

IN A MATTER OF MINUTES THE EYE CAN KNOW WHICH WAY TO GROW.
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Purpose: When fitted with positive or negative lenses, the eyes of chicks grow in the direction that minimizes the blur imposed by the lenses. Do they start growing in a random or default direction and then correct their direction of growth if the magnitude of blur increases (trial and error)? Or do they initially assess the correct direction in which to grow? We measured the ocular responses occurring after a single brief period of lens-wear.

Methods: Speculating that eyes that had recently compensated for lenses might be especially responsive, we fitted both eyes of all chicks with weak positive lenses (+2 to +4D) two days before the experiment. During the experiment chicks either wore a +10D lens for ten minutes while restrained in the center of a 60 cm drum (to ensure myopic blur) or wore a -7D lens for 1 hr in a normal cage environment. The weak positive lenses remained over the fellow eyes. All chicks were put in the dark after lens-wear and re-measured 2 hours after the first measurement (shown as mean interocular differences).

Results: Over the two hours most eyes responded in the compensatory directions: the vitreous chambers of 8 of 9 eyes wearing positive lenses became shallower relative to changes in their fellow eyes ($-52 \mu\text{m}$, $p < 0.01$); while the vitreous chambers of 8 of 9 eyes wearing negative lenses became deeper ($28 \mu\text{m}$, $p < 0.05$). The choroids of 8 of 9 chicks wearing positive lenses became thicker relative to changes in their fellow eyes ($10 \mu\text{m}$, $p > 0.05$); while the choroids of 8 of 9 chicks wearing negative lenses became thinner ($22 \mu\text{m}$, $p < 0.05$).

Conclusions: The eyes of chicks grew in the compensatory direction after ten minutes of wearing positive lenses or one hour of negative lenses. Because it seems unlikely that eyes can assess the improvement of their optics and reverse their course if necessary, all within minutes, we conclude that eyes can rapidly determine the sign of the imposed blur without needing to resort to a trial and error method.