Supplementary Table 1. Vector-promoter combinations used in successful *in vivo* proof of concept studies via subretinal injections in canine model diseases; efficacy of the same vector in other species, and use in human clinical trials is included where applicable.

Target cell and Disease		**Vector-Promoter-*Transgene****	**Dog**	**Mouse**	**Man**
RPE					
RPE65-LCA	1	AAV2-CMV/CBA-*RPE65*	Positive outcome *cRPE65*, *hRPE65* [1, 2]	Positive outcome in *rd12 hRPE65* [3, 4]	Positive outcome *hRPE65*[5, 6]
	2	AAV2-CMV/CBA-*RPE65*	Positive outcome *hRPE65*[7]	Positive outcome in *rd12* and KO mice *hRPE65*[7]	Positive outcome *hRPE65*[8]
	3	rAAV.hRPE65p.*hRPE65*	Positive outcome[9]	NR	Positive outcome[10]
Other studies		AAV1-CMV/CBA-*cRPE65,* AAV1-CMV/CBA-*hRPE65*, AAV1-hRPE65-*hRPE65*, AAV5-CMV/CBA-*hRPE65*	Positive outcome[2]		
		AAV2-hCMV-*RPE65*	Positive outcome[11]		
		AAV2-hRPE65-*RPE65*, AAV4-hRPE65-*RPE65*	Positive outcome[12]		
BEST1-BVMD		AAV2-hVMD2-*cBEST1* AAV2-hVMD2-*hBEST1*	Positive outcomes[13, 14]		
Cones					
CNGB3-ACHM		AAV5-PR2.1-*hCNGB3*	Rescue of cone function and structure[15]	Rescue of cone function[16]	Clinical trial (NCT02599922) based on these studies and supporting work[16] is ongoing with AAV2tYF vector
Rods					
PDE6B-RP		AAV2/5RK.*cpde6β*	Early (P20) treatment rescues rod function.		

		AAV2/8RK.*cpde6β*	Stable long-term treatment. Both vectors result in comparable outcomes[17, 18]	
RHO-ADRP		AAV5-HOP-*hRHO*-H1-*shRNA*$_{820}$	Rescue of rod structure, and prevention of retinal degeneration 2^{ry} to clinical light exposure[19, 20]	shRNA targets a conserved region of human and dog *RHO*, but not mouse (Lewin et al., unpublished)
PDE6A-RP		AAV2/8$_{mut733}$.CBAp.*cPDE6a*	Positive but partial improvement of rod function, and of rod and cone survival[21]	
CNGB1-RP		AAV5-GRK1-*cCNGB1*	Rescue of rod function (ERG, vision), and structural preservation[22]	
Rods and cones				
RPGR-XLRP				
	1	AAV5-hIRBP-*hRPGRstb*	Prevents or arrests degeneration in early stage disease[23]	
	2	AAV5-hIRBP-*hRPGRstb*	Arrests degeneration in mid- and late- stage disease[24]	
	3	AAV5-hGRK1-*hRPGRstb*	Arrests degeneration in early and mid-stage disease[25]	
		----------	----------	
		AAV5-hGRK1-*hRPGRco*	Arrests degeneration in early-stage disease (*co* is comparable to *stb*)[25]	

	Study 4	AAV2$_{tYF}$-hGRK1-*hRPGRco*	Arrests degeneration in early-stage disease[26]	
	Study 5	AAV8-GRK1-*hRPGRco*[27]	Safety and efficacy reported in *RPGR* KO and *rd12* models.	Clinical trial ongoing (NCT03116113). No further details on vector used provided.
RPGRIP1-CORD		AAV2/5RK-*cRpgrip1* AAV2/8RK-*cRpgrip1*	Restored cone and rod function comparable with both vectors. Cones better preserved than rods long-term[28]	
NPHP5-LCA		AAV5-hIRBP-*cNPHP5*	High dose/early treatment markedly slows degeneration[29, 30]	
		----------	----------	
		scAAV8$_{Y733F}$-hGRK1-*cNPHP5*	Long-term rescue of function and structure after early and mid-stage treatment	

