

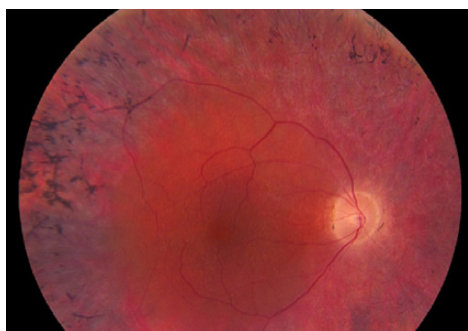
# Ophthalmology Update

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**Figure.** A fundus photograph of the right eye of a patient with retinitis pigmentosa.

## Inherited Retinal Diseases: Diagnosis, Clinical Trials and Treatments

Inherited retinal diseases (IRDs) vary widely, but most of them lead to progressive and profound visual symptoms. Timely diagnosis, counseling and resource discussions are imperative to improve quality of life. Depending on the condition, treatment may be available, often through clinical trials, with the goal to slow the disease for vision preservation. Mayo Clinic's approach to IRDs combines comprehensive, multidisciplinary care with the latest research, imaging and treatments available.

### CLINICAL TRIALS

Retinitis pigmentosa (RP) is an inherited degenerative disease, and it is one of the most common IRDs (Figure). It often leads to loss of night and peripheral vision. "Most inherited retinal diseases are progressive," says Brittni A. Scruggs, M.D., Ph.D., an ophthalmologist at Mayo Clinic in Rochester, Minnesota. "If you could slow down the freight train, you could really have an impact on the quality of life of the patient."

Mayo Clinic is involved in the NAC (N-acetylcysteine) Attack clinical trial. NAC Attack is a phase 3 multicenter, randomized placebo-controlled study to evaluate the efficacy and safety of oral NAC in people with RP. The NAC Attack study identified Mayo Clinic, along with about 30 other clinics that specialize in inherited retinal degenerations, as a participating clinical site.

Studies have proved that excessive oxidative stress plays a key role in photoreceptor cell death in RP as cited in *Progress in Retinal and Eye Research*. The effect of NAC treatment on reducing photoreceptor loss has been shown in animal studies. Oral NAC treatment is known to be safe short-term, and this was recently demonstrated in 30 patients with RP who received oral NAC for six months as evidenced in the *Journal of Clinical Investigation*.

This phase 3 clinical trial from centers across the world is necessary to determine the long-term safety of NAC and to determine whether oral NAC can slow photoreceptor loss and delay vision loss in patients with RP. Enrollment for this trial at Mayo Clinic started in October 2023.

Mayo Clinic Ophthalmology also is dedicated to advancing ophthalmic gene therapy research and clinical trials for IRDs. In 2024, Mayo will be a clinical trial site for VISTA, a randomized controlled, masked, multicenter phase 2-3 trial to test the safety and efficacy of gene therapy for patients with X-linked RP.

Mayo Clinic is also part of the Foundation for Fighting Blindness (FFB) Consortium, which facilitates clinical studies in patients with rare inherited retinal disorders to accelerate development of treatments.



Raymond Iezzi Jr., M.D.



Brittani A. Scruggs, M.D., Ph.D.

In collaboration with FFB and the Jaeb Center for Health Research, Mayo Clinic investigators will soon recruit patients for the international multicenter Universal Rare Gene Study. This will be the largest natural history study for inherited retinal diseases for the purpose of disease characterization and defining subpopulations for future clinical trials of investigative treatments. Enrollment for this study will start in early 2024.

### GENETIC COUNSELING

“While aging or risk factors can cause common forms of macular degeneration, macular dystrophies and other IRDs are linked to genetic variants that trigger degradation of retinal cells,” says Raymond Iezzi Jr., M.D., an ophthalmologist at Mayo Clinic in Rochester, Minnesota. “Determining the exact genetic cause of a patient’s disease allows our team to accurately make a diagnosis and counsel on prognosis, clinical trial opportunities, family planning and vision rehabilitation strategies.”

At Mayo Clinic, highly skilled medical geneticists and certified genetic counselors meet with patients of all ages. Patients can expect the highest quality evaluations, timely and cost-effective genetic testing, and counseling by a caring, compassionate genetic counseling team at the time of their ophthalmology evaluation.

“We’ve built a beautiful collaboration with Mayo genetic consultants and counselors,” says Dr. Scruggs. “They see all patients with presumed IRDs within our ophthalmology clinic where they provide consultations, talk through diagnoses,

and work with the patient and their families to make informed decisions.”

### RESOURCES AND STRATEGIES

Mayo Clinic Ophthalmology has internationally renowned eye physicians, surgeons and optometrists who provide comprehensive care for people who seek answers about ophthalmological diseases and conditions, including inherited retinal diseases. At Mayo Clinic, patients can meet with vision loss rehabilitation specialists, driving experts, social workers and occupational therapists to enhance their experience and, ultimately, their vision.

