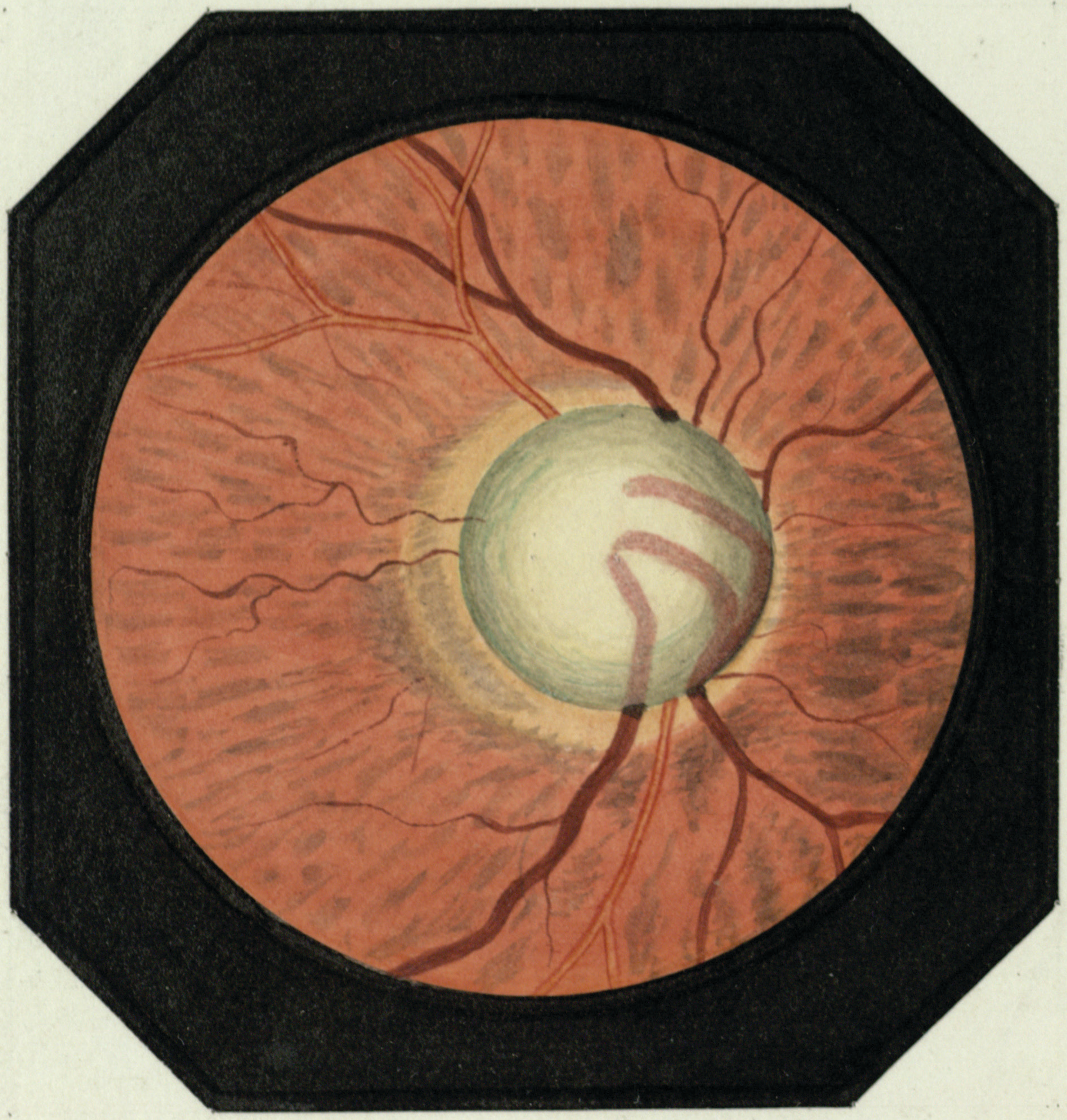

A Selected History of Retinal Illustrations, 1851–1900 and Beyond

OHSU Library

Fall 2019 Exhibit

A Selected History of Retinal Illustrations, 1851–1900 and Beyond

Curated by Donald L. Blanchard, M.D.

Fall 2019 Exhibit | OHSU Library

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A Selected History of Retinal Illustrations, 1851–1900 and Beyond

Overview

About this exhibit

This exhibit, on view from September to December 2019 in the OHSU Library, traces the developments in retinal illustration throughout the history of ophthalmology, from the first retinal atlases up to twentieth century techniques.

Until Helmholtz's discovery of the ophthalmoscope in 1851, the retina could not be visualized. Essentially all causes of loss of vision with a normal external exam were termed "Gutta Serena," or blindness due to some obscure posterior cause. Most of these patients had diseases of the retina, which is the nerve layer in the back of the eye that receives external images and relays them to the brain for interpretation.

