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Modulation of severity of RPGR-associated retinal degeneration in mice due to mutations in RPGR-interacting proteins

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Purpose:
In humans, over 80% of X-linked retinitis pigmentosa (XLRP) is caused by mutations in RPGR. RPGR-associated disease is clinically heterogeneous, indicating involvement of genes that can influence the associated phenotype. RPGR is known to interact with selected ciliary proteins including CEP290, RPGRIP1, NPHP1, NPHP4 and NPHP5. The purpose of this study is to assess the contribution of these RPGR-interacting proteins on the severity of RPGR-associated retinal degeneration in Rpgr⁹⁰ mice.

Methods:
Rpgr⁹⁰ female mice were bred with male Cep290¹⁶/¹⁶, Nphp¹+/-, Nphp⁴¹⁹²/¹⁹², Nphp⁵/-, Rpgr¹+/-, Males from F1 generation with genotype Rpgr⁹⁰/Cep290¹⁶/¹⁶, Rpgr⁹⁰/Nphp¹+/-, Rpgr⁹⁰/Nphp⁴¹⁹²/¹⁹², Rpgr⁹⁰/Nphp⁵/-, Rpgr⁹⁰/Rpgr¹+/- were selected for further analysis. Structural and function studies were performed using Histology, transmission electron microscopy (TEM), immunofluorescence staining, and Electroretinopgraphy (ERG).

Results
The Rpgr⁹⁰ mice exhibit degeneration of retina and relatively mild decrease in cone and rod function by 6 months of age. Our analysis of double mutant mice revealed that Rpgr⁹⁰/Cep290¹⁶/¹⁶ exhibit accelerated retinal degeneration as compared to Rpgr⁹⁰ mice. TEM analysis of Rpgr⁹⁰/Cep290¹⁶/¹⁶ retina showed vesicle accumulation at the base of the outer segments of photoreceptors, which were not detected in the Rpgr⁹⁰ mice. We also detected decreased cone-specific staining of M-opsin. No significant effect on the retina was observed in Rpgr⁹⁰/Nphp¹+/-, Rpgr⁹⁰/Nphp⁴¹⁹²/¹⁹², Rpgr⁹⁰/Nphp⁵/-, Rpgr⁹⁰/Rpgr¹+/- (n=3) mice up to 6 months of age, as compared to Rpgr⁹⁰.

Conclusions
Our studies suggest that mutations in CEP290 can potentially influence the severity of retinal phenotype due to mutations in RPGR. Further studies are in progress to assess the influence of additional RPGR-interacting proteins on RPGR-disease.