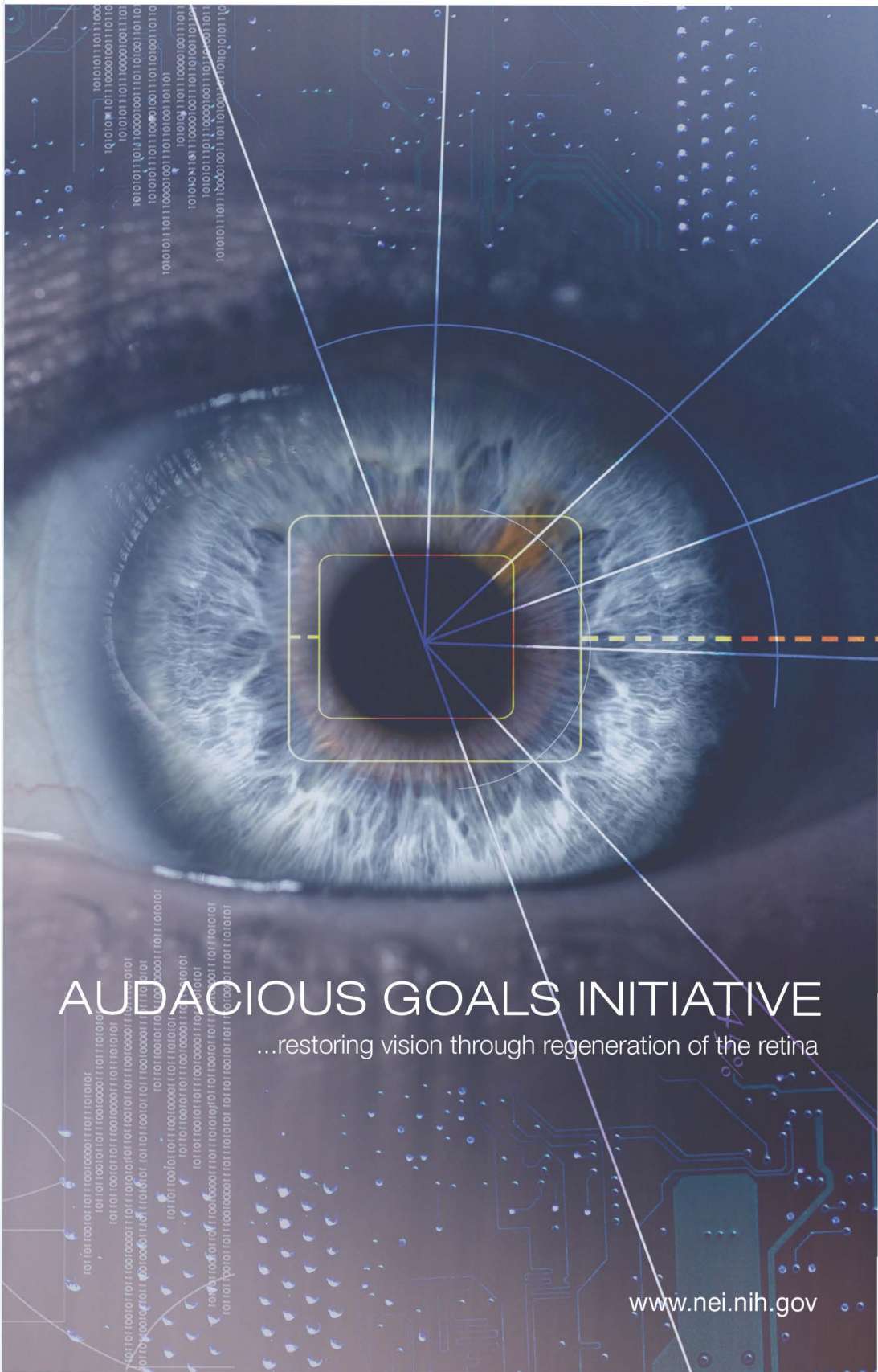
NEI AUDACIOUS GOALS INITIATIVE

National Eye Institute



AUDACIOUS GOALS INITIATIVE

...restoring vision through regeneration of the retina

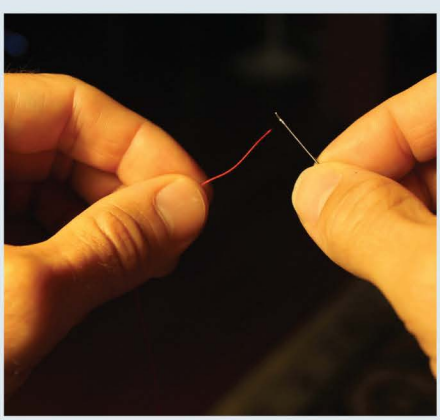
www.nei.nih.gov

The Retina

We rely on our sight every waking hour of every day…to work, play, and connect with the world.

