THE NEW FINDING OF LIGHT DEPENDENT CHANNELS AND EXCHANGERS IN THE VERTEBRATE RETINA

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Vertebrate photoreceptor is the site of visual adaptation which responds to light with a membrane hyperpolarization. This hyperpolarization is mediated by an ionic conductance that is kept open in darkness by cGMP acting as a ligand, and which closes in the light as a resulting of an increases in cGMP hydrolysis triggered by illumination. Ca^{2+}, Na^{+} and K^{+} appear to have a role in this phototransduction processes. According to present research, these light dependent ionic transport mechanisms reside only in the site of photoreceptor.

We have measured the Ca^{2+}, Na^{+} and K^{+} concentrations in dark and light adapted bullfrog's vitreous humor by using the Atomic Absorption spectrophotometer and there was significant concentration difference. The Ca^{2+} concentration of the light adapted vitreous humor was higher than that of the dark adapted. This means that Ca^{2+} activity between the photoreceptor and vitreous humor side is light dependent and we have investigated how Ca^{2+} move by way of certain transport mechanism by using a modified Ussing chamber technique in order to bring in vivo environments close.

To identify these transport systems, we treated with Ca^{2+} channel blokers or Na^{+} – Ca^{2+} exchanger blokers in the vitreous humor side of dissected eye cup. The results are summarized as followed:

1) Treating with Ca^{2+} channel blokers (Ni^{2+}, Co^{2+}, Cd^{2+}, Mn^{2+}, and Mg^{2+}) in vitreous humor side, during light adaptation, there was no comparable change in the a-wave of the ERG(electroretinogram), but the b-wave was suppressed. Even though the photoreceptor performed its function, because of the change in ionic concentration between the photoreceptor and vitreous humor, the b-wave originating from the neuron cell and non-neuron cell was changed. This means that a Ca^{2+} channel exsits in the vitreous humor side.
2) When we reduced the NaCl concentration by half and replaced it with Li^{+}, Na^{+}, K^{+}, Rb^{+}, and Cs^{+} in the vitreous humor side Ringer solution, the b-wave was suppressed or hyperpolarized. There was no change in the a-wave, so this means that an exchanger exsists in the vitreous humor side.

   From these results, we have concluded that a light dependent Ca^{2+} channel and Na^{+} – Ca^{2+} exchanger exsit in the vitreous humor side. Further syudies are processing to identify Na^{+}-, K^{+}- channels or other transport systems.