Gholam A. Peyman, M.D.

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Gholam A. Peyman is an ophthalmologist and retinal surgeon who is also a prolific and successful inventor. Peyman has, thus far, been granted 116 US patents covering a broad range of novel medical devices as well as new methods of diagnosis and treatment. His most widely-known invention to date is LASIK surgery, a revolutionary vision correction procedure which has enabled tens of millions of people to see clearly without glasses, for which he was awarded the first US patent in 1989 (link to image of patent, below). In addition to the numerous other honors and awards he has received (please see 4 Publications and awards), in 2005 he was selected by a ballot among the more than 30,000 ophthalmologists around the world to become one of the thirteen living ophthalmologists inducted into the Hall of Fame of Ophthalmology.

Life and career

At the age of 19, Peyman moved to Germany to begin his medical studies. He received his MD at the University of Freiburg in 1962. He completed his internship at St. Johannes Hospital in Düsseldorf, Germany in 1964 and at Passaic General Hospital in Passaic, New Jersey in 1965.

Peyman completed his residency in ophthalmology and a retina fellowship at the University of Essen, Essen Germany, in 1969 and an additional postdoctoral fellowship in retina at the Jules Stein Eye Institute, UCLA School of Medicine in Los Angeles in 1971.

Peyman initially held the position of Assistant Professor of Ophthalmology at the UCLA School of Medicine in 1971 and then served as Assistant Professor, Associate Professor and then Professor of Ophthalmology at the Abraham Lincoln School of Medicine, University of Illinois in Chicago during 1971-1987.

Peyman held a joint appointment at the School of Medicine and also at the Neuroscience Center of Excellence at the Louisiana State University Medical University Medical Center in New Orleans during 1987-2000. During 1998-2000 Peyman held the Prince Abdul Aziz Bin Ahmed Bin Abdul Aziz Al Saud Chair in Retinal Diseases.

During 2000-2006, Peyman served as Professor of Ophthalmology and Co-Director, Vitreo-Retinal Service, Tulane University School of Medicine in New Orleans.

During 2006-2007 he was Professor of Ophthalmology at the University of Arizona, Tucson with a cross appointment at University of Arizona College of Optical Sciences. He has been emeritus Professor of Ophthalmology at Tulane University since 2009.

Peyman is currently Professor of Basic Medical Sciences at the University of Arizona, Phoenix and Joint Professor at the College of Optical Sciences.
LASIK surgery and improvements to LASIK

The Invention of LASIK Surgery  In 1977, because of his interest in the effects of lasers on tissues in the eye, Peyman began evaluating the potential use of a CO₂ laser to modify corneal refraction in rabbits. No prior study had existed on this concept. The laser was applied to the surface of the cornea using different patterns. This laser created significant scarring. His conclusions at that time were: 1) one has to wait for the development of an ablative laser and 2) one should not ablate the surface of the cornea but, instead, the ablation should take place under a flap in order to prevent scarring and other undesirable sequelae.

Peyman published the first article on this subject in 1980[4]. In 1982, he read an article from Bell Laboratories, published in Laser Focus, describing the photo-ablative properties of an excimer laser on organic material. This was very exciting information, but Peyman did not have access to this laser, which at the time was new and very expensive.

By 1985 and beyond, many investigators were interested in incising or ablatiing the corneal surface. However, because of his previous experience with the CO₂ laser, Peyman wanted to avoid surface ablation in order to prevent potential corneal scarring and the pain associated with the removal of the corneal epithelium, necessary to expose the surface of the cornea. Therefore, in July 1985, he applied for a patent that described a method of modifying corneal refractive errors using laser ablation under a corneal flap (please see Figure 1). This US patent was accepted after two revisions and issued in June, 1989.

Peyman performed a number of experimental studies evaluating the effect of various excimer lasers in collaboration with Physics Department of the University of Helsinki, Finland. Since he had purchased an Erb-Yag laser in the U.S., he evaluated the concept using this laser in vivo in rabbit and primate eyes and described the creation of a hinged corneal flap to enable the ablation to be performed on the exposed corneal bed, thus reducing the potential for post-operative scarring and pain[5].

Improvements to LASIK Surgery: Inlays  Always aware of the potential limitations of his invention, Peyman devoted considerable time and effort in subsequent years to ameliorating them. In order to improve the risk/benefit considerations of the LASIK procedure, he invented and patented a broad range of ablative and non-ablative inlays to be placed under the surgical flap. These inlays offered many potential advantages over the standard LASIK technique, the most significant of which is that the inlay procedure is reversible[6].

