

Why Babies Don't See Well

Human newborns see poorly. There may be several reasons for this, but one of the most striking is the immaturity of the retinal photoreceptors. Anatomical studies by Yuodelis and Hendrickson (1986) and physical studies by Banks and Bennett (1988) have shown that the cone photoreceptors of the newborn central retina are over $7.5\ \mu$ in diameter, shrinking to the normal adult width of $2\ \mu$ in about 3 years. During this time, the cone density in this region increases from 18 photoreceptors per $100\ \mu$ to 42 photoreceptors per $100\ \mu$, and the photoreceptors develop both their outer segments (that catch the light) and their basal axonal processes. Figure 1 highlights the differences between the photoreceptors of neonatal and adult retinas. The neonatal retina has poorly differentiated photoreceptors, and those photoreceptors that it does have are so wide that not many of them can fit into a given area. Banks and Bennett calculate that this causes the central region of the newborn retina to absorb light about 350 times more poorly than the same region of the adult retina. This low number of photoreceptors per retinal area also prevents the babies from discriminating between two points at a distance. This may be why a newborn responds to visual stimuli only when they are brought close to the baby's face. The development of the human retinal photoreceptor provides an excellent example of differentiation that begins early in development, but which is not complete until years after birth.

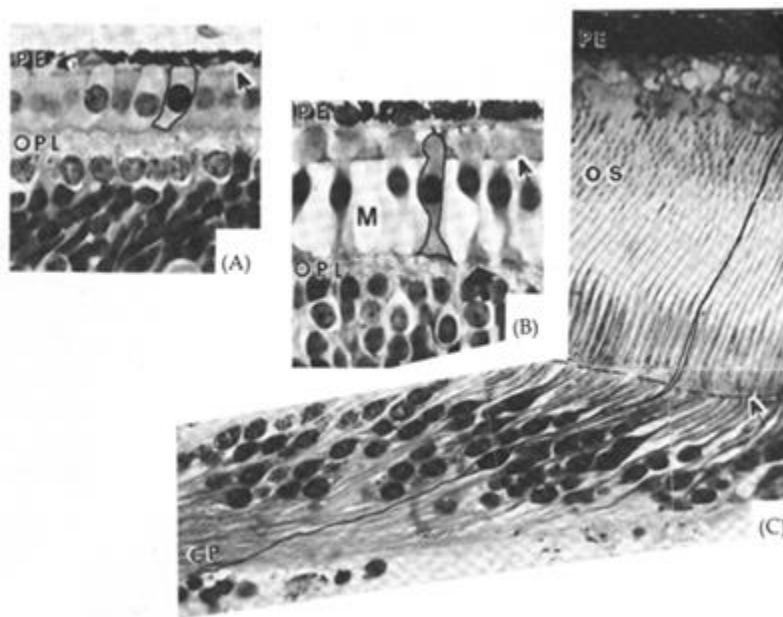


Figure 1 Development of the cone photoreceptors in the central region of the human retina. Stained light microscope sections were photographed and one cone in each retina outlined for clarity. The pigment epithelium (PE), outer plexiform layer (OPL), Müller glia (M), and outer segments of the photoreceptor (OS) have been labeled. (A) Fetus of 22 weeks' gestation. (B) Newborn 5 days after birth. (C) 72-year-old. The arrow points to the outer limiting membrane, which served as the original border for the retinal neurons. The axon outlined in (C) is actually shorter than normal, thus allowing the synapse with the bipolar neuron to be shown in the picture. The synapse is formed at the cone synaptic pedicle (CP). (From Yuodelis and Hendrickson, 1986, courtesy of A. Hendrickson.)

Literature Cited

Banks MS, Bennett PJ (1988) Optical and photoreceptor immaturities limit the spatial and chromatic vision of human neonates. *J. Opt. Soc. Am.* 5: 2059–2079.

Yuodelis C, Hendrickson A (1986) A qualitative and quantitative analysis of the human fovea during development. *Vision Res.* 26: 847–855.

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