1933  First corneal transplant, Dr. Ramon Castroviejo
1935  Discovery of Hyaluronic acid and its molecular structure, Dr. Karl Meyer
1936  Microbiologic transmission of trachoma established, Dr. Philips Thygeson
1940  New methods developed for the quantitative analysis of DNA sugars, Dr. Zacharias Dische
1947  First retinoblastoma, pediatric, and adult ocular tumor clinics, Dr. Algernon B. Reese
1958  Retina clinic established, Dr. Charles Campbell
1961  First medical use of the ruby laser, Dr. Charles Campbell
1961  First basic and clinical corneal research center established, Dr. A. Gerard DeVoe and Dr. Anthony Donn
1965  Keratoprosthesis developed, Dr. Hernando Cardona
1966  Development of System for preserving corneas until transplant, Dr. Saiichi Mishima
1968  First argon laser developed, Dr. Francis L’Esperance, Jr.
1974  Confocal microscopy first used to detect new structural features of the eye, Dr. David Maurice
1980  First wide field specular microscope developed, Dr. Charles Koester
1983  Development of Healon, a hyaluronic acid polymer that transformed cataract and corneal surgery, Dr. Endre Balazs
1983  Pioneering excimer laser surgery, Dr. Stephen Trokel and Dr. Francis A. L’Esperance, Jr.
1994  First human retinal cell transplants, Dr. Peter Gouras
1996  Development of latanoprost (Xalatan™) for the treatment of glaucoma, Dr. Laszlo Bito
1996  FDA approval of Perfluorocarbons for retinal surgery, Dr. Stanley Chang
Dear Patients, Friends and Colleagues:

I am delighted to share this Department of Ophthalmology report with you. We are now well on our way to building a world-class institution where disease-focused scientific research generates innovative clinical strategies for preventing and curing eye disease. This report is an account of the excellence that has already brought the Department a wealth of international respect and recognition.

For the past six years, we have been preparing the Department to meet the 21st century’s most important challenges in the field of ophthalmology. New and successful programs have been established in basic and clinical research, in education and training, and in treatment. This effort will benefit from a number of nationally and internationally distinguished ophthalmic scientists and clinicians who have recently joined the Department’s faculty. When completed, extensive physical renovation of the Eye Institute will provide faculty with the best work environment possible and ensure that examination and treatment areas offer patients the highest degree of comfort and efficiency. Sophisticated diagnostic and treatment technologies have been installed to deliver the most accurate and up-to-date therapy.

Private philanthropic support has been invaluable in planning for and achieving our goals, and we are very grateful to the Institute's Board of Advisors and many friends who have come forward to help with every aspect of these advances. The commitment, dedication, and generosity of the Board and other donors is extraordinary. We have also been fortunate in attracting and maintaining excellent federal and corporate funding in recognition of our faculty's superior reputation, which has been made even more eminent by recent recruitments.

Today’s swift progress in scientific discovery and technology, combined with the indisputable excellence of our faculty, makes it possible for us to help more and more patients avoid impending eye disease, or to give them treatment that will reduce the consequences of such problems. Our vision for the future is to continue bringing better vision to our patients.

Sincerely,

Stanley Chang, MD, Chairman
Department of Ophthalmology
Edward S. Harkness Professor
sclera

retina

optic nerve

vitreous cavity

iris

cornea

pupil

lens
The human eye gives us more information about the outside world than any other sensory organ, producing continuous images that are instantly transmitted to the brain for processing. Not only is the eye a personal window on the world, but it offers a noninvasive and immediate view into the body’s vascular system, providing physicians with an opportunity for early diagnosis of hypertension and diabetes.

In an adult, the eye has a diameter of approximately 25mm (or one inch). It sits in a cavity in the skull called the eye’s orbit. The one sixth of the eye’s surface that is exposed beyond the orbit is protected against strong light and foreign objects by the eyelids, eyelashes, and eyebrows.

The outermost layer of the eyeball is the visible white of the eye, the sclera, which provides structure and strength; it is covered by a thin membrane called the conjunctiva. The clear substance located inside the sclera is called the vitreous, a gel-like material that gives the eye its spherical shape. In front of the sclera is the transparent, protective cornea, which provides most of the focusing power for light entering the eye. The cornea’s outermost layer of tissue contains cells that have the ability to regenerate within three days, allowing for rapid healing of superficial injuries. From the cornea, light passes through the pupil, the dark circle centered in the iris, the blue, green, brown or hazel ring of color that helps describe a person’s appearance. The eye’s iris also functions like the iris of a camera, opening and closing to regulate the pupil’s size, which controls how much light penetrates the eye, by becoming smaller under bright conditions, or expanding in a dim environment.

Behind the iris, the lens provides fine-tuning for focusing and reading by altering its shape. The lens directs light onto the fine nerve tissue of the retina, which lines the inside wall of the eye and acts like the film in a camera. The retina converts the light into images and then into electrical impulses that are sent along the optic nerve to the brain. Within the brain, these signals undergo processing by the visual cortex, which senses and interprets them as the shapes and colors that the eye “sees.”
Retina:

Columbia University's Department of Ophthalmology at the Edward S. Harkness Eye Institute is a leader in retinal research. Ophthalmic studies at Columbia, sometimes undertaken in collaboration with other departments, use multiple approaches to reach an understanding of retinal disease. Their research includes: identifying genes linked to macular degeneration, seeking ways to stop the progress of diabetic retinal disease, and developing interventions that can save the sight of premature infants during their first few months of life. Although it most often threatens the sight of older adults, retinal disease puts all ages at risk.

RETINAL DETACHMENT

Each year, approximately one in 10,000 Americans develops a retinal detachment. The condition occurs because, with aging, the vitreous— the clear gel filling 80 percent of the eye’s central cavity—liquifies, thereby reducing its support of the retina, neurosensory tissue that ordinarily lines the back wall of the eye. The resulting detachment is usually painless, but its onset may be recognized when clear sight is interrupted by dark spots, or “floaters,” and transient light flashes. Once retinal detachment has taken place, vision often deteriorates rapidly.

In most cases, detachment occurs when the fabric of the retina tears, allowing the vitreous to leak into space under the retina. Although usually small, some such tears are large enough to be called “giant.” Treatment of this condition requires unfolding the section of the retina that has collapsed, then repositioning and securing it against the rear wall of the eye.

Stanley Chang, MD, Edward S. Harkness Professor and Chairman of the Department of Ophthalmology, has been a leader in revolutionizing retinal reattachment surgery, raising its success from 35 to 90 percent over a 10-year period. Dr. Chang’s innovation introduced perfluorcarbon liquid into the eye as a means of restoring normal retinal attachment. Because it is heavy enough to press out any fluid that has leaked behind the retina, perfluorcarbon’s presence allows the retina to return to its proper position against the eye’s back wall. Before this successful new technique could be used on humans, however, Dr. Chang also had to develop methods of purifying perfluorocarbon sufficiently to prevent any injury to eye tissue. Once that safeguard was achieved, the Federal Drug Administration gave its approval and perfluorcarbon liquid has been a major component of vitreoretinal surgery since 1996. “The greatest satisfaction in research,” says Dr. Chang, “occurs when one of our ideas is successful in the laboratory and then is developed into a product used worldwide to improve patient care.”
In the Eye of the Beholder

In the 17th century after the gross anatomy of the eye had been firmly established, scientists realized that the retina, not the cornea as previously thought, was responsible for detecting light. German mathematician and astronomer Johannes Kepler was first to propose that the lens of the eye focuses images onto the retina. A few decades later, the French mathematician and philosopher René Descartes scraped tissue from the back of an ox’s eyeball to make the orb transparent. He then placed it on a window ledge so that he could look through it from the back. What Descartes saw was an inverted image of the scenery, which he correctly deduced resulted from its being focused by the eye’s lens onto the retina.