Improvements to LASIK Surgery: Accelerating the Return of Corneal Sensitivity  Creating the surgical flap that enables the LASIK procedure necessarily cuts corneal nerves, leaving the surface of the cornea insensitive for many months following the LASIK procedure. This is a potential risk for the patient in several ways. For example the surface of the eye could be scratched and damaged without the patient realizing this, sometimes leading to an infection that has serious consequences. Peyman evaluated the application of topical cyclosporine to peri- and post-surgery LASIK patients in order to address this problem. He was able to convincingly demonstrate in a controlled clinical study that its use dramatically accelerates the return of corneal sensitivity after LASIK surgery when compared to the contra-lateral control eye (which received LASIK surgery but not cyclosporine). In 2008 Peyman was awarded the Waring medal by a leading peer-reviewed ophthalmology journal for this breakthrough invention[7] (please also see 4 Publications and awards).
Peyman’s inquiring mind, coupled with his keen interest in engineering and pharmacology along with his in-depth background and experience in ophthalmology resulted, over a 40-year period, in a remarkable range of novel devices, improvements in surgical methods and revolutionary new treatment methods and modalities. Peyman has authored 10 books and over 860 scientific publications. He has trained more than 100 retina fellows.

A partial list of Peyman’s most significant discoveries and inventions (with first publication date), many of which are still in use today, includes:

**Modifications and improvements to the operating microscope (1972, 1974 and 1977) [8]**

**Vitrectomy instruments and techniques**
- Techniques of vitreous removal (1971, 1972)[9]
- Vitreous scissors and forceps (1975)[10]
- The vitrophage (1976, 1977)[11]
- Improved vitrectomy illumination system (1976)[12]
- Wide-angle cutter vitrophage (1976)[13]
- Miniaturization of the vitrophage (1980)[14]
- A bent-tipped vitrophage for anterior segment surgery (1982)[15]
- An illuminated air-fluid switch for vitrectomy (1988)[16]
- A miniaturized vitrectomy system (23 gauge) for vitreous and retinal biopsy (1990)[17]
- A pneumovitrector for diagnostic biopsy of the vitreous (1996)[18]
- A new high-speed pneumatic vitrectomy cutter (2002)[19]
- Small-size pediatric vitrectomy wide-angle contact lens (2003)[20]
- A new, non-contact wide-field viewing system for vitreous surgery (2003)[21]

**Endolaser for vitrectomy**
- Intraocular photocoagulation with the argon-krypton laser (1980)[22]
- Argon endolaser (1981)[23]
- A microscope filter for endophotoagulation (1981)[24]
- Protective eye filters for endolaser therapy (1986)[25]
- Special short needles to inject and aspirate high-viscosity silicone oil (1986)[26]
- Contact lenses for Nd:YAG application in the vitreous (1984)[27]
- A new contact lens for Nd:YAG laser capsulotomy (1986)[28]
- An automatic laser filter for the indirect ophthalmoscope (1987)[29]
- A bent-tipped endolaser probe (1987)[30]
- An endolaser probe with aspiration capability (1992)[31]

**Vitreous substitutes**
- Evaluation of perfluorocarbon gases in the vitreous (1973)[32]
- Use of fluorosilicone to unfold a giant retinal tear (1987)[33]
- Injection of fluorosilicone oil and pars plana vitrectomy for complex retinal detachment (1987)[34]
- Experimental evaluation of perfluorophenanthrene as a high specific gravity vitreous substitute (1989)[35]
- Perfluorocarbon liquids in ophthalmology (1995)[36]

**Eye wall resection (tumors) and biopsy**
- Full thickness eye wall resection (1972)[37]
- Local excision of choroidal malignant melanoma: Full thickness eye wall resection (1974)[38]
- Biopsy of human scleral-chorioretinal tissue (1975)[39]
- Abintermo resection of uveal melanoma[40]
- Histopathology of Goldmann-Favre syndrome obtained by full-thickness eye-wall biopsy (1977)[41]
- Full thickness eye wall resection of choroidal neoplasms (1979)[42]
- Treatment of large von Hippel tumors by eye wall resection (1983)[43]
- Internal retinal biopsy: Surgical technique and results (1990)[44]