The department uses state-of-the-art imaging modalities and has collaborative relationships across Mayo Clinic. “Some patients might not have a clinical trial or treatment as an option,” says Dr. Scruggs. “Our priority is to optimize our patient’s quality of vision and quality of life with the resources that we have.”

### FOR MORE INFORMATION

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Applied Genetic Technologies Corp. A Clinical Trial Evaluating the Safety and Efficacy of a Single Subretinal Injection of AGTC-501 in Participants With X-linked Retinitis Pigmentosa Caused by RPGR Mutations. [ClinicalTrials.gov](https://clinicaltrials.gov).

Jaeb Center for Health Research. Universal Rare Gene Study: A Registry and Natural History Study of Retinal Dystrophies Associated With Rare Disease-Causing Genetic Variants (Uni-Rare). [ClinicalTrials.gov](https://clinicaltrials.gov).

## Custom-Made Iris Implants Improve Functionality and Appearance



Keith H. Baratz, M.D.



Sanjay V. Patel, M.D.

Managing iris defects can be challenging, whether the defects are congenital or acquired through traumatic events. These defects can lead to many visual symptoms, including decreased visual acuity and disability glare. “When necessary, an iris implant can mimic a natural iris and help improve visual symptoms that have been affecting a patient’s quality of life,” says Keith H. Baratz, M.D., an ophthalmologist at Mayo Clinic in Rochester, Minnesota.

Within the last few years, the efficacy of a custom-made artificial iris device was studied by the United States Food and Drug Administration. Participants included people with photophobia, sensitivity secondary to partial or complete congenital or acquired iris defects, or both. The study found that the artificial iris surpassed all key safety endpoints for adverse events related to the device, intraocular lens or implant surgery and met all key efficacy

endpoints, including decreased glare, improved health-related quality of life and satisfaction with physical appearance. Study results were published in the June 2022 issue of *Ophthalmology*.

To prepare for this type of surgery at Mayo Clinic, the patient undergoes an evaluation, special photography of both irises to create a match between the prosthesis and healthy iris, and examination of the eye. “We give a comprehensive examination of the eye and discuss the plan for the surgery itself,” says Dr. Baratz. Once the plan is discussed and a surgery is scheduled for about 2 to 3 months after the initial appointment, the photos of the eye are sent to Germany for the custom-made prosthesis.

The iris prosthesis is a thin disk of biocompatible medical-grade silicone and the first of its kind. Each iris is custom-made for each patient using photos of the patient’s eyes to aid in mimicking the patient’s natural iris (Figure).

“There is some versatility to this procedure as well, including a sutureless and a sutured iris prosthesis, depending on the anatomy of the eye,” says Sanjay V. Patel, M.D., an ophthalmologist at Mayo Clinic

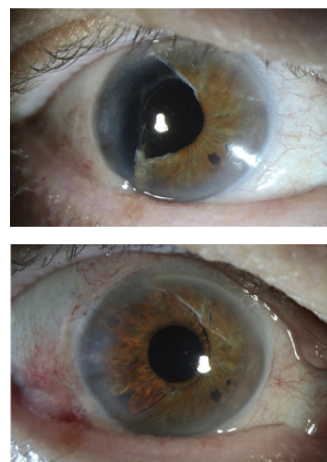
in Rochester, Minnesota. “The prosthesis can be implanted into the capsular bag at primary cataract surgery or placed secondarily in the sulcus with or without scleral fixation.”

Once the procedure is complete, little specialized follow-up care is typically needed. Long-term studies have shown that the device has been well tolerated. While the artificial pupil is fixed, it is the sufficient size for posterior examination and surgery. If needs should arise after surgery, Mayo Clinic has the resources to manage them.

Overall, this newer technology has shown positive results for patients seeking to ameliorate their conditions. “While this iris prosthesis brings important functional improvements, such as improvement in glare and vision, it can also bring cosmetic improvements, which can contribute to a patient’s overall improved health and happiness. There’s an art to the design of these implants, and when it’s successful, a patient can feel more at ease with the function and appearance of their eye,” says Dr. Baratz.

#### FOR MORE INFORMATION

Results of the United States Food and Drug Administration clinical trial of the CustomFlex Artificial Iris. *Ophthalmology*. 2022;129:614.



**Figure.** Before and after custom-made iris prosthesis.

## Dry Eye Clinic Offers New Testing and Treatments

Many people may experience episodes of dry eyes. Medications, age, medical conditions, eyelid problems and excessive eye strain all can result in dry eyes. For most people with occasional or mild dry eye symptoms, it’s enough to regularly use nonprescription eye drops. For patients with more persistent and serious symptoms, however, the solution can seem more elusive.

