Supplemental Figures and Tables

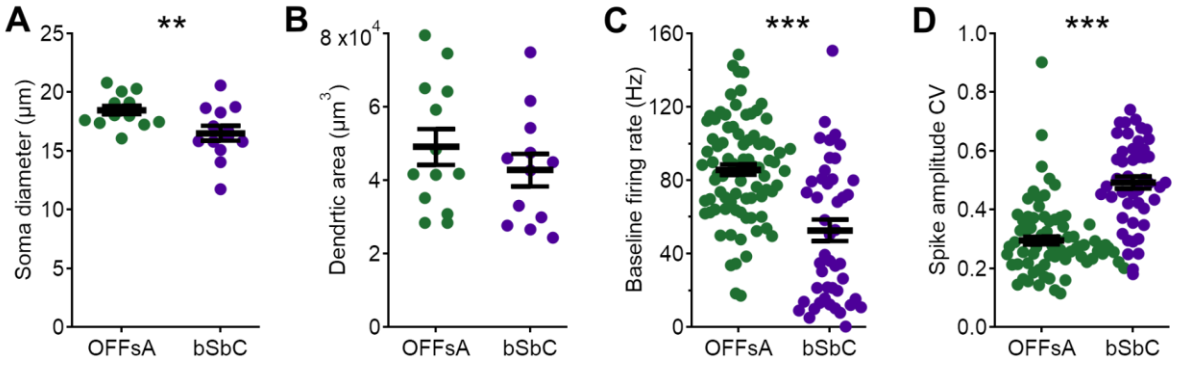

Figure S1. OFFsA and bSbC RGCs differ in morphological and physiological parameters, related to Figure 1.
(A) Soma diameter of the OFFsA (N = 14) and bSbC (N = 13), p = 0.010.
(B) Convex dendritic area of the OFFsA (N = 13) and bSbC (N = 12), p = 0.35.
(C) Baseline firing rate in darkness of the OFFsA (N = 86) and bSbC (N = 47), $p = 1.0 \times 10^{-07}$.
(D) Coefficient of variation (CV) of the baseline firing spike amplitudes in darkness of the OFFsA (N = 86) and bSbC (N = 47), $p = 2.8 \times 10^{-14}$. ** indicates a p-value < 0.01, *** indicates a p-value < 0.001.

