

Eye Research *News*

Guide to Eye Health

RESEARCH UPDATES

Science continues to uncover ways we might make lifestyle choices to reduce risk for developing a serious eye disorder. Vision researchers have commented that risk factors for eye diseases are passed to subsequent generations not only through genetic inheritance but also possibly through the lifestyle habits we model and encourage.

- Eating foods rich in a variety of vitamins and minerals may help postpone nuclear **cataract**, the most common type of cataract in the U.S. The diet in the study featured high quantities of fruits, vegetables, whole grains, and lean protein such as beans, fish, eggs, and low quantities of salt and fat.
- Having a combination of three healthy behavior patterns (healthy diet, physical activity, and not smoking) may lower odds for **age-related macular degeneration (AMD)** by as much as 71%. The findings suggest that a combination of healthy behavior patterns might be more important in reducing AMD risk than focusing on just one behavior. Also, among women younger than 75 years, intake of vitamin D from foods and supplements may decrease odds of early AMD.
- Use of oral contraceptives for five or more years has been associated with a 25% increased risk of developing primary open angle **glaucoma** (the most prevalent form of the disease).



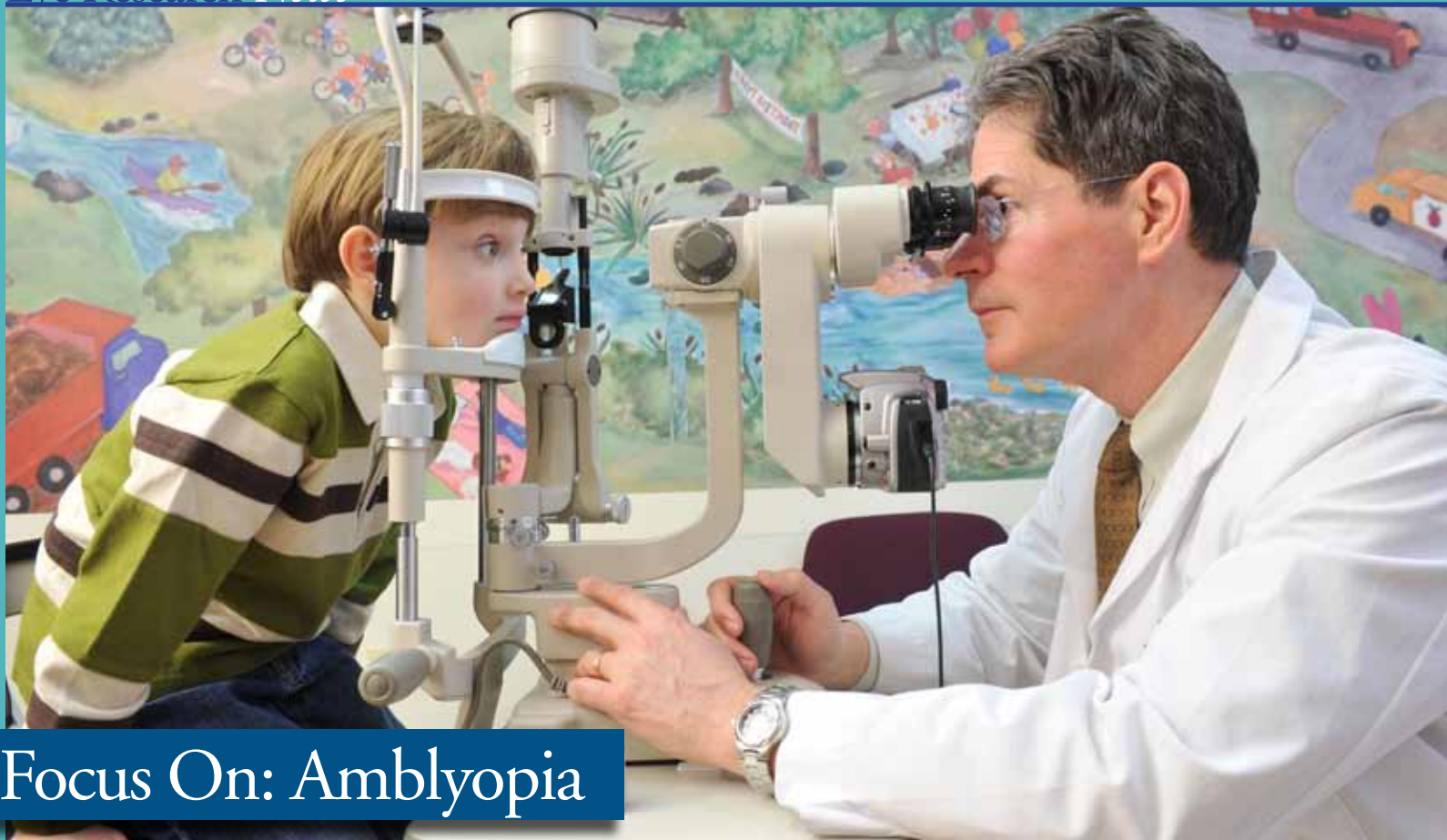
Artificial Sight is Evolving

RPB's mission to cure, prevent or treat all blinding disorders includes the restoration of sight. Researchers are pursuing a variety of approaches to provide severe-vision-loss patients with enough information for their brains to "see."

The Intelligent Retina Implant System (IRIS), in early development by RPB scientists, will take the concept of an artificial retina to a new level. In some ways it is similar to other vision prostheses: a camera mounted on a pair of eye glasses captures images which are wirelessly transmitted to an implantable module that stimulates retinal neurons. But the IRIS will use 3,200 electrodes to create much higher resolution images, rather than the 16 electrodes found in models currently being tested in patients. It will also be capable of compensating for damage resulting from the progression of retinal disease, allowing a patient to make adjustments that optimize the image that he or she "sees" after implantation surgery.

At the same time, RPB scientists have been testing a device which uses the tongue to transmit visual signals to the brain. Called the BrainPort, it could become a lower-cost, noninvasive alternative to retinal implants. Wearing a tiny video camera mounted to eyeglasses and connected by wire to a 400-electrode sensory array held in their mouths, participants in the study were able to identify more than half of the life-sized obstacles in their path. After a few hours, patients can be taught to use the system to sense and avoid objects in front of them and to improve their walking speed to nearly that of walking an unobstructed course. A future model of the tongue sensor, with more electrodes, will provide more detailed information to the brain.





Focus On: Amblyopia