Dr. Chang has also made a significant impact on the treatment of proliferative vitreoretinopathy (PVR), a condition that occurs when retinal surgery results in excessive scar tissue formation, leading to recurrent detachment. Dr. Chang improved the success of PVR repair by using a long-acting gas bubble to hold the retina in place against the eye wall long enough for postoperative conditions to heal and for the retina to become snugly reattached to the wall.

Ongoing Columbia research seeks pharmacological solutions to the scarring seen in both PVR and diabetic retinopathy. According to Gaetano R. Barile, MD, Assistant Professor of Clinical Ophthalmology, five-to-ten percent of the time, inflammatory scar tissue response is overwhelming and results in recurrent retinal detachment. “At the moment,” he adds, “the only way to address this problem is with more surgery!” To solve this problem, Dr. Barile is looking for drugs that can target PVR’s inflammatory factors, with the goal of inducing cell death before scarring occurs. His colleague, William M. Schiff, MD, Assistant Professor of Clinical Ophthalmology, is developing a multicenter trial on pharmacological interventions that may reduce risk for this condition. By using a diversified, multifaceted approach to managing these problems, the Department is able to develop treatment strategies for each stage of retinal detachment.

Dr. Stanley Chang, Edward S. Harkness Professor and Chairman of the Department of Ophthalmology is well known internationally for advances made in vitreoretinal surgery, and especially in complex forms of retinal detachment.
As life expectancy in our time increases, so do eye diseases that are common in the elderly, like age-related macular degeneration (AMD) and glaucoma. More than 10 million Americans over the age of 60 suffer irreversible vision loss from AMD. “Our AMD research at Columbia is extremely important because so many patients are affected by this disorder,” says R. Theodore Smith, MD, PhD, Associate Clinical Professor of Ophthalmology. “One of AMD’s horrors,” he declares, “is that people may be severely impaired for as long as 20 or 30 years. And, even if their health is otherwise good, diminished sight takes away the pleasures of reading or seeing their grandchildren’s faces, and robs them of many other moments that makes life enjoyable.”

AMD attacks the macula, the highly sensitive portion of the retina responsible for fine focusing. There are two types of AMD: “wet,” caused by leakage of fluid from fragile new blood vessels behind the macula, accounts for only 10 percent of cases, while “dry,” for which the cause is still unknown, affects 90 percent of patients. Age is a primary risk, Caucasians are most susceptible, and overexposure to sunlight and smoking both increase the chances of being struck by AMD.

Dr. R. Theodore Smith is a specialist in treating in age-related macular degeneration.

**Healthy Eyes Respond with Higher Energy**

Electroretinography (ERG) is a technology for diagnosing degenerative eye disease like AMD. ERG records the eye’s electrical responses to light flashes. It can distinguish between healthy eyes, which shown increased electrical activity in reaction to greater light intensity, and eye with poor photoreception, which do not. The Department has been in the forefront of using ERG to gather this clinical data for analyzing the basis of retinal disease.
AMD. Department of Ophthalmology scientists, collaborating with colleagues at Columbia’s Genome Center, are also exploring the possibility of a link between heredity and AMD.

In 1997, Rando Allikmets, PhD, the Louis V. Gerstner Jr. Scholar and Assistant Professor of Ophthalmic Science, found the first gene linked to AMD. It was the genetic mutation for Stargardt’s disease, a juvenile form of macular degeneration and offered the earliest clue to the complex mechanisms that generate AMD. Dr. Allikmets, joined by Drs. Barile and Smith, now heads Columbia’s Macular Genetics Study, searching the DNA of thousands of participants in New York for AMD genes and gene variations. The three retinal experts direct a team of tristate regional specialists who gather this genetic information both from patients affected by AMD and from their families. This data will form the basis for developing new preventive measures against AMD’s destruction and for improving methods of treating this eye disease.

For Dr. Allikmets, size is a key factor to the success of the Macular Genetic Study. “The winners in human molecular genetics will be those who have access to large, well-defined cohorts of patients,” he says. His outcomes will benefit from this study’s use of new technology—the microarray gene chip—an automatic pattern finder for gene base sequences in DNA that analyzes genetic mutations rapidly and inexpensively. When a patient’s blood sample is added to a chip, or slide, that is loaded with hundreds or even thousands of mutations, the technology automatically detects which variants of certain genes the patient possesses and whether they match those of others who have the disease.

Dr. Rando Allikmets seeks genetic data that will shed new light on how to treat AMD.
Associate Professor of Ophthalmic Science, Janet Sparrow, PhD, has contributed to AMD research by challenging the assumption that lipofuscin, which builds up in the retinal pigment epithelium (RPE) with age and with some inherited disorders, is harmless. “When the eye’s RPE, a special layer of ‘nursing’ cells in the retina, is healthy,” she explains, “the light-sensing part of the macula is also healthy. But when the RPE fails, there is corresponding damage to its photoreceptor cells, which impairs the vision.”

To test her theory, Dr. Sparrow worked with Dr. Koji Nakanishi, Centennial Professor of Chemistry at Columbia, who has synthesized A2E, a derivative of vitamin A and a major component of lipofuscin. The study’s outcome showed that RPE cells combined with A2E die when exposed to simulated sunlight, while those without A2E remain healthy. “If we can identify molecules that may initiate RPE damage, we might be able to combat their formation or to destroy them,” says Dr. Sparrow.

While some scientists are searching for AMD’s causes, others are trying transplantation strategies to counter retinal degeneration. Associate Professor of Ophthalmology Lucian V. Del Priore, MD, PhD, who is the first Robert L. Burch III Scholar, is already focusing on improved transplant techniques for AMD. Dr. Del Priore is exploring the best way to replace or regenerate RPE cells that have been unavoidably removed during surgical treatment for wet AMD, or those that have deteriorated in dry AMD. His colleague, Peter Gouras, MD, Professor of Ophthalmology, made headlines in the 1980’s by transplanting normal RPE cells into the subretinal space of young rats with inherited retinal disease. “It was the first time cell transplantation succeeded in treating hereditary degeneration of the retina,” says Dr. Gouras. Since then, with colleagues around the world, he has been working to develop successful procedures for transplanting RPE cells from one human to another.

