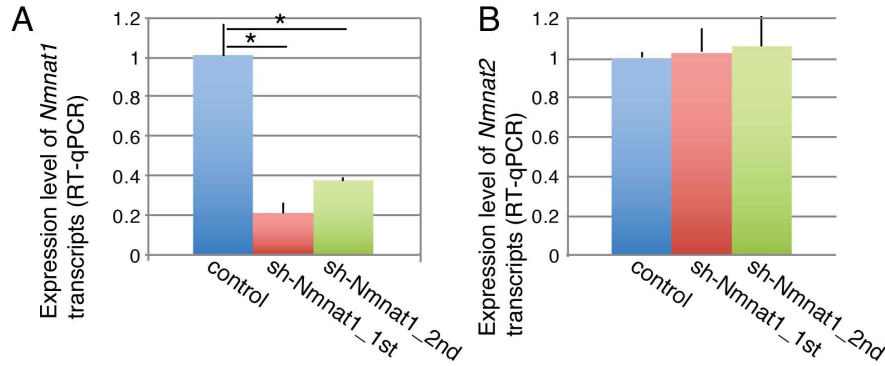


### Supplemental Figure1



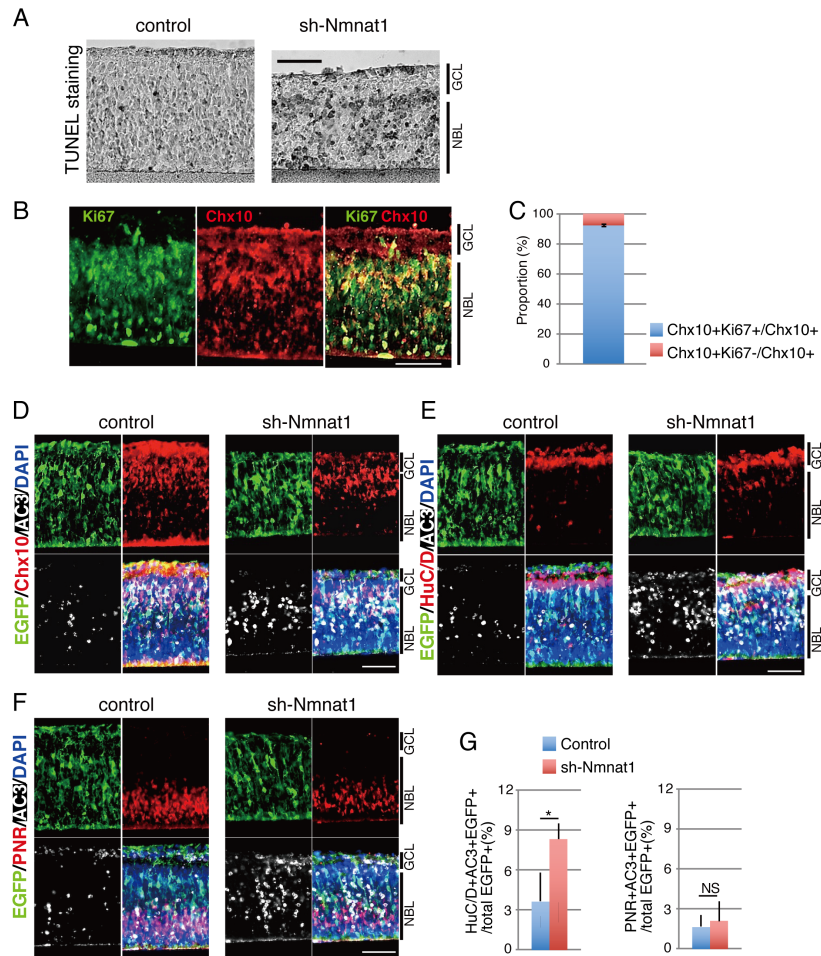
A. The expression levels of *Nmnat1*, 2, and 3 transcripts in developing photoreceptors and other retinal cells were examined in RNA-seq (GSE71464). Mouse retinas were isolated and fractionated to Cd73 positive photoreceptor and C73 negative other retinal cells, and RNA-seq was performed using total RNA purified from the fractions (Ueno et al., Sci Rep 6, 29264, 2016). FPKM values of *Nmnat1*, 2, 3 are shown. B, C. In situ hybridization of *Nmnat1* using retinal sections at indicated developmental stages. Anti-sense (B) and sense (C) probes were used.