Mayo Clinic’s new dry eye clinic offers new imaging and treatment options, along with comprehensive, multidisciplinary care. The process begins with a complete dry eye evaluation, including imaging of the ocular surface and meibomian glands. “We are also able to test the health of the tears,” says Cherie B. Nau, O.D., an optometrist at Mayo Clinic in Rochester, Minnesota. “Ocular surface imaging

and tear quality testing help providers direct treatment and allows us to monitor progress.”

One of the new technologies available is the Keratograph, which provides an image of the corneal surface and shows the condition of the meibomian glands. It allows healthcare professionals in the dry eye clinic to closely monitor how each treatment changes measurements.

The dry eye clinic also offers specialized, in-office treatments, including lid cleaning, meibomian gland treatments and skin surface treatment. Intense-pulsed light therapy is an option for patients who would benefit from treating the glands in the eyelids to decrease inflammation and help the glands produce better oils.



Cherie B. Nau, O.D.



Barbara K. Tylka, O.D.



Eye drops also can be made from a patient's own blood. These drops are called autologous blood serum drops. "This is an option if you have severe dry eye symptoms which don't respond to other treatments," says Barbara K. Tylka, O.D., an optometrist at Mayo Clinic in Rochester, Minnesota. "To make these eye drops, a sample of the patient's blood is processed to remove the red blood cells and then mixed with a salt solution."

There can be a variety of systemic diseases that might exacerbate dry eye, which leads to the dry eye clinic team working with many different specialties on a daily basis. Whether it's a referral from primary care or a collaborative effort with an ophthalmological surgeon, the dry eye clinic works to meet each patient's unique needs. "As a chronic disease, dry eye can be very frustrating for the patient," says Dr. Nau. "The team that has been assembled is very compassionate to the patients' needs and struggles."

Because pain is a common symptom for patients, the dry eye clinic also

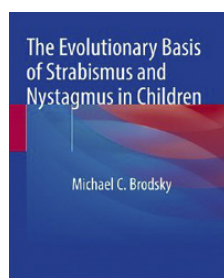
has developed a close working relationship with Mayo Clinic's Pain Rehabilitation Center (PRC). The PRC teams based at Mayo Clinic's campuses in Arizona, Florida and Minnesota use a rehabilitation approach that incorporates behavioral, physical and occupational therapies to help restore physical activities and improve quality of life. "Sometimes, it's beneficial for patients to address the pain aspect first so that we can more effectively treat their other dry eye symptoms," says Dr. Tylka.

With the addition of new testing and treatment, along with comprehensive evaluations, Mayo Clinic's dry eye clinic provides a unique opportunity for patients and their providers. "This condition in moderate to severe stages greatly affects patients' quality of life," says Dr. Tylka. "We are very grateful to have this new clinic available, and we're excited for the positive impact it will have on the patients who need it."

## Textbook Review: Evolutionary Analysis of Pediatric Eye Movement Disorders

A scientific textbook by Michael C. Brodsky, M.D., an emeritus ophthalmologist at Mayo Clinic in Rochester, Minnesota, provides a comprehensive neurologic explanation for the unique eye movement disorders that afflict children with infantile strabismus and nystagmus. *The Evolutionary Basis of Strabismus and Nystagmus in Children*, published by Springer, contains a collection of 20 essays that explain these disorders and consolidate the interrelationships between them.

Dr. Brodsky is a professor of ophthalmology and a professor of neurology at Mayo Clinic College of Medicine and Science and the Knights Templar Eye Foundation Research Professor of Ophthalmology at Mayo Clinic. For the past 25 years, he has been studying the enigmatic conditions that fill pediatric ophthalmology clinics. His findings have given rise to a



Book cover for *The Evolutionary Basis of Strabismus and Nystagmus in Children*, published 2021, Springer



Michael C. Brodsky, M.D.

groundbreaking and unifying theory: These interrelated ocular motor aberrations arise from the evolutionary expression of ancestral visual reflexes.

### FOR MORE INFORMATION

Brodsky MC. *The Evolutionary Basis of Strabismus and Nystagmus in Children*. Springer; 2021.



### CONTACT US

Mayo Clinic welcomes inquiries and referrals, and a request to a specific physician is not required to refer a patient.

#### Phoenix/Scottsdale, Arizona

866-629-6362

#### Jacksonville, Florida

800-634-1417

#### Rochester, Minnesota

800-533-1564



### RESOURCES

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### EDUCATION OPPORTUNITIES

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or email [cme@mayo.edu](mailto:cme@mayo.edu)

## Ophthalmology Update

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#### Cover Image

Human multicolored iris of the eye animation concept  
Credit: CG Alex

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