While transplantation has been tried on a limited number of patients, Dr. Del Priore says simply replacing their RPE cells doesn’t seem to work. He and his colleagues have focused on the role of a subretinal surface, called Bruch’s membrane, to which cells must remain

No More Blues
Sometimes the discoveries of basic science may find an almost immediate application to prevention or treatment. Because her work suggests that the sun’s rays can have damaging effects on the retina, Dr. Sparrow is ready with important advice. “We should all think about filtering out blue light from the sun to avoid hurting the retinal tissue,” she says, adding, “A yellow-tinted lens would be our best choice.”
attached for transplant survival. “Ordinarily,” he explains, “these cells line up like a flat mosaic of tiles, but the pattern can be disrupted either by AMD, or when surgery is performed to remove leaking blood vessels.” Dr. Del Priore believes the solution to this problem is “getting cells to stick to Bruch’s membrane” and thinks that using a glue-like protein mixture will help RPE cells stay in place. “If we can create such an artificial surface and reverse the result of aging, it would be a tremendous advance,” he says. “Even with a modest success rate, the procedure would make an enormous difference in helping thousands of people regain normal vision.”

Dr. Del Priore discusses his research with Department of Ophthalmology Advisory Board Member Robert L. Burch III.

This transplanted retinal pigment epithelial (RPE) cell remains round and does not spread, because the basal lamina layer of Bruch’s membrane to which it should be attached is damaged.

Finding a Cure
Between Lab and Clinic
Researchers often work with animal models, but what happens when humans are the only known species affected? In his research determining how to make RPE cells adhere to Bruch’s membrane, Dr. Del Priore uses eye cells from deceased donors, some of whom had AMD. “What I do is translational research,” says Dr. Del Priore, who spends half his time treating retinal patients and the other half in the laboratory. “I’m not trying to find the exact mechanism of macular degeneration, although I’d love to know that. I’m looking at the clinical problem and gearing everything to developing new treatments by going from the laboratory bench to my patients, and back again.”
Retina:

**RETINITIS PIGMENTOSA**

Approximately 100,000 people in the United States are affected with the group of inherited diseases known as retinitis pigmentosa (RP). RP causes deterioration of the retina’s photoreceptor cells, which reduces clarity of sight over a period of time and can result in blindness by middle age. Department of Ophthalmology faculty members have made significant contributions to a fundamental understanding of this type of eye disease. For the past two decades, Dr. Peter Gouras has collaborated with Cynthia MacKay, MD, Associate Clinical Professor in Ophthalmology, using electrophysiologic and genetic evaluation to investigate hereditary retinal degeneration. New hope for treatment of these disorders is beginning to appear. RP may also be associated with mutations of the gene for Stargardt’s disease that was identified by Dr. Rando Allikmets. Dr. Allikmets is collaborating with Dr. Gouras to correct the gene defect in patients affected by Stargardt’s disease. In addition, Dr. Peter Gouras’ early successful transplantation of RPE cells in animal models of the disease has led to testing in human clinical trials in Sweden.

Dr. Gouras points out that, until recently, there was “no hope for treating diseases of the photoreceptor layer.” He is, however, optimistic about making headway toward managing such problems.

**Tracking Gene Therapy**

A jellyfish gene for green fluorescent protein developed at Columbia is helping researchers in Dr. Peter Gouras’s laboratory to study how genes act in the human retina. By introducing the protein into cells of the rabbit retinas shown here they were able to track gene expression in a virus. “When we want to see if a virus is working,” says Dr. Gouras, “we put it in with the jellyfish gene protein and look at it under blue light with the high resolution of the Scanning Laser Ophthalmoscope. With this technique we can see living cells expressing the gene and track it for weeks.” In the future, a virus may be used to introduce missing genes into the epithelial cells of children who suffer from Leber’s Congenital Amaurosis (LCA). Because LCA is caused by the lack of these genes, genetic therapy may provide the cure for this blinding disease.
through cell transplantation and gene therapy, which he describes as a far more tractable approach that’s “coming soon.” In pursuit of these solutions, Dr. Gouras collaborates with world-renowned Columbia virologist, Stephen P. Goff, PhD, Higgins Professor of Biochemistry and Molecular Biophysics and Microbiology. They are developing viral vectors that can carry selected genes to target sites chosen for effective RP treatment.

More than 130 of the genes so far identified by the Human Genome Project could be involved in hereditary retinal degenerative disorders. Determining the normal function of such disease-associated genes is the next step in developing an appropriate treatment for patients with these problems, says Assistant Professor of Ophthalmic Science Melanie Sohocki, PhD, the William Acquavella Scholar in Retinal Research. Dr. Sohocki has discovered one of several genes known to cause Leber’s Congenital Amaurosis, a rare form of inherited retinopathy that causes poor vision and eventual blindness, in more than 10,000 children born each year in the United States. Understanding this gene’s normal function could help in developing treatment for LCA and many other inherited eye problems as well. She is also seeking the missing or altered gene product that is responsible for degenerative eye disease. If found, it could be used as a target for creating and testing new therapies.

Dr. Sohocki is committed to sharing data that comes to light in the course of her studies with other scientists who are seeking new genes and undertaking gene therapy trials. She also tries to keep clinicians up to date on the rapidly unfolding potential of genetic treatment. “Parents facing the heartbreak of a child going blind from hereditary eye disease want to know the cause behind it and whether there is anything that can be done to reverse its course,” says Dr. Sohocki.

Dr. Melanie Sohocki, the Acquavella Scholar, discusses her research with Advisory Board Member William Acquavella, who established the position.
Retina:

DIABETIC RETINOPATHY

Early Diagnosis Crucial To Treating Retinopathy

The longer a person has diabetes, the greater his or her chances of developing retinopathy, damage to the retina caused by microvascular changes. On average, a careful eye examination reveals mild retinal abnormalities about seven years after the onset of diabetes, but the damage that threatens vision does not usually occur until much later. If detected early, retinopathy can sometimes be treated with laser photocoagulation.
Schmidt, Dr. Barile has worked on developing an animal model of diabetic retinopathy. Genetic manipulation is expected to provide information about RAGE and other potential mechanisms of vascular complications from diabetes that occur throughout the body. This data could help to develop more specific treatments for diabetic retinopathy in patients affected by macular edema, which causes loss of reading vision, and in those suffering from the more aggressive new blood vessel formation of proliferative retinopathy.

Departmental scientists are also examining the efficacy of an implantable drug-delivery device that is not much larger than the head of pin, to counter the effects of diabetic retinopathy and macular edema, a swelling in the central area of the retina. The mini-implant would have the capability of sending a sustained-release drug to a target area in the eye, over a period of weeks, or even months.

Even though patients with diabetes can reduce their risk for loss of sight through careful control of diet, glucose levels and exercise, many of them have only limited access to medical care. In a city the size of New York, says Dr. William Schiff, that means a very large population of diabetic patients with potential eye problems often go undetected. To address this problem, an innovative Diabetes Screening Program will be put in place at Columbia. Under Dr. Schiff’s direction, the program will use telemedicine to reach out to patients in the New York area who are not already being cared for by an ophthalmologist. The program’s sophisticated digital photography equipment will allow staff at Columbia’s Naomi Berrie Diabetes Center and other area clinics and hospitals to record retinal images for computerized transmission to diabetic eye disease specialists, who will evaluate each case. Patients will be referred to ophthalmologists as needed.

Dr. William Schiff will screen diabetes patients who have had no previous ophthalmological care.