### Supplemental Figure 2



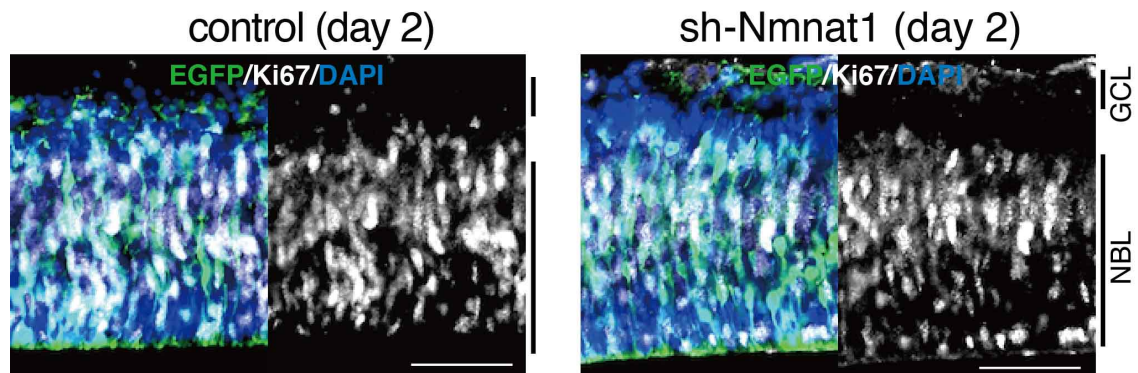
A, B. Plasmids containing scramble, sh-Nmnat1\_1, or sh-Nmnat1\_2 was transfected into NIH3T3 cells, and the cells were harvested after 48 hours of culture. RT-qPCR to detect *Nmnat1* (A), and *Nmnat2* (B) transcripts was done. Values are expressed relative to values of *Gapdh*. Three independent transfection was done, and average with standard deviation was performed. Statistical calculation was performed by Turkey HSD, p, \* $<0.05$ .