***** The Vector-Promoter-Transgene information is taken directly from the published manuscripts.

BVMD: Best vitelliform macular dystrophy

CMV/CBA: cytomegalovirus immediate early enhancer/chicken ß-actin promoter

co: codon optimized

cRPE65, *hRPE65*: canine or human, respectively, *RPE65* cDNA

hGRK1, RK: human G-coupled receptor kinase

HOP: human opsin promoter

sc: self-complementary

References

1. Acland GM, Aguirre GD, Ray J, et al. Gene therapy restores vision in a canine model of childhood blindness. *Nat Genet* 2001;28:92-95.
2. Acland GM, Aguirre GD, Bennett J, et al. Long-term restoration of rod and cone vision by single dose rAAV-mediated gene transfer to the retina in a canine model of childhood blindness. *Mol Ther* 2005;12:1072-1082.

3. Roman AJ, Boye SL, Aleman TS, et al. Electroretinographic analyses of Rpe65-mutant rd12 mice: developing an in vivo bioassay for human gene therapy trials of Leber congenital amaurosis. *Mol Vis* 2007;13:1701-1710.
4. Cideciyan AV, Aleman TS, Boye SL, et al. Human gene therapy for RPE65 isomerase deficiency activates the retinoid cycle of vision but with slow rod kinetics. *Proc Natl Acad Sci U S A* 2008;105:15112-15117.
5. Hauswirth W, Aleman TS, Kaushal S, et al. Phase I Trial of Leber Congenital Amaurosis due to RPE65 Mutations by Ocular Subretinal Injection of Adeno-Associated Virus Gene Vector: Short-Term Results. *Hum Gene Ther* 2008
6. Jacobson SG, Cideciyan AV, Ratnakaram R, et al. Gene therapy for leber congenital amaurosis caused by RPE65 mutations: safety and efficacy in 15 children and adults followed up to 3 years. *Arch Ophthalmol* 2012;130:9-24.
7. Bennicelli J, Wright JF, Komaromy A, et al. Reversal of blindness in animal models of leber congenital amaurosis using optimized AAV2-mediated gene transfer. *Mol Ther* 2008;16:458-465.
8. Maguire AM, Simonelli F, Pierce EA, et al. Safety and efficacy of gene transfer for Leber's congenital amaurosis. *N Engl J Med* 2008;358:2240-2248.
9. Annear MJ, Bartoe JT, Barker SE, et al. Gene therapy in the second eye of RPE65-deficient dogs improves retinal function. *Gene Ther* 2011;18:53-61.
10. Bainbridge JW, Smith AJ, Barker SS, et al. Effect of gene therapy on visual function in Leber's congenital amaurosis. *N Engl J Med* 2008;358:2231-2239.
11. Narfstrom K, Katz ML, Bragadottir R, et al. Functional and structural recovery of the retina after gene therapy in the RPE65 null mutation dog. *Invest Ophthalmol Vis Sci* 2003;44:1663-1672.
12. Le Meur G, Stieger K, Smith AJ, et al. Restoration of vision in RPE65-deficient Briard dogs using an AAV serotype 4 vector that specifically targets the retinal pigmented epithelium. *Gene Ther* 2007;14:292-303.
13. Guziewicz KE, Komaromy AM, Hauswirth WW, et al. Evaluation of AAV-mediated BEST1 expression In the canine retina. *Investigative Ophthalmology and Visual Science* 2011;52:ARVO E-Abstract 4378.
14. Guziewicz KE, Zangerl B, Komaromy AM, et al. Recombinant AAV-mediated BEST1 transfer to the retinal pigment epithelium: analysis of serotype-dependent retinal effects. *PLoS One* 2013;8:e75666.
15. Komaromy AM, Alexander JJ, Rowlan JS, et al. Gene therapy rescues cone function in congenital achromatopsia. *Hum Mol Genet* 2010;19:2581-2593.
16. Ye GJ, Budzynski E, Sonnentag P, et al. Cone-Specific Promoters for Gene Therapy of Achromatopsia and Other Retinal Diseases. *Hum Gene Ther* 2016;27:72-82.
17. Petit L, Lheriteau E, Weber M, et al. Restoration of vision in the pde6beta-deficient dog, a large animal model of rod-cone dystrophy. *Mol Ther* 2012;20:2019-2030.
18. Pichard V, Provost N, Mendes-Madeira A, et al. AAV-mediated gene therapy halts retinal degeneration in PDE6beta-deficient dogs. *Mol Ther* 2016;24:867-876.
19. Cideciyan AV, Jacobson SG, Aleman TS, et al. In vivo dynamics of retinal injury and repair in the rhodopsin mutant dog model of human retinitis pigmentosa. *Proc Natl Acad Sci U S A* 2005;102:5233-5238.
20. Beltran WA, Cideciyan AV, Sudharsan R, et al. AAV-mediated knockdown and replacement of rhodopsin protects rods in a canine model of RHO-ADRP. *Investigative Ophthalmology and Visual Science* 2017;58:ARVO E-Abstract 4483.
21. Mowat FM, Occelli LM, Bartoe JT, et al. Gene Therapy in a Large Animal Model of PDE6A-Retinitis Pigmentosa. *Front Neurosci* 2017;11:342.
22. Petersen-Jones S, Occelli L, Winkler PA, Chiodo V, Boye S, Hauswirth W. Gene augmentation therapy in a large animal model of CNGB1 retinitis pigmentosa. *XVII International Symposium on Retinal Degeneration.* Kyoto, Japan; 2016.