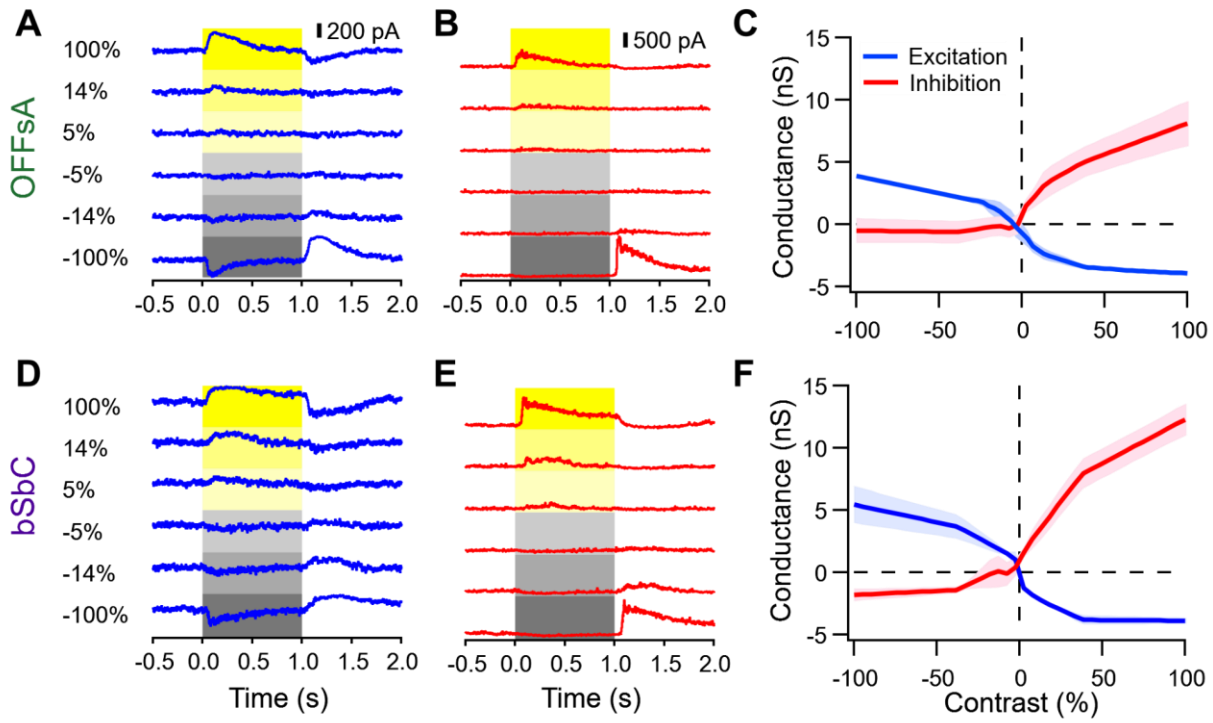

Figure S2. Synaptic currents in OFFsA and the bSbC RGCs are similar, related to Figure 2.
(A, B, D, E) Example traces from voltage clamp recordings during the presentation of contrast steps as indicated at a hold of -60 mV to measure excitatory currents **(A, D)** and at a hold of 20 mV to measure inhibitory currents **(B, E)** from an OFFsA RGC **(A, B)** and a bSbC RGC **(D, E)**.
(C, F) Peak excitatory (*blue*) and inhibitory (*red*) synaptic conductance as a function of contrast for OFFsA RGCs (**C**) and bSbC RGCs (**F**). Shaded regions are SEM across cells (N = 3 OFFsA, 3 bSbC).

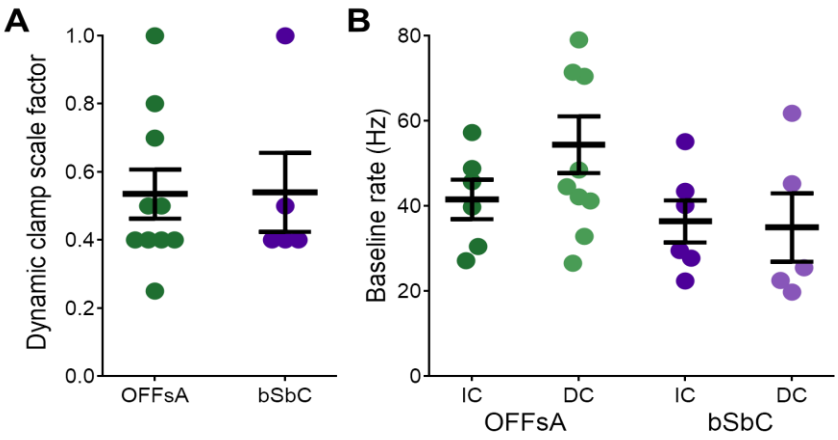

Figure S3. Dynamic clamp parameters are not significantly different between RGC types, related to Figure 2.
(A) Dynamic clamp conductance scale factor for recordings in each RGC type (T-test, p = 0.97). OFFsA N = 10, bSbC N = 5.
(B) Comparison of baseline firing rates in the 2 RGC types in current clamp in the absence of synaptic blockers (IC) and in dynamic clamp with synaptic blockers and baseline conductances applied (DC). OFFsAs, IC N = 6, p = 0.19; bSbCs, IC N = 6, p = 0.88.

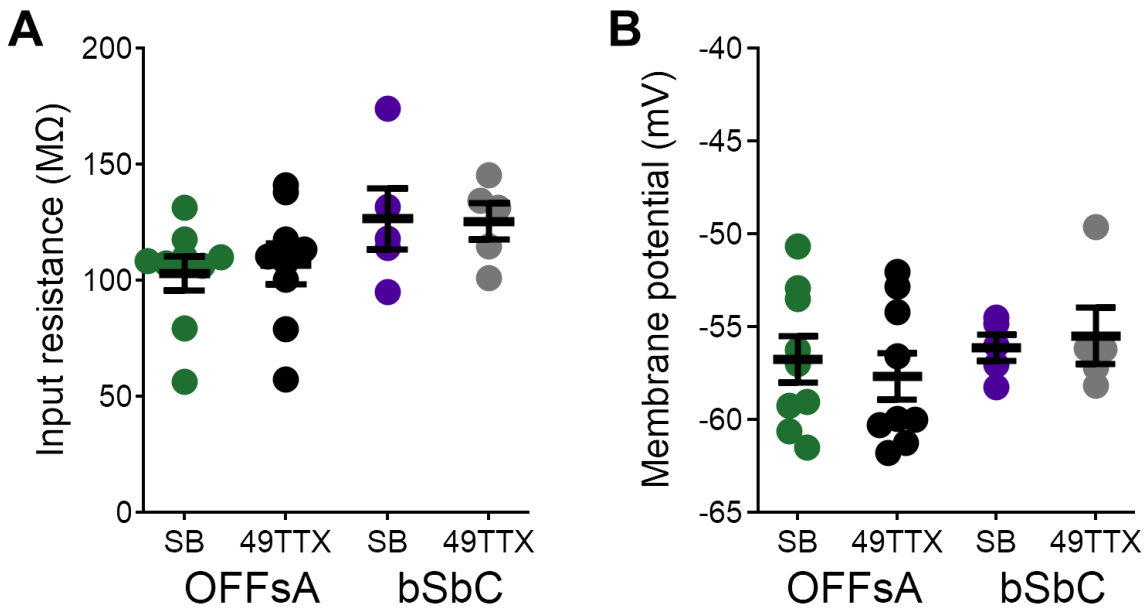

Figure S4. Passive properties are not significantly changed in an $Na_v1.6$-specific channel blocker, related to Figure 5.