### Supplemental Figure 3



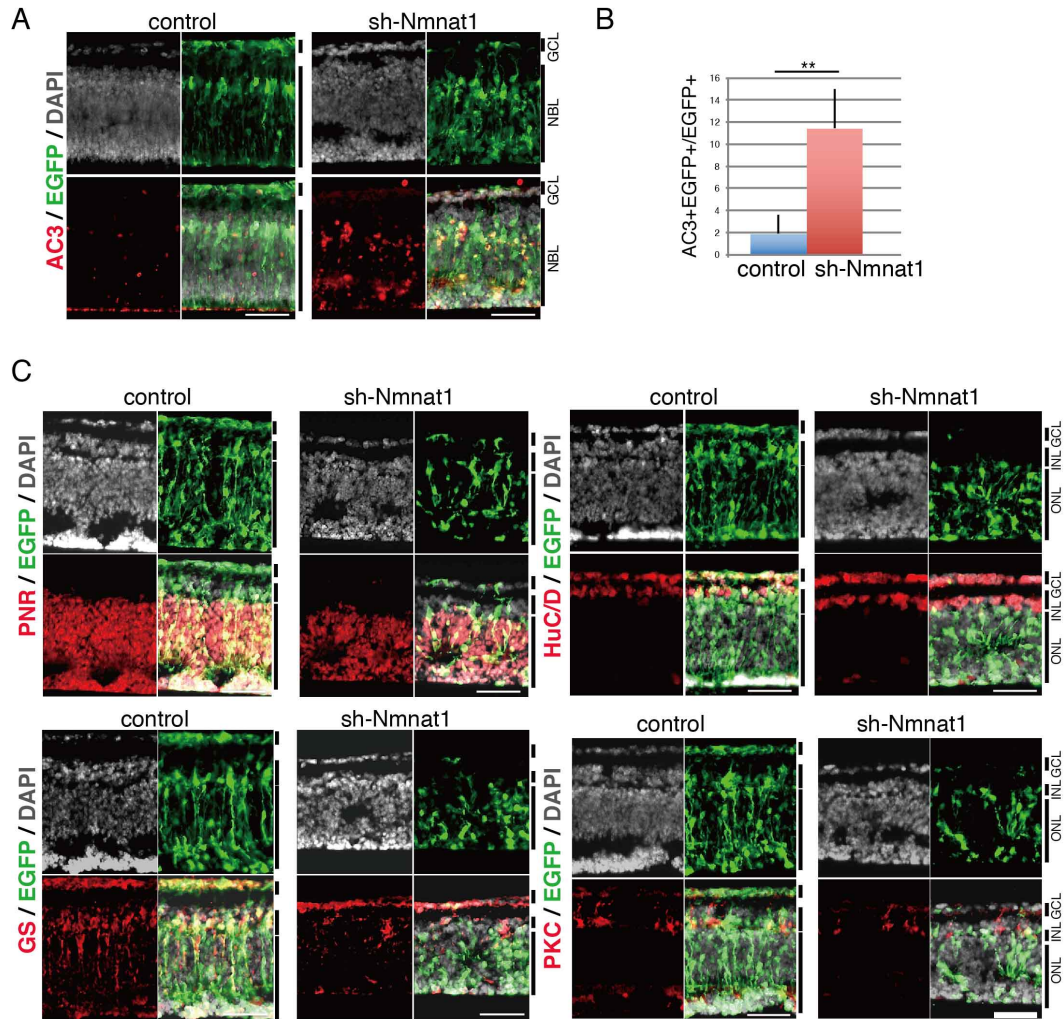
A. Isolated retinas at E17.5 were transfected with control or sh-Nmnat1 plasmid with EGFP-expressing plasmid, and after 4 days, TUNEL was done to detect DNA fragments. B, C. Mice retinas were isolated at E17.5, and immunostaining was performed after 3 days of culture by using anti-Ki67 and -Chx10 antibodies. Population of Chx10+Ki67+ double positive cell or Chx10+Ki67- single positive cells in total Chx10 positive cells was calculated in C. Values are average of three independent samples with standard deviation. D-G. Isolated retinas at E17.5 were transfected with control or sh-Nmnat1 plasmid with EGFP-expressing plasmid, and after 4 days, cryosections were immunostained with anti-EGFP, -AC3 antibodies with either one of anti-Chx10 (D), -HuC/D (E), or -PNR antibodies (F). Nuclei were visualized by staining with DAPI. Population of HuC/D+AC3+EGFP+ triple positive cells (left panel) or PNR+AC3+EGFP+ triple positive cells (right panel) in total EGFP+ cells are shown in G. Transfection was performed three times independently (D-F), and average with standard deviation are shown in F. Statistical calculation was performed by Student's T-Test,  $p$ ,  $* < 0.05$ ,  $n.s. > 0.05$ . Scale bar = 50  $\mu$ m.

