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# Embryonic Origin of Avian Corneal Sensory Nerves

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## Abstract

Sensory nerves play a vital role in maintaining corneal transparency. They originate in the trigeminal ganglion, which is derived from two embryonic cell populations (cranial neural crest and ectodermal placode). Nonetheless, it is unclear whether corneal nerves arise from neural crest, from placode, or from both. Quail–chick chimeras and species-specific antibodies allowed tracing quail-derived neural crest or placode cells during trigeminal ganglion and corneal development, and after ablation of either neural crest or placode. Neural crest chimeras showed quail nuclei in the proximal part of the trigeminal ganglion, and quail nerves in the pericorneal nerve ring and in the cornea. In sharp contrast, placode chimeras showed quail nuclei in the distal part of the trigeminal ganglion, but no quail nerves in the cornea or in the pericorneal nerve ring. Quail placode-derived nerves were present, however, in the eyelids. Neural crest ablation between stages 8 and 9 resulted in diminished trigeminal ganglia and absence of corneal innervation. Ablation of placode after stage 11 resulted in loss of the ophthalmic branch of the trigeminal ganglion and reduced corneal innervation. Noninnervated corneas still became transparent. These results indicate for the first time that although both neural crest and placode contribute to the trigeminal ganglion, corneal innervation is entirely neural crest-derived. Nonetheless, proper corneal innervation requires presence of both cell types in the embryonic trigeminal ganglion. Also, complete lack of innervation has no discernible effect on development of corneal transparency or cell densities.

## Keywords

neural crest; placode; trigeminal ganglion; nerves; cornea; quail–chick chimera

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