Dr. William Schiff will screen diabetes patients who have had no previous ophthalmological care.
Retinopathy of prematurity (ROP) is among the top three causes of blindness and severe loss of vision in the approximately 40,000 premature infants born annually in the United States. Some of these tiny babies are as young as 23 weeks of age and weigh less than two pounds at delivery. While the survival rate for “micropreemies” has improved significantly, when normal development of blood vessels in the mother’s womb is interrupted by such an early birth, the infant’s still extremely immature retinal blood vessels may grow in an uncontrolled fashion. The scar tissue and retinal detachment that occurs as a result then causes visual loss and blindness. According to John T. Flynn, MD, Anne S. Cohen Professor of Pediatric Ophthalmology and Strabismus, Vice-Chairman of the Department of Ophthalmology, if an ophthalmologist skilled in examining such small infants begins seeing them at about 32 weeks of age, for a period extending over 10-to-12 weeks, the disease can be detected. If the condition becomes severe, the baby may receive laser treatment, reducing the rate of visual loss by approximately 50 percent.

Michael Chiang, MD, a member of the Pediatric Ophthalmology Division, specializes in bioinformatics. He plans to apply computer technology to improving the delivery of eye care to adult and pediatric patients.
Ten percent of premature infants in the lowest birth weight categories who develop ROP will need laser treatment to arrest abnormal blood vessel growth in one or both eyes. If the procedure fails and retinal detachment occurs, as it does in about 30 percent of these cases, further surgery can be done. Approximately 100 infants receive such treatment each year at the Edward S. Harkness Eye Institute. Robert Lopez, MD, Associate Professor of Clinical Ophthalmology, is one of the very few surgeons in the tristate area who performs this surgery. Because these infants are not yet completely developed, they may be medically unstable. In addition, their eyes are much smaller and anatomically different than those of adults, which, Dr. Lopez admits, “means the surgery is a challenge, one of the most difficult of retinal procedures.” He adds that “Even after surgery, their prognosis is guarded.” To make the procedure more effective, Dr. Lopez is working with industry to develop smaller surgical instruments, like forceps and scissors, tailored to fit the tiny infant eye.

Seeking to develop preventive measures for ROP, Dr. Flynn hopes to join with the Division of Neonatology in the Department of Pediatrics and the School of Public Health to reduce premature births by decreasing pregnancy among high-risk women in the catchment area of Columbia’s prenatal care network. He also believes that standards of prenatal care must be developed for these high-risk women so that, even if preterm labor cannot be fully prevented, their pregnancies will be extended for as long as possible.

Dr. Flynn has established a Neonatal Telemedicine Vision Center at the Edward S. Harkness Eye Institute. Digital images of infants, born where there is no adequate ophthalmology screening available, are taken with a special wide-angle camera. They can be sent via internet from anywhere in the world to receive immediate diagnosis, and, if necessary, treatment based on these images can be recommended. Dr. Flynn is a Principal Investigator of the Early Treatment of Retinopathy of Prematurity (ETROP) Clinical Trial, a 23-center nationwide study in which Columbia and Cornell are united to form New York City’s only participating center. The trial asks: Should we treat ROP infants earlier than we do at present, in the hope of improving laser treatment results? “We don’t know the answer yet, but hope to by the end of this study,” says Dr. Flynn.
“Patients who have laser vision correction for nearsightedness, farsightedness and astigmatism are among our happiest,” says Director of Laser Vision Correction Richard E. Braunstein, MD, Miranda Wong Tang Assistant Professor of Clinical Ophthalmology and Residency Training Director. Normally, the eye creates a clear image because the cornea bends—or refracts—incoming light to focus it precisely on the retina. But if the cornea is too steeply curved, too flat, or irregular in shape, light fails to reach the appropriate point of focus on the retina and vision is blurred or distorted. When this happens, glasses may be prescribed, or ophthalmologists may recommend laser surgery to correct the cornea’s shape.

REFRACTIVE SURGERY

Photo-refractive keratectomy (PRK) is a process that removes layers of tissue and reshapes the corneal surface to improve optical power. In a slightly different version of the procedure, laser-assisted in situ keratomileusis (LASIK), surgeons use a motorized blade called a keratome to cut an ultra-thin circular flap from the cornea. The flap,

Historic Evidence at Harkness

In a quiet area of the Edward S. Harkness Eye Institute’s eighth floor, the John M. Wheeler Library houses a large and important collection of ophthalmic history. Antique scientific instruments, ophthalmic journals and historic books trace the development of eye care over the past few centuries. Named for the Eye Institute’s first director, the library’s display includes 18th-century Chinese spectacles, candle-illuminated implements for examining the internal eye, and early surgical tools (see inset). The library is also a repository for more than 2,000 medical illustrations, used before the advent of modern diagnostic imaging to document eye disorders.

Dr. Richard Braunstein, Miranda Wong Tang Assistant Professor of Clinical Ophthalmology, gives Mrs. Tang a tour of the Laser Vision Correction Laboratory where he is Director.
Dr. Stephen Trokel guides the precise process of laser surgery using state-of-the-art instrumentation.

which remains partially attached during the procedure, is completely replaced after surgery to protect the eye so that it can heal more quickly and with less discomfort than that which may occur in PRK surgery.

Since the 1960’s, Stephen Trokel, MD, Vice-Chairman of the Department of Ophthalmology and Professor of Clinical Ophthalmology, has been fascinated by “the magic” of laser surgery. In the 1980’s, he speculated that this technology could be adapted for operating on the human eye to correct its optical power. He was soon proven right, and experiments on animal models in the 1980’s rapidly led to developing the first commercial instruments for such use. The first half of the 1990’s were then devoted to perfecting technical advances for excimer laser vision correction, because, as Dr. Trokel explains, “we had to prove the concept and demonstrate that use of the laser had a high degree of safety.”

Laser vision surgery, as Dr. Trokel believed it would be, is very successful today. Less than one-half of one percent of patients experience side effects or complications. Nevertheless, Dr. Braunstein has been principal investigator for three FDA multicenter clinical trials dedicated to developing improvements for PRK and LASIK technology. With Dr. Trokel, he is working to make the surgery even more precise and to ensure long-term health for eyes that have undergone the procedure. Every eye is different, says Dr. Braunstein, so customizing treatment is important.

Laser Pioneer
According to Francis L’Esperance, MD, Professor of Clinical Ophthalmology, “Ninety percent of all lasers used in ophthalmology, and in medicine worldwide, were developed at the Harkness Eye Institute.” Dr. L’Esperance has been working with lasers since the 1960’s, when he joined Bell Telephone Laboratory physicists to develop the argon laser. First used in 1968 to treat diabetic retinopathy, it is now a standard instrument for many procedures throughout medicine. During the 1970s and 1980s, Dr. L’Esperance continued to work with lasers, including surgery for vision correction.
FUCHS DYSTROPHY, FLUID TRANSPORT AND WOUND HEALING

What Do Blinking, Onions and Sadness Have in Common?

There are three kinds of tears. Those that keep the eyeball surface smooth so that vision remains clear are basal tears, released every six seconds with each blink of the eyelid. When the eye is assaulted by odors like onions or by the intrusion of a foreign object, reflex tears ward off the irritation and the salt in tears acts as an antiseptic to prevent eye infections. But, the tears that appear when we cry are different. First, their chemical makeup has 20-to-25 percent more protein than other types of tears, and, second, scientists still don’t agree on exactly why emotions produce tears.