*Supplemental Figure 4*



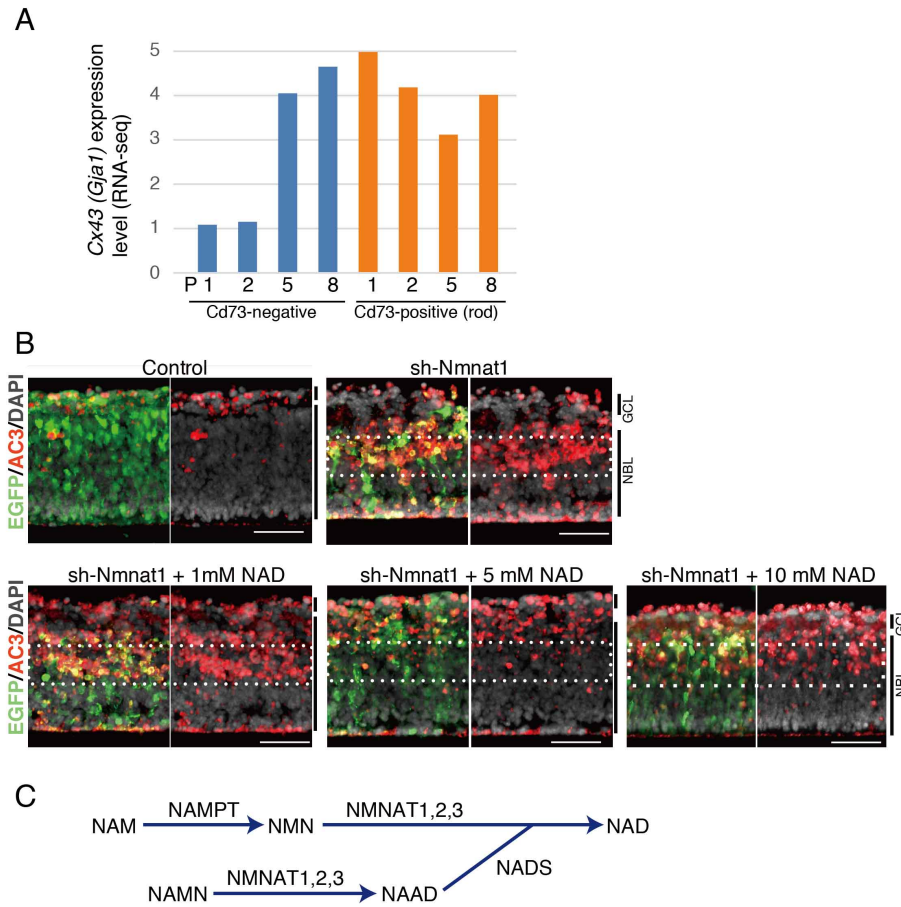
Cell proliferation was examined by anti-Ki67 antibody after 2 days of retinal explant culture transfected with control or sh-Nmnat1 together with EGFP expression plasmid at E17.5. Nuclei were visualized by staining with DAPI. Scale bar = 50  $\mu$ m.

