Reading plays an important role in our lives, but can also compromise visual health

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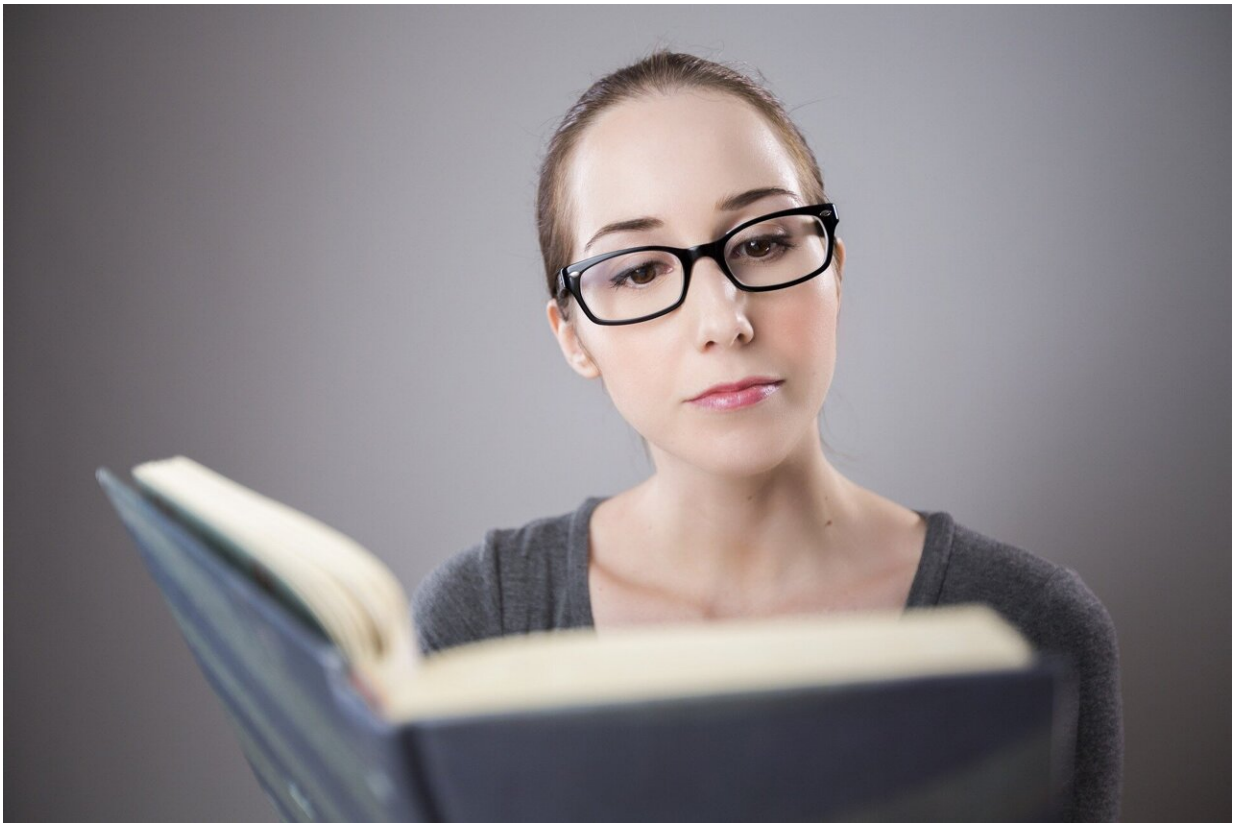

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Reading plays an important role in our society and is a fundamental component of our education system. However, reading can also compromise our visual health. Children and adolescents spend many

hours reading at a developmental stage when their eyes are adjusting their growth based on visual input.

A large body of research demonstrates that reading increases the risk of developing myopia (nearsightedness), a visual disorder that blurs vision at far distances. Research also demonstrates that myopia is not just an inconvenience that can be solved by wearing lenses. It is a serious condition that is increasing at an alarming rate across the world and is associated with sight-threatening diseases such as retinal detachment, myopic maculopathy, or glaucoma. We know that reading increases the risk of myopia progression, but we do not know why.

In a new paper that will be published in the *Journal of Vision*, scientists at State University of New York (SUNY) College of Optometry demonstrate that the images formed by our eyes during reading lack the diversity of contrasts, luminance transients, visual motion and visual change needed to activate major visual pathways signaling light stimuli, generally known as ON pathways (responsive to 'light on').

The study compared the eye visual input and visuomotor activity generated by humans performing two visual tasks that are associated with different risk of myopia progression, reading (high risk) and walking (low risk). The results indicate that multiple factors including low light, low contrast, and the lack of self-motion make reading less effective at driving ON pathways than walking.

Based on these results, the paper proposes a mechanism of myopia development that requires ON pathways to be strongly activated along the day to properly adjust eye growth. Under this mechanism, sustained reading for prolonged periods of time reduces the activation of ON pathways making the eye grow beyond its focus plane and blurring vision at far distance.

ON pathways are extremely well preserved during evolution and are present in all animal eyes that can generate images, from flies to humans. These pathways are also carefully calibrated across species to be maximally activated by different visual environments. For example, in animals with high visual acuity such as primates and birds of prey, ON pathways are best stimulated by bright high-resolution images moving slowly within central vision (e.g. images in the eye of a bird seeing a prey one mile away from the sky).

Conversely, in animals with low visual acuity such as nocturnal rodents, ON pathways are best stimulated by dim low-resolution images moving at fast speeds (e.g. images in the eye of a mouse seeing the walls of a narrow cave a few inches away while running). The visual activation of ON pathways provides an ideal signal to adjust the eye size based on the spatiotemporal properties of each visual environment.

If the mechanism proposed by the authors is correct, their work could open new lines of myopia prevention and treatment based on visual diets that boost ON pathway activation. The research was done by Sabina Poudel, Hamed Rahimi-Nasrabadi and collaborators in the laboratories of Jose-Manuel Alonso at the SUNY College of Optometry.

More information: Sabina Poudel et al, Differences in visual stimulation between reading and walking and implications for myopia development, *Journal of Vision* (2023). DOI: 10.1167/jov.23.4.3

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