(A) Input resistance for the OFFsA (p = 0.19, paired T-test) and bSbC (p = 0.92, paired T-test) in synaptic blockers (SB) and in SB + 49TTX. OFFsA is *green* for SB and *black* for 49TTX, bSbC is *purple* for SB and *gray* for 49TTX. OFFsA N = 9, bSbC N = 5.

(B) Membrane potential for the OFFsA (p = 0.091 paired T-test) and bSbC (p = 0.70, paired T-test) in synaptic blockers (SB) and in 49TTX.

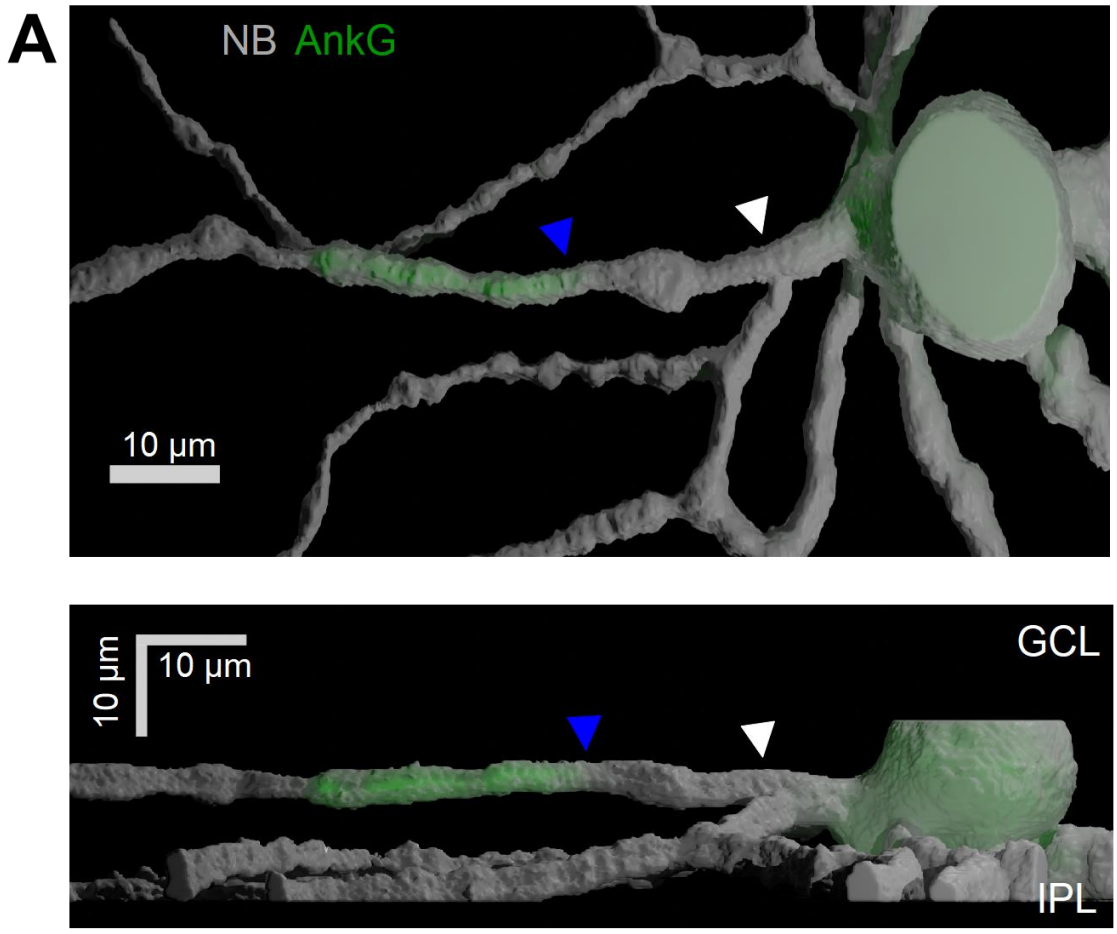

Figure S5. Some bSbC RGC axons arise from a primary dendrite, related to Figure 6.
(A) An example rendering of a bSbC RGC filled with neurobiotin (gray) with AnkG labeled to mark the AIS (green). The white arrow denotes the branching point of the axon off the primary dendrite and the blue arrow indicates the start of the AIS. The soma is in the ganglion cell layer (GCL) while the dendrites stratify in the inner plexiform layer (IPL).