# Supplemental Figure 5



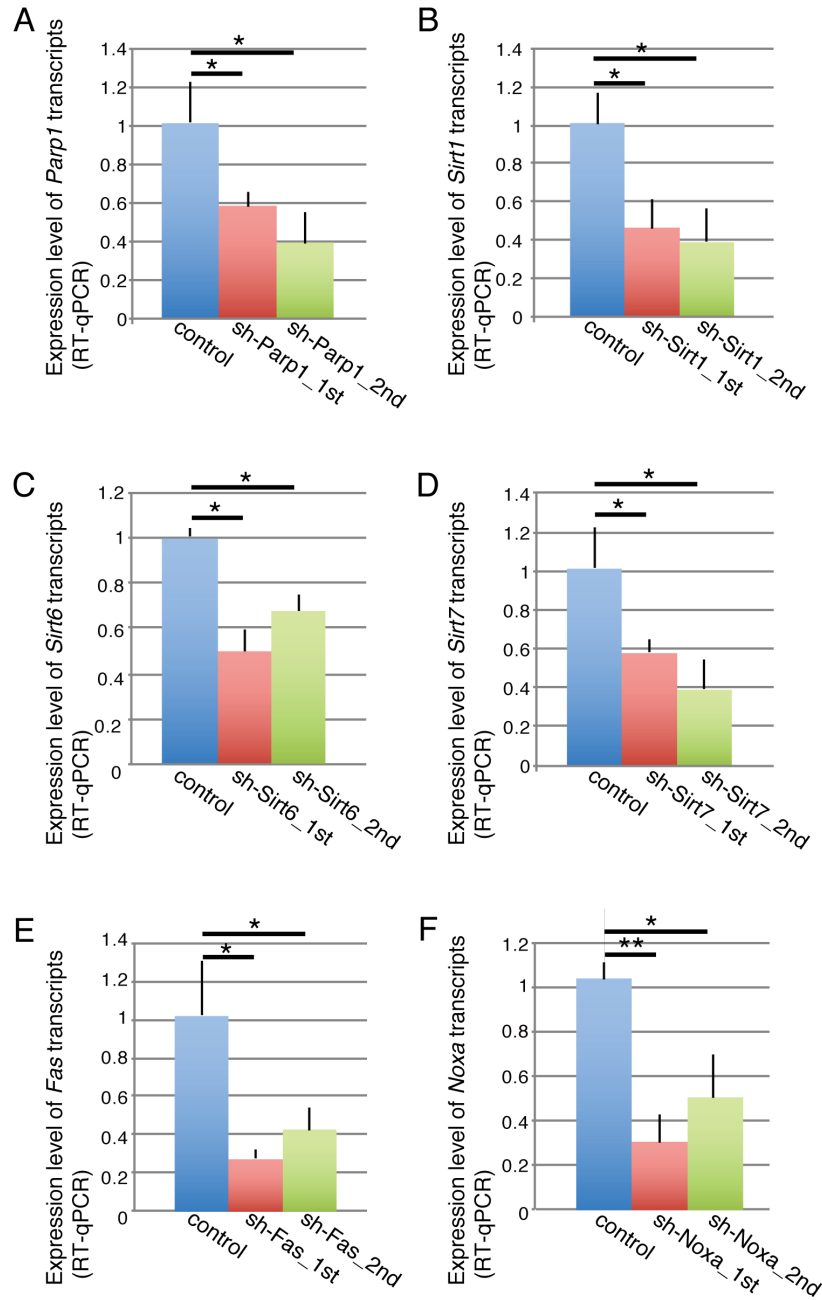
A-C. Isolated retinas at P1 were transfected with control or sh-Nmnat1 plasmid with EGFP-expressing plasmid, and after 4 days (A), or 10 days (C), retinas were harvested and immunostained with anti-EGFP and indicated antibodies. Nuclei were visualized by staining with DAPI. AC3+EGFP+ double positive cell population in total EGFP positive cells are calculated. Average value of three independent samples with standard deviation are shown in B. Statistical calculation was performed by Student's T-Test,  $p$ ,  $** < 0.01$ .

## Supplemental Figure 6



A. Expression levels of *Cx43* (*Gja1*) transcript in developing retina (Cd73+ rod photoreceptors and Cd73- other cells) examined by RNA-seq are shown. B. Isolated retinas at E17.5 were transfected with control or sh-Nmnat1 and cultured as explants in the presence of NAD with indicated concentration. After 4 days, immunostaining was done by using anti-EGFP, -AC3 antibodies. Nuclei were visualized with DAPI. C. Schematic representation of Nmnats and NAD related derivatives.

**Supplemental Figure 7**



A-F. Plasmids encoding control, or indicated sh-RNA were transfected into NIH3T3 cells, and the cells were harvested after 48 hours of culture. RT-qPCR to detect indicated transcripts was done. Values are expressed relative to value of *Gapdh*. Three independent transfection were done, and averages with standard deviation are shown. Statistical calculation was performed by Turkey HSD, p, \* $<0.05$ , \*\* $<0.01$ .