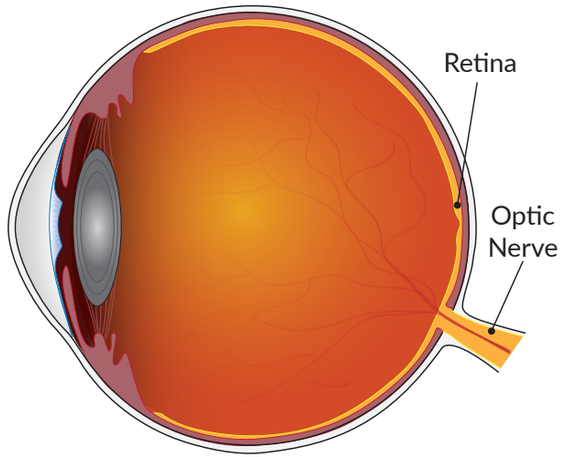
About the Goal

The AGI is stimulating the development of new therapies for vision loss and blindness. With continued support and guidance through the National Eye Institute, it aims to regenerate the light-sensitive retina and its connections to the brain.



Some of the most common and devastating vision disorders affect the neural retina and its connections with the brain. Age-related macular degeneration (AMD), glaucoma, and retinitis pigmentosa are just a few conditions that can cause irreversible vision loss. Our data suggests that by 2050, as many as 9 million Americans will have low vision, and 4 million will be blind, the majority from diseases like AMD and glaucoma.

AGI projects are laying the groundwork for clinical studies of new strategies for reversing vision loss. Currently, three research consortia are bringing different perspectives to this problem.

The future of AGI – tackling the challenges of transplantation

Whether replacement cells come from one's own body or another person's, we need to understand how the immune system reacts to replacement eye tissue. The AGI is exploring the conditions and methods needed that will allow replacement cells or tissue to restore visual function.

Learn more about AGI and read the report on AGI accomplishments at nei.nih.gov/agi

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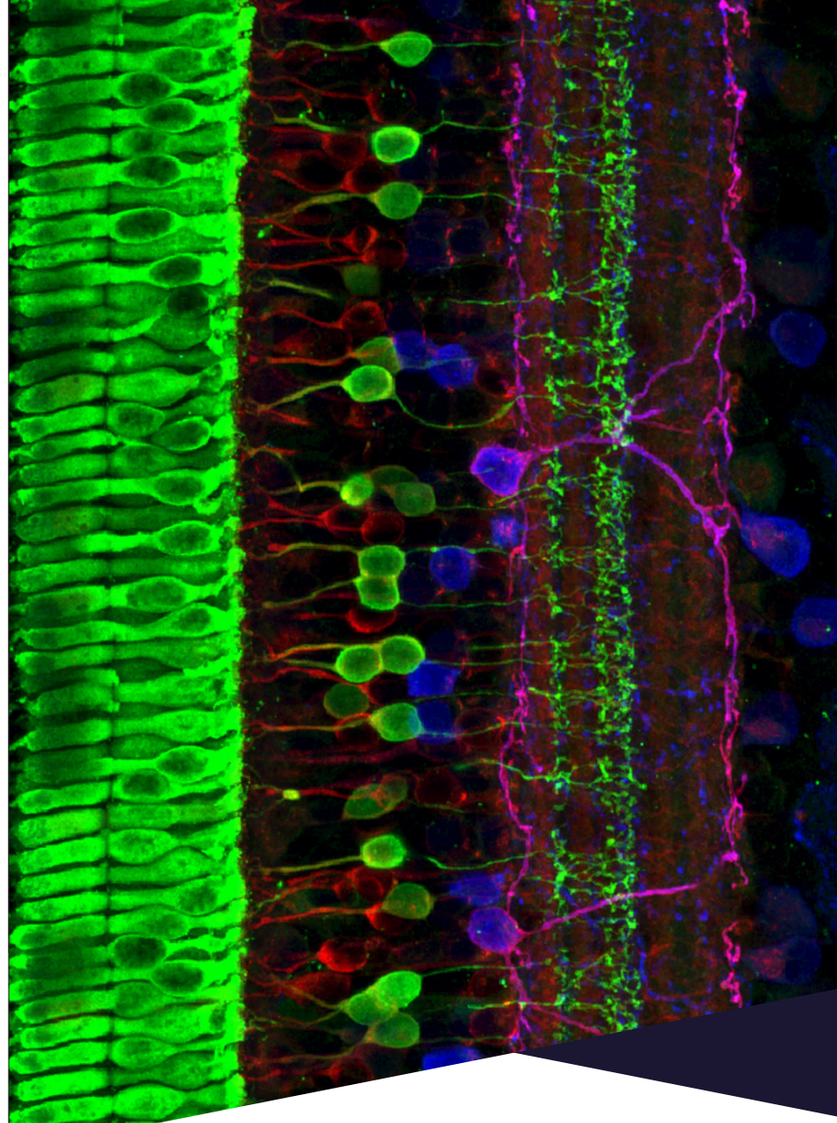