R. Lawrence Tychsen, M.D., Washington University, has explored curing some cases of amblyopia, in the early stages of the condition, by using an excimer laser to reshape the cornea and correct large refractive errors.

As many as five percent of all children may be born with amblyopia (sometimes referred to as “lazy eye”), making it the most common cause of visual impairment in childhood. Amblyopia develops when eye-to-brain signaling is compromised by any number of underlying factors: strabismus (misaligned eyes), extreme near- or far-sightedness, extreme astigmatism, cataract, or corneal opacity. Untreated, it can lead to loss of vision as the developing brain chooses to ignore the compromised eye’s weaker signal in favor of the stronger eye’s information.

Early diagnosis of amblyopia is paramount in order for treatment to be applied when it can be most effective. But early diagnosis is made difficult by the age of patients, who are too young to adequately communicate their condition. Treatments consist of patching the stronger eye or blurring it with eye drops, thereby forcing use of the weaker eye. There is some RPB-supported

For the last ten years, RPB and the Walt and Lilly Disney Foundation have partnered to support a group of outstanding amblyopia researchers in an effort to better understand, treat and cure this prevalent and hard-to-diagnose eye disorder.

research which suggests that amblyopic patients aged seven through 17 may also benefit from treatment, although to a lesser degree. People who grow up with uncorrected amblyopia can experience problems with self-image, work, school and friendships.

There is also evidence that children whose eyes are misaligned (strabismus) and point outward (exotropia) are at significantly increased risk of developing mental illness by early adulthood.

The RPB-Disney initiative has expanded all aspects of medical science’s understanding of amblyopia: eye-brain communications; early detection; causes; and treatment. Following are just some of the findings reported by RPB-Disney amblyopia investigators.

David L. Guyton, M.D., The Johns Hopkins University and David G. Hunter, M.D., Ph.D., Harvard Medical School have collaborated for 20 years on the development of a reliable, hand-held

Pediatric Vision Scanner (PVS). They both received the RPB Walt and Lilly Disney Amblyopia Award in order to advance their work. Recently, they announced better-than-expected results from their simple, seconds-long screening exam with the PVS.

"We designed the device to detect strabismus, but the fact that the device could detect any form of amblyopia was completely unexpected—and a key advance for making more accurate patient referrals," said Hunter. He hopes the device will find widespread use among pediatricians to screen toddlers and preschoolers for amblyopia during annual well-child visits. "The eyes of a child with amblyopia can look perfectly fine, even while one eye is slowly losing vision," says Dr. Hunter. "Once a child reaches school age, treatment is less likely to restore useful vision. We'd really like to begin treating them when they're three years old—or younger."