A healthy cornea is like a transparent window revealing the interior of the eye. Disease, infection or injury may, however, turn the cornea cloudy, make it painful, or cause vision loss. Fuch’s dystrophy is an inherited disease that affects the cornea’s inner layer, or endothelium, which pumps fluids out of the cornea to maintain clear sight. As patients age, they lose endothelial cells and the cornea becomes less efficient at pumping, so that it swells, distorting vision. Fortunately, according to B. Dobli Srinivasan, MD, Professor of Clinical Ophthalmology, corneal transplantation has an 85 percent success rate.

To understand Fuch’s dystrophy and many other forms of eye disease, it is necessary to know how fluids move through layers of eye tissue, a process fundamental to eye function. Jorge Fischbarg, MD, PhD, Professor of Physiology, Cellular Biophysics and Ophthalmology, whose research at the molecular level has provided groundbreaking information in this area, says, “We believe we’re close to solving the basic mystery of epithelial cells, which may lead to a fresh approach for treating fluid transport systems gone awry. But,” he adds, “there’s no telling when such a discovery is going to be made or what the repercussions will be.” One unexpected result of his studies showed that glucose transport...
proteins related to the Stargardt’s disease gene found by Columbia’s Dr. Rando Allikemets are responsible for carrying fluid across eye tissue. “Our basic research,” says Dr. Fischbarg, “may pay off in understanding the structure of this protein and discovering what happens when it doesn’t work.”

David M. Maurice, PhD, Professor of Ocular Physiology in the Department of Ophthalmology, is an expert in corneal physiology. Like Dr. Fischbarg, Dr. Maurice studies fluid transport in the eye, but from the perspective of wound healing, an essential indicator of the cornea’s ability to rebound after laser correction or other eye surgeries. Dr. Maurice has raised questions about how the substance of tears affects corneal wound healing. After making small surgical cuts in mouse corneas to damage their connective tissue cells, he observed that, if tears were present, the cells died, but if there were no tears in the injured area, they survived.

Dr. Maurice has created a device that can observe and track changes in the corneal cells of live mice during the period that follows a mild injury. That work has revealed important and surprising insights. Most scientists, he points out, have always believed that when injury occurred, white blood cells headed straight to the damaged area to help with healing. “But,” he says, “we’ve noticed that many of the white cells simply wander about without ever getting to the wound site. Whether this lag delays or promotes healing is, however, uncertain.” He also anticipates collecting significant data on the prevention of scarring, unwanted blood vessel growth, and other circumstances that impede quick and complete tissue healing. The cornea, he says,

Dr. David Maurice and two colleagues who join him in solving questions about ocular wound healing.
should be a major source for insights into wound healing throughout the entire body.

Once, only a biopsy could give doctors information on corneal healing, but tracking and diagnosis of corneal problems have been advanced by innovative ophthalmic instrumentation. In the early 1970’s, before joining Columbia, Dr. Maurice developed the confocal microscope to make examination of living human ocular tissue at the cellular level possible without invading the eye’s surface. This extraordinary technology can magnify tissue up to 100 times its actual size, producing exquisitely defined details of cellular changes as they occur.

Department of Ophthalmology Special Lecturer Charles J. Koester, PhD, who worked on expanding the capabilities of the confocal scanning slit microscope, showed that by scanning back and forth rapidly, one could construct a complete field of view. Recalling that he and James D. Auran, MD, Associate Professor of Clinical Ophthalmology, photographed one another’s eyes with this instrument at regular intervals, Dr. Koester says that, in doing so, they were able to track a previously unknown pattern of nerve growth in the cornea. Dr. Auran, still finds this technology essential for diagnosing and following metabolic diseases, fungal and bacterial infections, and post-surgical healing. In addition, he says, tracking such changes in the cornea may also allow scientists to monitor the severity of diseases like multiple myeloma, a bone marrow cancer that destroys bone tissue. But, mostly, Dr. Auran says, he values the instrument for its ability to reveal what has never before been observed in the eye.
Edward S. Harkness Eye Institute

Dr. John Espy, MD, Clinical Professor of Ophthalmology, is exemplary of the high standards of clinical care provided by Eye Institute physicians. Throughout his long career, he has witnessed many new developments and incorporated them into his clinical practice. He is one of many departmental faculty members who provide state-of-the-art diagnosis and treatment for their patients through continuing medical education programs and skills transfer.

When Dr. Espy entered the field of ophthalmology in the early 1960’s, cataract surgery required a week-long hospital stay, and contact lenses were the most recent development in eye care. Having already seen many ophthalmic advances, Dr. Espy is optimistic about the future. “The major concern for eye health over the next few years,” he says, “is age-related macular degeneration (AMD).” He predicts, however, that it will soon be possible to help AMD patients through retinal translocation (moving healthy parts of the patient’s own retina to replace its affected areas), or with an electronic device that carries corrective impulses directly to the brain. Dr. Espy also believes new information on genetically modified disorders and corrective gene therapy holds substantial promise.

“John Espy’s unique historical perspective is an invaluable resource for the Department,” says Dr. Stanley Chang, Chairman of Ophthalmology. “He is an outstanding clinician and teacher, and we hope to benefit from his wisdom and knowledge for years to come.”

Dr. John W. Espy, a witness to many milestones achieved in Columbia’s Department of Ophthalmology during the 20th century.

Seneca, the Roman statesman and philosopher, is said to have read prodigiously, studying his texts through the magnification of a glass globe filled with water. Eye glasses as we know them today were first shown in an Italian fresco from 1352, where a bespectacled monk copies manuscripts. Early lenses were probably made of quartz set into bone, metal or leather. Keeping them on was a problem until the 18th century when rigid side pieces replaced ribbons and strings with weights. In the same period, Benjamin Franklin invented bifocals by cutting two pairs of spectacles—one for reading and one for distance—in half and placing them one atop the other in the same frame. That way, he said, “I have only to move my eyes up or down to see either far or near.”
Cataract: When cataracts form, they block passage of light through the eye’s lens, which normally focuses light rays on the retina. At least 30 percent of people over 65 have signs of cataract formation, and those numbers are expected to increase among a population in which many more people are living much longer. The only available treatment for cataracts is surgical replacement of the clouded lens with an artificial one, implanted at the time of cataract removal. In rare cases no implant is used, and only corrective lenses are added to complete the treatment.

Almost one-and-a-half million cataract operations are performed annually in the United States at an estimated cost of $3.5 billion. The success of the procedure was assured in 1983, when Endre Balazs, PhD, Columbia’s Aldrich Professor Emeritus, developed the substance Healon® to help prevent collapse of the anterior chamber of the eye during surgery. Healon® is now standard for use in lens implantation.

The Greeks Had a Word for It
Cataract is a Greek word meaning “white water falling,” because the blurred vision caused by a cataract is like looking through a waterfall. Reportedly, physicians in ancient Babylon and India were the first to use instruments to push the hard, cloudy lens out of the way, allowing light rays to re-enter the eye. This primitive surgery, called couching, was practiced as late as 1748, when the French surgeon Jacques Daviel performed the first cataract extraction.

In cataract surgery, the artificial intraocular folding lens replaces the eye’s damaged lens, returning clear sight to the patient.