23. Beltran WA, Cideciyan AV, Lewin AS, et al. Gene therapy rescues photoreceptor blindness in dogs and paves the way for treating human X-linked retinitis pigmentosa. *Proc Natl Acad Sci U S A* 2012;109:2132-2137.
24. Beltran WA, Cideciyan AV, Iwabe S, et al. Successful arrest of photoreceptor and vision loss expands the therapeutic window of retinal gene therapy to later stages of disease. *Proc Natl Acad Sci U S A* 2015;112:E5844-5853.
25. Beltran WA, Cideciyan AV, Boye SE, et al. Optimization of Retinal Gene Therapy for X-Linked Retinitis Pigmentosa Due to RPGR Mutations. *Mol Ther* 2017;25:1866-1880.
26. Ye GJ, Beltran WA, Dufour VL, et al. Safety and efficacy of AAV2tYF-GRK1-hRPGR vectors in a canine model of RPGR-XLRP. *XXV Congress of the European Society of Gene & Cell Therapy.* Berlin, Germany; 2017.
27. Fischer MD, McClements ME, Martinez-Fernandez de la Camara C, et al. Codon-Optimized RPGR Improves Stability and Efficacy of AAV8 Gene Therapy in Two Mouse Models of X-Linked Retinitis Pigmentosa. *Mol Ther* 2017;25:1854-1865.
28. Lheriteau E, Libeau L, Stieger K, et al. The RPGRIP1-deficient dog, a promising canine model for gene therapy. *Mol Vis* 2009;15:349-361.
29. Aguirre GD, Cideciyan AV, Boye SL, et al. AAV-mediated gene augmentation restores retinal function and vision in the canine model of NPHP5 Leber congenital amaurosis. *Investigative Ophthalmology and Visual Science* 2016;57:ARVO E-Abstract 2293.
30. Aguirre GA. Going beyond the connecting cilium: cone outer segment formation after NPHP5 gene therapy. *Fourth Annual Innovation Summit: Retinal Cell and Gene Therapy.* Baltimore MD; 2017.