Using new brain imaging methods developed in his laboratory, Anthony M. Norcia, Ph.D., Smith-Kettlewell Eye Research Institute has been the first to track the progression of visual information throughout the intact human brain, millisecond by millisecond, to determine where and how signals from the amblyopic eye are lost or suppressed. His results, so far, suggest that the damaging effects of amblyopia are more widespread in the



What a child sees looking into the PVS.

brain's cortex than previously understood, and that amblyopia treatment should be expanded to explore non-visual tasks that challenge the brain.

David R. Copenhagen, Ph.D., University of California, San Francisco has found that a specific hormone-like factor, called a neurotrophin, plays a key role in the development of neural connections in the retina during the eye's early growth. His work raises the possibility that neurotrophins could be used to remedy incorrect neural connections in the visual system.

Stem Cell Breakthrough by Eye Researchers Has Broad Implications

Much has been publicized about the potential for stem cells to repair or restore damaged tissues, but there has been concern over the risk that the new cells might form tumors. Growing enough of the specialized cells has also been a challenge.

RPB-supported scientists have now developed a method for creating long-term, self-renewing, primitive neural precursor cells from human embryonic stem cells. These new cells can be directed to become many types of neuron—including those lost in macular degeneration, retinitis pigmentosa or glaucoma—without increased risk of tumor formation. And the same

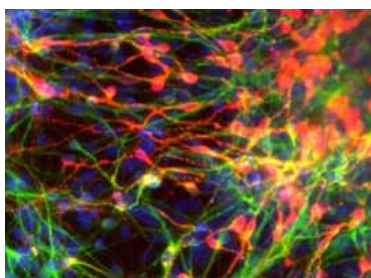


Photo: UC San Diego School of Medicine

"We can generate neurons [pictured in red] for specific conditions like ALS (Lou Gehrig's disease) or Parkinson's disease, or eye-specific neurons that are lost in macular degeneration, retinitis pigmentosa or glaucoma," says Zhang.

method can be applied to stem cells that have been artificially derived from adult, mature cells.

According to the lead researcher, Kang Zhang, M.D., Ph.D., University of California, San Diego (a recipient of several RPB grants): "It means we can generate stable, renewable neural stem cells or downstream products quickly, in great quantities and in a clinical grade—millions in less than a week—that can be used for clinical trials and, eventually, for clinical treatments. Until now, that has not been possible."

Dry AMD vision loss slowed. Following a successful phase 2 clinical trial, scientists feel they are on the verge of providing the first treatment for geographic atrophy, a severe form of dry age-related macular degeneration. In a simple surgical procedure, a capsule containing genetically engineered cells is implanted in the back of the patient's eye. The cells continuously release a retina re-nourishing compound over a 12-month period while the capsule keeps out antibodies and immune cells that otherwise would attack and destroy the implanted cells.

Can chemicals reignite sight? New chemicals appear to restore light-dependent function to blind retinas by causing retinal ganglion cells to act as rods and cones. The same investigators reported that the reanimated retinas were properly interfacing with brain circuits, offering the hope of restoring visual function to individuals with retinitis pigmentosa and macular degeneration.

Omega-3s looking better and better. Adding to previous findings that omega-3 fatty acids prevent retinopathy (the overgrowth of leaky blood vessels in the retina, characteristic of wet AMD, diabetic retinopathy and retinopathy of prematurity), scientists report that omega-3s not only inhibit the growth of abnormal blood vessels, but promote the growth of healthy vessels. They also report that taking aspirin or NSAIDs (like ibuprofen) does not interfere with the benefits of omega-3s, which had been a previous concern. A separate investigation confirms that omega-3s increase tear production and volume for patients with dry eye.

Better treatment for retinopathy of prematurity. Scientists have shown that bevacizumab (also known as Avastin)—which is currently used as a chemotherapy drug and, by some practitioners, to treat the leaky blood vessels associated with wet macular degeneration—is the most effective treatment for severe cases of retinopathy of prematurity. When compared with laser therapy, this new therapy does a better job of preserving vision, with faster recovery and fewer complications.



Gifts to Research to Prevent Blindness Save Sight

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- Establish a Charitable Remainder Trust (CRT) that enables you to provide for yourself and/or your family—and to support eye research as well.
- Include RPB in a bequest.

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