Columbia’s ophthalmologists are still in the forefront of making cataract technology even more efficient and comfortable. As Dr. Richard Braunstein explains, “The basic results of the procedure alone are no longer adequate. We want to maximize vision and improve accuracy in the patient’s refraction, while minimizing complications.” To reach these goals, Dr. Braunstein is running clinical trials that should help determine the most accurate method of predicting cataract surgery outcomes.

How cataracts originate is still unknown, but environmental factors like exposure to ultraviolet light and ionizing radiation, together with other agents and genetics, are suspected of causing the primary type of critical cataracts. In the Department’s Eye Radiation and Environmental Research Laboratory (ERERL), directed by Basil V. Worgul, PhD, Professor of Radiation Biology (in Ophthalmology and Radiology), the emphasis is on changes in the eye associated with environmental...
genotoxins, radiation and other potential mutagens. Dr. Worgul makes it clear that “A substantial subset of all cataracts results from accumulated exposure to conditions like background radiation and ultraviolet light. We hypothesize that studying cataracts that develop following radiation exposure, whether experimental or accidental, can give us new insights from the cellular to the clinical level.”

Since 1986, Dr. Worgul has helped lead a joint Ukrainian-American effort to measure effects on cataract development in 12,000 of the 250,000 people who cleaned up after the Chernobyl nuclear power plant accident. It has been shown conclusively that higher doses of radiation speed up the appearance of cataracts, but it is believed that current risk estimates of such accelerated cataract progression are still too low. With their unique data from Chernobyl clean-up workers, the team is trying to improve the accuracy of these figures so that they can protect others who may face radiation in the workplace, like airplane pilots, radiologists, medical technicians and astronauts.

Abraham Spector, PhD, is Malcolm P. Aldrich Research Professor of Ophthalmology and Research Director of the Department of Ophthalmology. He studies the occurrence of cataract disease in older individuals—maturity onset cataract—which afflicts millions of people and results in more than 1.5 million operations per year in the United States alone.
Although cataract extraction from the eye’s lens is among the safest of surgical procedures, in about two percent of such cases it results in vision-threatening complications. To ward off the need for such operations in older patients, Dr. Spector is developing methodologies to prevent the onset of age-dependent cataract. His research team, which includes Mr. Wanchao Mas and Drs. Fang Sun, Dayu Li and Norman Kleiman, has shown that oxidative stress is an initiating or contributing event in all maturity onset cataract. In the young, explains Dr. Spector, antioxidative defenses are strong, but they become reduced as people age. Because the team has also demonstrated that, in approximately 25 percent of these cases, elevated levels of peroxides are probably responsible for inaugurating the cataractous process, they are seeking to define defense genes that may help to prevent formation of this type of cataract. Their analysis of 12,500 genes has revealed a small group of approximately 20 antioxidative defense genes with the potential to do so. Dr. Spector’s group has now begun work to enrich the lens with these genes as a means of assessing their effectiveness.

While he has dedicated much of his own scientific work to studies of the lens, Dr. Spector believes that all segments of the eye are interdependent and that diseases in one area can cause pathological damage in the eye’s other tissues. In his capacity as Director of Research for the Department, he focuses on strengthening a program of research covering the investigation of all eye tissues and encourages a broad spectrum of research interests throughout the Department.

Dr. Abraham Spector, who directs the Department of Ophthalmology’s research programs, devotes his own studies to problems of the aging eye.

**James P. Dillon, PhD.** Research Scientist (in the Department of Ophthalmology) also investigates effects of aging on the eye, especially in the lens and retina. He and Dr. Stanley Chang are studying eye patients to detect which wave lengths of light are transmitted from the cornea and lens to the retina. Dr. Dillon is also questioning whether the artificial lens implanted during cataract surgery damages the retina and why cataracts often develop within a year after removal of the vitreous. He theorizes that oxygen is to blame, since the vitreous—usually exposed to little oxygen—is replaced with saline containing 20 percent oxygen, a level high enough to cause cataracts.

**Slit beam images of human lenses:** normal (left) and showing cortical cataracts (right). Dr. Spector believes that exposure to peroxides can cause the observed transition from a clear to an opaque lens in the formation of cataracts in the aging eye.
Glaucoma: TECHNOLOGY AND TREATMENT

Glascoma is called the “sneak thief of sight” because it develops gradually and painlessly, without obvious symptoms. In most cases, glaucoma occurs when inner eye pressure, also called intraocular pressure, or IOP, rises because fluid in the eye is prevented from draining properly. Although the disease damages the optic nerve fibers, impairing vision, many people are unaware that they have glaucoma until their sight is seriously affected. In the United States, there are about three million people with glaucoma, many of whom have become blind as a result. Glaucoma usually occurs after the age of 40.

African Americans, people with a family history of glaucoma, and those who are very nearsighted or diabetic are at a higher risk for the disease. Abnormal development of the eye may even cause glaucoma in infants and toddlers. Glaucoma cannot be prevented, but if diagnosed and treated early, it can be controlled. Fortunately, new technology makes diagnosis and follow up—more precise than ever before.

Although most patients with glaucoma have elevated intraocular pressures (IOPs), researchers have now discovered that up to 30 percent of patients with this disease have IOP levels that are in the normal range. “Our understanding of glaucoma is different than it was 20 years ago,” said Dr. James C. Tsai, Director of Columbia’s Glaucoma Division. Department of Ophthalmology Advisory Board Member Homer McK. Rees.

Timing, Precision and Detail
Glaucoma may be successfully treated with medications, but first the disease must be detected. Therefore, all persons over age 40 should be tested regularly. Max Forbes, MD, Professor of Clinical Ophthalmology emphasizes that “The importance of having a highly refined diagnostic capability cannot be overstated,” if a patient’s condition is to be correctly assessed with regard to timely treatment for glaucoma. Two sophisticated instruments used by Dr. Forbes and his colleagues are the Nerve Fiber Analyzer, presented to the Department by Advisory Board member Homer McK. Rees, and the Confocal Scanning Laser, the gift of Mr. and Mrs. Steven Ollendorff. These imaging systems provide detailed measurements that help to define the condition of the nerve fiber layer emanating from the optic nerve, an essential piece of information in diagnosing glaucoma.

Dr. James C. Tsai, Director of Columbia’s Glaucoma Division. Department of Ophthalmology Advisory Board Member Homer McK. Rees.

Dr. Forbes takes a patient through testing.
“Today we realize that there are other important risk factors besides elevated IOP in the development of glaucoma,” says Dr. James C. Tsai, MD, Director of the Glaucoma Division, Associate Professor of Ophthalmology, and Homer McK. Rees Scholar. “The disease is more complex than we ever imagined it to be,” adds Dr. Tsai, who is developing an animal model of glaucoma that is not dependent on increased IOP. Dr. Tsai also points out that it is critical to consider the intricate connection between the eye and brain when studying glaucoma, because ischemia (reduced blood flow) of the optic nerve has recently been identified as another key risk factor in glaucoma. “With Columbia’s strengths in the neurosciences,” he adds, “we are well positioned to make significant advances in glaucoma research.”