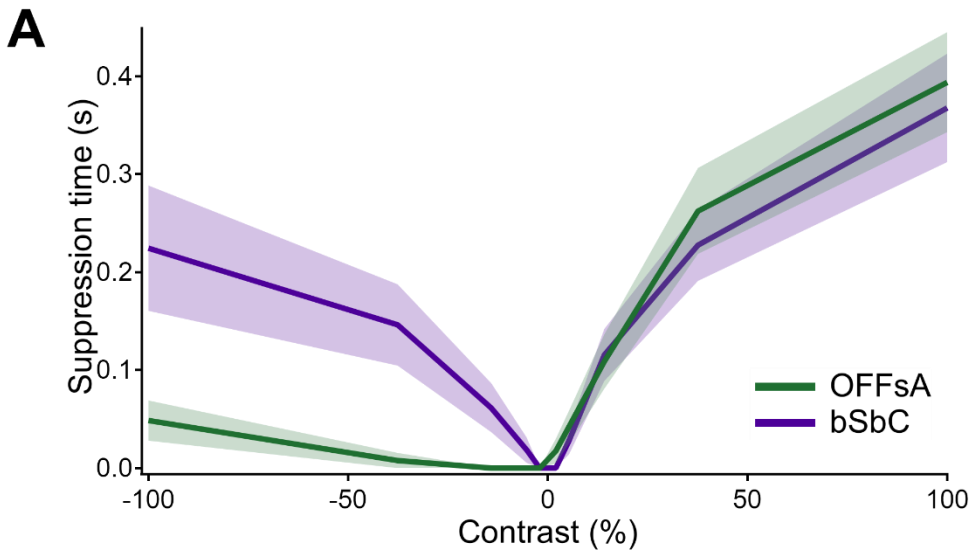

Figure S6: OFFsA and bSbC suppression times differ, related to Figure 1.
(A) Suppression time per contrast step for the OFFsA and bSbC. OFFsA N = 40, bSbC N = 31. Suppression time was calculated as the largest inter-spike interval during the stimulus period.

Parameter	OFFsA value	bSbC value	Source
Max G_{Na} (nS)	200	150	Computed from maximum measured action potential slope, capacitance, and Na^+ driving force.
AIS Length (µm)	22	16	AnkG staining (**Fig. 7**).
$Na_V1.6$ Ratio	0.4	0	Estimated from reduction of maximum action potential slope in $Na_V1.6$ blockage (**Fig. 6**).
Shared values			
Capacitance (pF)	58 (OFFsA 65, bSbC 52)		Computed from the input resistance of the cell times the tau from an exponential fit to the membrane voltage in response to hyperpolarization.
Dendritic Length (µm)	508 (668, 347)		Computed from measured input resistance and capacitance after subtracting the membrane area of the other compartments.
Soma Diameter (µm)	17.5 (18.5, 16.5)		Light microscopy (**Fig. 1**).
Hillock Length (µm)	24 (26, 21)		AnkG staining (**Fig. 7**).
Axon Length (µm)	1000		Arbitrary (axon is not a propagating compartment in the model).
Max G_K (nS)	290 (340, 250)		Computed from minimum measured action potential slope (falling phase), capacitance, and K^+ driving force.
Na_V and K_V channel density ratio: AIS / other compartments	30		Reference (Bender and Trussell 2012).
Specific capacitance ($\mu F/cm^2$)	1		Reference (Hille 2001).
Axial resistance (Ω*cm)	200		References (Schachter et al. 2010; Abbas et al. 2013).
Temperature (°C)	32		Set in experiments.
Membrane resistance ($\Omega*cm^2$)	3900		Computed based on total membrane area and measured input resistance (Freed et al. 1992).
Na^+ reversal potential (mV)	30		Adjusted down so the spikes were the correct height.
K^+ reversal potential (mV)	-90		References (Hille 2001; Hodgkin and Huxley 1952).
Leak reversal potential (mV)	-60		Computed based on measured resting potential.

Table S1: Compartmental model parameter inputs, related to STAR Methods.
For shared values, numbers in parentheses show the computed value for OFFsA RGCs and bSbC RGCs respectively. The value used in the model is the average of the values for the two RGCs.

Parameters Swapped	Input Resistance (MΩ)	
	OFFsA	bSbC
None	102.84	102.87
Max G_{Na}	102.84	102.87
AIS Length	102.87	102.84
$Na_V1.6$ Ratio	102.84	102.87

Table S2: Input resistance for the different models, related to STAR Methods.
None indicates that the model has only OFFsA or bSbC parameters **Figure 7C**, while the swapped parameter values correspond to the models in **Figure 7D-F**.