NEI AGI

Audacious Goals Initiative
for Regenerative Medicine in Vision

Functional Imaging Consortium

Functional imaging projects are developing new methods to noninvasively image cells and tissues of the visual system.

As blinding conditions progress, the cells in the retina that receive and process light are damaged and lost. AGI imaging projects are helping researchers noninvasively study these cells so that they may observe the effects of experimental treatments.

Leveraging diverse technologies to visualize the eye

Adaptive Optics (AO) – AO enables a clearer view of retinal tissues at the back of the eye. AO compensates for aberrations imposed by the structures of the eye, much the way AO telescopes compensate for aberrations imposed by the Earth's atmosphere.

DBSI and fMRI – Scientists are adapting diffusion basis spectrum imaging (DBSI) and functional magnetic resonance imaging (fMRI) to evaluate visual signals as they pass through the optic nerve. This will help clinicians measure the effectiveness of treatments to restore optic nerve function.

Advanced infrared (2-photon) imaging – Researchers are developing techniques that use infrared light from special pulsed lasers to view naturally fluorescent compounds in the cells of the eye. This technique delivers safe amounts of light and could be used to monitor disease and assess treatments.

Eye-tracking technology – AGI-funded teams are developing new eye tracking technologies to compensate for involuntary eye movements that make imaging of the eye difficult.

Regenerative Factor Discovery Consortium

AGI discovery projects are searching for factors such as genes, proteins, and other cellular messengers that are important for neural regeneration. The consortium is developing a database to make information from the projects publicly available.

Most human neurons fail to regenerate on their own. However, many species of fish and amphibians have the ability to regenerate neuronal structures and regain function. AGI scientists are learning how to unlock similar regenerative capacity in humans.

Understanding the Retina

Several types of neurons and support cells exist in the retina, all of which are necessary to carry visual information to the brain. Discovery projects are investigating three key cell types:

Photoreceptors are the light-sensing cells of the retina. Scientists are studying how to connect transplanted photoreceptors to their neural neighbors so they can transmit visual information to the brain.

Retinal ganglion cells (RGCs) relay information from photoreceptors to the brain via the optic nerve. AGI research teams are testing how to replace these cells after they have been damaged.

Müller glia support retina neuron structure and function. In zebrafish, Müller glial cells can reprogram into fully functional photoreceptors after injury. Scientists are studying Müller glia in different animals and are searching for factors that could enable vision restoration in humans.

Translation-Enabling Models Consortium

The AGI translation-enabling models projects are bridging the gap between basic research and clinical trials. Project scientists are developing new models for glaucoma and other degenerative retinal diseases. These models will help researchers learn the root cause of disease, study disease progression, and test potential therapies.

Most existing eye disease models poorly emulate human cases. The AGI Translation-Enabling Models Consortium is generating new models to inform human clinical trials of vision-restoration therapies.

New disease models

AGI teams are developing models that mimic important aspects of human vision, including the presence of cone photoreceptors, which are important for sharp central vision and color perception. Most animal models lack cone photoreceptors, so AGI scientists are developing new cone-rich animal models such as the ground squirrel and tree shrew.

AGI research teams are developing models for testing therapies that replace RGCs and photoreceptors. Follow-up projects will fine-tune surgical techniques and measures of cell survival and function in preparation for clinical trials.