Introduction of the drug Xalatan has revolutionized treatment for glaucoma patients. Developed under the direction of Laszlo Z. Bito, PhD, then Professor of Ocular Physiology in the Department of Ophthalmology, now Emeritus Professor, Xalatan increases the eye’s natural outflow of aqueous humor, thereby lessening IOP levels. Because it nourishes the lens and cornea, this treatment is preferable to older drugs which reduce production of the aqueous humor. A single drop of Xalatan once a day significantly lowers IOP with far fewer side effects than other glaucoma medications, which require taking multiple doses every day.
Neuro-Ophthalmology:

Neuro-Ophthalmology studies nervous system function as it relates to ophthalmology. The optic nerve is the cable that carries information from the retina to the brain, and a problem anywhere along its branches may cause partial or total vision loss. Although glaucoma is by far the most common such disorder, multiple sclerosis, ischemic optic neuropathy, brain tumors, and, less often, environmental, pharmacological or hereditary problems may also result in optic nerve damage. Myles M. Behrens, MD, Professor of Clinical Ophthalmology and Co-Chief of Neuro-Ophthalmology, says that understanding many of these disease processes has been greatly accelerated by “the explosion in neuroimaging, e.g., MRI and other neurodiagnostics.”

Two such new methods, the Multifocal Visual Evoked Potential (VEP) and Multifocal Electoretinogram (ERG), record patterns of retinal electrical impulses that respond to stimulus from light. These patterns evaluate function over the entire visual pathway between retina and brain to distinguish local eye damage from neurologically-based vision problems. The current gold standard for detecting visual defects, Visual Field examination, may spot problems that occur only after 25-to-30 percent of optic nerve axons has been damaged, while the more objective and comprehensive multifocal technology shows multiple visual field sectors simultaneously.

Neuropsychologist Donald C. Hood, PhD, James F. Bender Professor of Psychology explains, “Although the eye emits only one potential (electrical signal) at a time, multifocal technology can record 103 responses in just seven minutes.” Dr. Hood has adapted VEP for collecting clinical research data. He collaborates with neuro-ophthalmologist Jeffrey G. Odel, MD, Associate Professor of Clinical Ophthalmology and Co-Chief of Neuro-Ophthalmology, and Vivienne Greenstein, PhD, Assistant Professor of Ophthalmic Science, in gathering information that could zero in on the earliest stages of disease process, hastening opportunity for early intervention.

Because it is one of only two groups in the world with VEP technology that can record substantial data on glaucoma damage to ganglion cells and the optic nerve, Columbia may also succeed, where others have failed, in identifying neuroprotective agents that could be used in ophthalmology.

The Multifocal ERG responses shown here (upper panel) are taken from the eye of a patient who has good vision only in the lower left corner of her visual field. A three-dimensional representation of the same responses (lower panel) is shown as a pyramid. The data confirms that the patient’s visual defect is retinal, rather than neural, in origin.
The Department of Ophthalmology’s Ulrich Ollendorff, MD, Digital Diagnostic Imaging Center was made possible through the generosity of Steven and Bjorg Ollendorff, Dr. Ollendorff’s son and daughter-in-law. Imaging carried out at the Center documents eye conditions and provides sophisticated imaging that gives physicians information needed to diagnose disorders of the eye.

Technology at the Ollendorff Center includes a digital retinal imaging system that highlights the blood vessel circulation in the retina, and fluorescein angiography and indocyanine angiography that allow the precise localization of abnormalities in the retina to assist in laser or photodynamic treatments. Another instrument, the AVI digital slit lamp, documents changes in the front part of the eye—cornea, iris, lens—for size and consistency. All images can be exported via computer for teleconferencing, or to the patient’s local doctor.

The Ollendorff Center’s Heidelberg Retinal Tomograph (HRT) also produces retinal images and shows structural changes in the optic nerve head that may be precursors to any measured change in visual function. It can be used as a retinal flowmeter (HRF) as well, giving Dr. James Tsai a technique for pursuing his theory that blood flow is intricately involved in the progression of glaucoma. HRF measures actual blood flow in the optic nerve head and surrounding retina, and can compare readings from glaucoma patients with high pressure to those with normal pressure.

Vital Measurements for Retinal Nerve Cell Analysis
Board of Advisors member Homer McK. Reese’s recent gift of Optical Coherence Tomography (OCT) instrumentation has made early detection and treatment of glaucoma possible for patients at the Eye Institute. OCT, a laser instrument showing a cross-sectional image of the eye, produces a topographical representation of the retina and provides computerized measurements and analysis of the retinal nerve cells. When OCT shows reduced thickness in this nerve fiber layer, glaucoma treatment may be necessary.
The generosity of Louis and Gloria Milstein Flanzer has been responsible for many recent renovations for the Eye Institute. The Flanzer Eye Center, named for its donors, is a major facility for eye care that substantially advances the work of the Eye Institute. This beautiful clinical environment puts patients at ease, and ophthalmologists in the Flanzer Center enjoy state-of-the-art conditions for the diagnosis and treatment of their patients. Instrumentation available in the Center includes: the YAG laser for glaucoma procedures and removal of secondary membranes after cataract surgery, the Argon laser for mending retinal tears and reducing blood vessel growth, photodynamic therapy, and transpupillary thermal therapy for macular degeneration. A Center-wide digital angiography system allows physicians to view the condition of blood vessels in their patients’ eyes and to make a diagnosis immediately following examination and imaging. This networked system provides an important educational component for patients, giving them a better understanding of the treatment plan recommended for their care.

To ensure that future generations of ophthalmologists are able to choose an academic entry for their careers, the Flanzers have also funded two fellowships in the Department. This assistance is invaluable both to the Department, which gains the fresh perspective of young ophthalmologists, and to the fellows, who are surrounded by the seasoned expertise and experience of their faculty mentors.

Optimal Conditions for Eye Surgery
In 1997, Vivian and Seymour Milstein and the Milstein Family Foundation gave a gift that made it possible to refurbish the Eye Institute’s operating suites. The Milsteins were interested in providing a completely modernized environment for performing eye surgery under optimal conditions that would give patients and their families an enhanced sense of security and comfort during treatment. The renovated suites are also equipped with audiovisual transmission that will send a view of surgical procedures to the amphitheatre currently being renovated with support from Louis and Gloria Milstein Flanzer. This sophisticated process will allow visiting ophthalmologists and physicians-in-training to observe the fine detail of modern surgical techniques, while providing patient privacy.

Louis and Gloria Milstein Flanzer with Vivian and Seymour Milstein share in celebrating the opening of the Department of Ophthalmology’s state-of-the-art Flanzer Center in 1997.
Today, because of the rapid advances taking place in basic science, the underlying causes of vision disorders are better understood and the ability to develop new treatments for them is increasing. Future discoveries in genetics and molecular biology will point the way to saving the sight of millions, both in the United States and worldwide.

The Louis V. Gerstner Jr. Clinical Research Center in Vision, scheduled to open in late 2002, will give both basic scientists and clinicians advanced opportunities to test promising new ideas for the diagnosis and treatment of eye disease. These procedures require careful scientific design, standardized protocols and objective monitoring of data to guarantee accuracy and patient safety. The Gerstner Center will help guarantee that clinical research in the Department of Ophthalmology is in full accord with government, institutional and hospital guidelines.