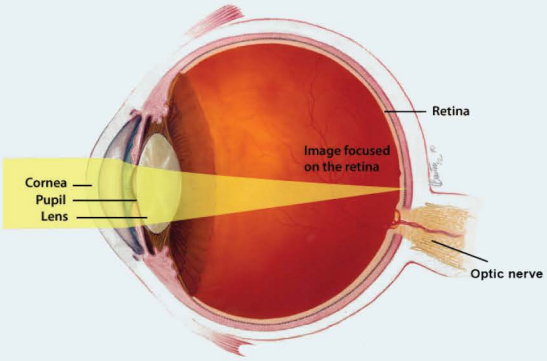
Despite advances in understanding and treating many vision disorders, we are still unable to cure diseases that attack and destroy cells in the retina—the light-sensitive tissue in the back of the eye. When retinal cells die, they are gone for good. And with them goes the vision we too easily take for granted.

Imagine if we could restore vision through regeneration of the retina…

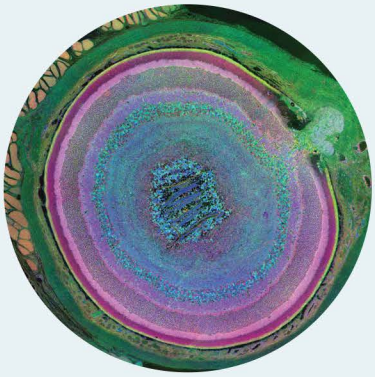


The retina translates light into a language the brain understands

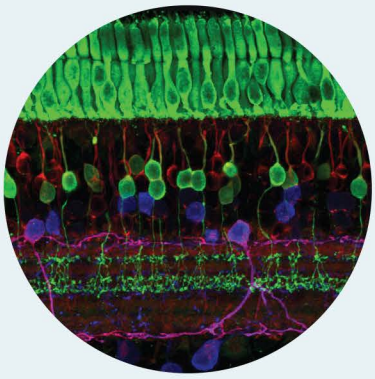
The eye focuses light on the retina. Across the retina are neurons called rod and cone photoreceptors. Light activates these neurons, which in turn activate a complex network of other retinal neurons. Together, these cells encode light into signals the brain can understand. Retinal ganglion cells, with their telephone wire-like axons, carry the signals through the optic nerve to the visual centers of the brain.



The retina lines the back of the eye.



Cross-sectional image of a mouse eye showing various tissue layers. Courtesy of Bryan William Jones and Robert E. Marc, **University of Utah.**



Ground squirrel retina magnified by confocal microscopy. Cone photoreceptors (green) can be seen in the top layer. Courtesy of Wei Li, **National Eye Institute, NIH.**

A delicate but powerful tissue

For a tissue no larger than a postage stamp, the retina consumes lots of energy. Even when our bodies are at rest—for example, while watching a movie—our retinas are busy translating patterns of light into faces, landscapes, and action scenes. But vision quickly deteriorates when normal function of the retina is interrupted. There are hundreds of rare genetic disorders that affect the retina. Many common eye diseases affect the retina too. For example, diabetic retinopathy damages blood vessels that support the retina. In age-related macular degeneration, the build-up of toxic material damages tissue called the retinal pigment epithelium (RPE), which supports retinal function. Glaucoma damages retinal ganglion cells, cutting off signals between the retina and the brain. All these conditions can lead to the death of retinal neurons. On its own, the body cannot regenerate retinal neurons.