**Surgical and pharmaceutical treatments for bacterial endophthalmitis** (numerous publications 1973-1982)[45]
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<tr>
<th>Topic</th>
<th>References</th>
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<tr>
<td>Pressure-controlled shunt for glaucoma</td>
<td>(1974)</td>
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<td>The first ultraviolet light-absorbing intra-ocular lens (IOL)</td>
<td>(1982)</td>
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<td>Intravitreal antineoplastic (cancer) drugs</td>
<td>(1982)</td>
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<td>Combination intravitreal therapy</td>
<td>(1974)</td>
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<td>Intravitreal effects of antiviral drugs</td>
<td>(1984)</td>
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<td>Intravitreal immunosuppressants</td>
<td>(1986)</td>
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<td>Slow release ocular drug delivery</td>
<td>(1986)</td>
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<td>First attempt to correct refractive errors using lasers</td>
<td>(1980)</td>
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- An experimental "aqueous shunt" for the regulation of intraocular pressure. (1974)
- Experimental evaluation of a posterior drainage system. (1983)
- Ultraviolet light absorbing pseudophakos (1982)
- Toxicity of antineoplastic drugs in vitrectomy infusion fluids (1983 and 1984)
- Bacterial endophthalmitis: Treatment with intraocular injection of gentamicin and dexamethasone (1974)
- Toxicity of antibiotic combinations for vitrectomy infusion fluid (1979)
- Toxicity of antineoplastic drug combinations in vitrectomy infusion fluid (1984)
- In vitro evaluation of cellular inhibitory potential of various antineoplastic drugs and dexamethasone (1985)
- Proliferative vitreoretinopathy and chemotherapeutic agents (1985)
- Effects of selected repeated intravitreal chemotherapeutic agents (1985)
- Toxicity and clearance of a combination of liposome-encapsulated ganciclovir and trifluridine (1989)
- Toxicity of antiviral drugs (1984)
- Parenterally-administered acyclovir for viral retinitis associated with AIDS (1984)
- Intravitreal toxicity of hydroxyacyclovir (BW-B759U), a new antiviral agent (1985)
- Retinal toxicity of ganciclovir in vitrectomy infusion solution (1987)
- Toxicity of intravitreal injection of foscarnet in the rabbit eye (1988)
- Retinal toxicity study of intravitreal cyclosporine (1986)
- Ocular toxicity of intravitreal tacrolimus (2002)
- Intravitreal liposome-encapsulated gentamicin in a rabbit model: Prolonged therapeutic levels (1986)
- Clearance of sodium fluorescein incorporated into microspheres from the vitreous after intravitreal injection (1991)
- Clearance of microsphere-entrapped 5-fluorouracil and cytosine arabinoside from the vitreous of primates (1992)
- Comparison of the effects of argon fluoride (ArF) and krypton fluoride (KrF) excimer lasers on ocular structures (1985)
- The Nd:YAG laser 1.3μ wavelength: In vitro effects on ocular structures (1987)
- Effects of an erbium:YAG laser on ocular structures (1987)
- Contact laser: Thermal sclerostomy ab interna (1987)
- Internal trans-pars plana filtering procedure in humans (1988)
- Internal pars plana sclerotomy with the contact Nd:YAG laser: An experimental study (1988)
Intraocular telescope for age related macular degeneration
- Age-related macular degeneration and its management (1988) [80]

Retinal pigment epithelium transplantation
- A technique for retinal pigment epithelium transplantation for age-related macular degeneration secondary to extensive subfoveal scarring (1991) [81]

Photodynamic therapy for ARMD
- The effect of light-activating tin ethyl etiopurpurin (SnET2) on normal rabbit choriocapillaries (1996) [82]
- Photodynamic therapy for choriocapillaris using tin ethyl etiopurpurin (SnET2) (1997) [83]
- Problems with and pitfalls of photodynamic therapy (2000) [84]

Semiconductor photodiode stimulation of the retina
- Subretinal semiconductor microphotodiode array (1998) [85]
- Implantation of silicon chip microphotodiode arrays into the cat subretinal space (2001) [86]
- Subretinal implantation of semiconductor-based photodiodes. Durability of novel implant designs (2002) [87]
- The artificial silicon retina microchip for the treatment of vision loss from retinitis pigmentosa (2004) [88]
Honors and awards

1973  Fisher Prize, Chicago Ophthalmology Society
1974  Advisor to the National Commission of Diabetes
1976  Honorary Member, New Zealand Ophthalmology Society
1979  Honor Award, American Academy of Ophthalmology
1981  Honorary Member, All India Ophthalmological Society
1982  Honorary Member, Paraguayan Ophthalmological Society
1984  Honorary Corresponding Member, Peruvian Ophthalmological Society
1988  Honorary Member, Latin American Ocular Angiofluorography and Photocoagulation Society
1989  U.S. Public Health Service grant EY07541 from the National Eye Institute, the National Institutes of Health Services, Bethesda, MD
1989  Senior Honor Award, American Academy of Ophthalmology
1990  Honorary member, All India Ophthalmological Laser Society
1996-97 Included in first edition of The Best Doctors in America: Southeast Region
1997  Honor Award, Vitreous Society
1998  Included in fourth edition of The Best Doctors in America
2001  Gertrude Pyron Lecturer Award, Vitreous Society Annual Meeting
2001  ASCRS Innovators Award
2003  Lifetime Achievement Award, Iranian Ophthalmology Society
2004  Paul Henkind Lecturer, Macula Society
2005  Hall of Fame of Ophthalmology
2005  Pfizer/ARVO Translational Research Award
2008  Waring Medal, Journal of Refractive Surgery
2008  Lifetime Achievement Award, American Academy of Ophthalmology

NOTE TO JD: FOR REFERENCES http://www.ascrs.org/Awards/Gholam-A-Peyman-MD.cfm
References

6. ^Examples of these inlays can be found in US Patents: #6,203,538, granted March 2001, #6,217,571, granted April 2001, AND #6,280,470, all entitled, "INTRATROMAL CORNEAL MODIFICATION"; #6,221,067, granted April 2001, entitled "CORNEAL MODIFICATION VIA IMPLANTATION"; and others.
References cont.

References cont.

100. ^University of Arizona Colleges of Optical Sciences web site (at http://www.optics.arizona.edu/faculty/Resumes/Peyman,%20Gholam.htm).