Three exceptional gifts, from the Louis V. Gerstner Foundation, from Russ and Angelica Berrie, and from the Starr Foundation, provided the basic support for establishing the Center. Their combined philanthropy will underwrite research fellowships, special programs in vision problems caused by diabetes, genetic screening to identify at-risk populations for eye disease, and the facilitation of gene-targeted pharmaceutical development. With this full range of
diagnostic and treatment services and clinical research programs, the Gerstner Center will offer one of the most comprehensive programs of its kind in the nation.

Facilities for clinical study coordinators, patient examination suites and diagnostic instrumentation for the Center will be located in a newly renovated area of the Edward S. Harkness Eye Institute. The Gerstner Center will give patients the opportunity to consult clinicians who use sophisticated diagnostic technologies. The Scanning Laser Ophthalmoscope, the confocal scanning slit microscope and Multifocal ERG and VEP, not offered by many medical centers, will be available to Harkness Eye Institute patients. Community physicians without access to such costly technology will be able to refer their patients to the Gerstner Center for advanced care and will receive an analysis of the results quickly via the Center’s computerized information systems.

With clinical research activities coordinated at a single location, it will be possible to expand and enhance the scope of interdisciplinary collaboration both within the University and with other academic medical centers. Partnerships with industry will also be strengthened in a united effort to develop novel methods of treating eye disease.
“Clinical curiosity feeds research,” asserts Dr. Stephen Trokel, who has spent much of his career considering questions about the treatment of clinical ocular problems. He believes that residents now preparing for careers in ophthalmic medicine with the Department of Ophthalmology are learning the importance of combining research with clinical practice first-hand by observing Department Chairman Dr. Stanley Chang. “An institution runs, by example, from the top,” says Dr. Trokel, citing Dr. Chang’s dual role as physician and scientific innovator in retinal surgery.

By Example

Nearly 18,000 children and adults receive care annually at the ITT Eye Clinic of the Harkness Eye Institute. Opened in 1933, the Eye Clinic was refurbished in 1992 through the generosity of the ITT Corporation and its former Chairman and Chief Executive Officer, Department of Ophthalmology Board Member Rand Araskog.

Services provided at the ITT Eye Clinic form the basis of training for the Department’s residents. This well-equipped and spacious clinical area houses both general and specialty clinics supervised and staffed by members of the faculty. Clinics include neuro-ophthalmology, retina, glaucoma, uveitis, external disease, cornea, contact lens, orbit and plastic reconstruction, ocular motility and tumor. A busy pediatric clinic, which also meets daily, is staffed by second- and third-year residents. As B. Dobli Srinivasan, MD, Director of Clinics, explains, “Columbia ophthalmology residents have the opportunity of seeing a very wide range of cases of significant academic interest” during their time in the ITT Clinic.

Residency Program Director Dr. Richard Braunstein says that, during their residency, the ophthalmologists in training present case reports, and are encouraged to participate in research projects. They often publish their findings, or present them at national and international meetings. Amilia Schrier, MD, and Dan Casper, MD, Assistant Professors of Clinical Ophthalmology play a significant part in teaching and mentoring the residents. At the clinic, Dr. Schrier and Dr. Casper are especially important in modeling the role of advocate for providing quality care and service to patients in the community.
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Recent changes in the health care environment are threatening the mission of academic medical centers to continue to provide the best quality care to all patients, to develop new treatments through research, and to train skilled, compassionate physicians. The world’s finest and most innovative health care system is being gradually weakened by forces that create disincentives to teach and to participate in research. Teaching hospitals currently face great challenges in maintaining fiscal soundness.

Philanthropy plays a vital role in insuring the viability of academic medical centers. You are invited to join in the effort to invest in the future by creating a solid foundation for the Department of Ophthalmology at Columbia and its scientists and doctors as they treat patients, develop new treatments for eye diseases and find ways to prevent visual loss. Through disease-focused research, our doctors hope to discover treatments for eye diseases that can be used all over the world to help patients in need. Every gift is meaningful, and will greatly help in the mission of the Department and the Edward Harkness Eye Institute.

Throughout the years, the Ophthalmology Department has enjoyed the generous support of the Board of Advisors and many good friends. Now the need is even more critical as science rapidly progresses and ophthalmology must advance these discoveries to the treatment of eye disease. Examples of new areas in our research effort are structural biology, bioinformatics, biomedical engineering and gene replacement. Philanthropy enables the Department to maintain and expand its research effort as these new developments in science occur. Recruitment of new faculty and starting pilot projects are mainly possible only through donor support. A gift may be given to support research programs, provide education, or improve clinical care through acquisition of new technology.

It is possible to make a tax-deductible gift in multiple parts over an extended period of time or through estate planning. Gifts to increase the endowment ensure the continuity of academic effort whether it is applied to support clinical or research activity. Please join us in maintaining the Edward Harkness Eye Institute’s role as a world leader in curing and preventing vision threatening disorders.

A program of planned giving offered by the Health Sciences Development Office. Giving Well provides a range of choices for our donors, physicians, alumni and friends who wish to make a gift to the Health Sciences. Our experts can guide donors through the steps for each type of planned gift, preparing proposals, suggesting bequest language, helping to create trusts, and even showing how a gift can benefit Columbia while simultaneously providing the donor with tax savings and lifetime income. For further information, please call: Elia Desruisseaux, Director of Planned Giving, at 212 304-7200.

The following list of giving opportunities demonstrates the broad scope of gifts that have been so meaningful in continuing the Department’s reputation for distinction in the field of Ophthalmology. Please contact Susan Taylor, Senior Development Officer for Ophthalmology, at 212-304-7200 if you are interested in learning more about the various ways in which you can support us.
NAMED GIFTS

All named gifts honor and commemorate the person whose name they bear.

Named Endowed Professorships:
Named endowed professorships are needed at all levels—Assistant, Associate and Full—to provide faculty support for clinical and research faculty. The creation of an endowed professorship recognizes superior achievement in the person appointed to the chair, provides income in perpetuity to the department and is a compelling attraction in retaining and recruiting outstanding professionals to the University. In addition, it honors and commemorates the name it bears.

Named Research Fellowships:
Provides annual support for the research and education of young clinicians and scientists.

Named Scholar Program
To enable the recruitment and ongoing support of promising assistant professor clinicians/scientists throughout the Department divisions.

RESEARCH FUNDING AND ENDOWMENT
Support is needed to supplement on-going clinical and basic science research projects, and to start new initiative and pilot projects in research. Income from the Department's research endowment is used to bridge support to continue research activity between grant cycles, start new areas of investigation, and to maintain core facilities for research such as a computing center, instrumentation laboratory, fluorescence microscope, imaging center, and statistical consultation.

FACILITY AND TECHNOLOGY IMPROVEMENTS
Renovations are needed in specific areas of clinical and research buildings to develop centers of excellence in Glaucoma, Retina, and Cornea and Refractive Surgery. Plans to update the pediatric and adult ambulatory care services are in progress. Research laboratories require modernization and renewal. Some naming opportunities are available.

WHEELER LIBRARY FUND
A fund for commutative gifts in supporting: a librarian; technology upgrades; and the growth of the collection.
“Vision without action is merely a dream. Action without vision just passes the time. Vision with action can change the world.”

*Joel Arthur Baker*