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New biology; New hope

The 21st century ushered in a wave of new biology, giving hope that technology may overcome the retina's limited capacity for self-repair. Advances in gene sequencing have helped us identify the genetic underpinnings of common and rare eye diseases. Gene therapy became a reality when researchers helped patients with a blinding disorder called Leber congenital amaurosis safely regain useful vision. The potential for stem cell therapies grew immensely when scientists learned how to reprogram adult skin cells into virtually any cell type in the body, including cells of the retina. New imaging technologies are enabling researchers to non-invasively view in real-time biological processes occurring in the retina at a cellular level. The National Eye Institute (NEI) Audacious Goals Initiative (AGI) will facilitate the convergence of these new technologies into new therapies for degenerative retinal disorders.

Catalyzing vision research

The NEI AGI is catalyzing research that will enable the restoration of vision through regeneration of the retina. The central goal is to replace cells of the retina that have been damaged by disease or injury and to restore their connections to the visual centers of the brain. Through strategic research funding, the NEI is enlisting dynamic scientists and teams who are developing the necessary knowledge and technology to make the goal a reality.

The NEI audacious goal is to regenerate neurons and neural connections in the eye and visual system.

What is the target?

The AGI is targeting the photoreceptors and retinal ganglion cells for regeneration. Significant loss of either cell type leads to severe vision loss or blindness.

What will it take to reach the goal?

The AGI is charting new territory. We must gain a better understanding of how retinal neurons mature, integrate with other cells, and extend their connections to appropriate regions of the brain. We must develop better, more efficient technologies for producing authentic replacement cells that are safe for transplantation. We also need new technologies to measure the function and growth of cells in the retina. And we need to develop systems for deploying new knowledge and technologies in the clinic.

When will NEI reach the goal?

With adequate funding, the NEI projects reaching the goal in 10–15 years.

About the AGI

NEI Director Paul A. Sieving, M.D., Ph.D., speaking at the Audacious Goals Development Meeting.

"It would be fantastic if..."

The AGI began with the Audacious Goals Challenge, a prize competition that challenged participants to imagine the greatest achievement for vision research during the next 10–15 years. The challenge attracted more than 450 innovative proposals from around the world. The NEI consolidated the proposals into six themes, which were further explored by leading experts at the Audacious Goals Development Meeting.

In consultation with the National Advisory Eye Council (NAEC), the NEI chose to pursue the goal of restoring vision through the regeneration of neurons and neural connections in the eye and visual system, specifically targeting the photoreceptors and retinal ganglion cells.

AGI Steering Committee

The AGI Steering Committee plots the scientific trajectory of the initiative. Consisting of three to five leading researchers, the steering committee is responsible for identifying knowledge gaps and the scientific expertise needed to bridge them.

The steering committee currently consists of four members:

Mark S. Blumenkranz, M.D.,
Stanford University

John E. Dowling, Ph.D.,
Harvard University

Pamela A. Raymond, Ph.D.,
University of Michigan

Joshua Sanes, Ph.D.,
Harvard University

National Advisory Eye Council

The NAEC provides administrative guidance to the NEI. NAEC consists of 12 recognized leaders in the fields of ophthalmology, optometry, and basic sciences. The NAEC will advise the NEI director on AGI funding plans and provide a second level of review on proposals to AGI funding opportunities.

AGI Working Group

The AGI Working Group comprises NEI staff who will help draft funding announcements, monitor the progress of research programs, and make recommendations to the AGI Steering Committee, the NAEC, and the NEI Director. The AGI Working Group includes Donald F. Everett, M.A., Thomas N. Greenwell, Ph.D., Michael A. Steinmetz, Ph.D., and Cheri L. Wiggs, Ph.D.

AGI Office at NEI

The AGI Office, led by Steven Becker, Ph.D., provides logistical support for all AGI-related activities.

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audaciousgoals@nih.gov
www.nei.nih.gov/audacious

NEI leads the federal government's research on the visual system and eye diseases. NEI supports basic and clinical science programs that result in the development of sight-saving treatments. For more information, visit http://www.nei.nih.gov.

The National Institutes of Health (NIH): NIH, the nation's medical research agency, includes 27 Institutes and Centers and is a component of the U.S. Department of Health and Human Services. NIH is the primary federal agency conducting and supporting basic, clinical, and translational medical research, and is investigating the causes, treatments, and cures for both common and rare diseases. For more information about NIH and its programs, visit http://www.nih.gov.

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