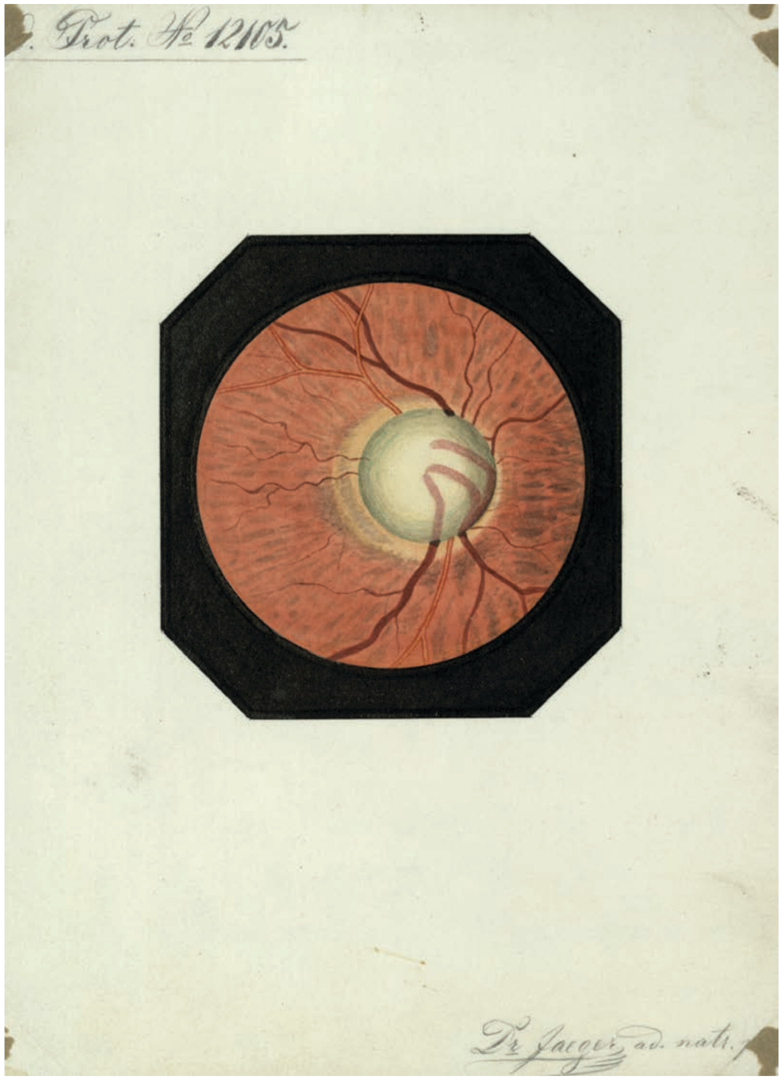
Suddenly, with the ophthalmoscope the retinal reasons for loss of vision could be identified and ultimately treated. Ophthalmologists such as Adrien Christoph Van Trigt, Eduard Jaeger, and Richard Liebreich wanted to share their discoveries, so they painted what they saw or hired professional artists. Given the novelty of this momentous new opening in medical understanding, sometimes what was seen was not fully understood, or was not painted with the correct emphasis on the actual pathology.

The first ophthalmoscope was a simple mirror. The meager light from a flickering flame or sooty lantern chimney led to indistinct viewing. The refraction of the patient and the examiner had to be corrected or else no image would be formed. Examiner's retinal fatigue led to inaccurate color representation of the patient's retina. Difficulties with color printing made for inaccurate depictions. However, by the early 1900s, a battery powered light with mirrors and lenses in the ophthalmoscope made the view of the retina much more stable and clearer. Photography of the retina, first pioneered in the late nineteenth century, became more widely used in the 1900s, and soon color photos were possible.

At the University of Oregon Medical School (now OHSU), John E. Weeks, M.D., a semi-retired ophthalmologist from New York, donated his expertise, library, and funding to the new eye clinic, constructed as part of the University Hospital project in 1955. Treatment of retinal diseases quickly became a major component of the mission of the eye clinic under the direction of Kenneth Swan, M.D., the first Chair of Ophthalmology. He became widely known as an extremely knowledgeable, caring, and empathetic ophthalmologist. At national meetings, his presentations were illustrated with high quality Zeiss photos of the retina, as well as artistic documentations of the findings.

About the curator

Donald L. Blanchard, M.D., Clinical Assistant Professor at Casey Eye Institute, is an ophthalmologist and a medical historian. He is a member of the Cogan Ophthalmic History Society and has presented papers including a history of Emily Dickinson's eye problem. He is a native of Portland and an alumnus of the University of Oregon Medical School. Dr. Blanchard is actively involved in the Casey Eye Institute library, where he was an honored recipient of the Volunteer of the Year Award for his work on the library holdings. His interest in the work of George Bartisch led him to translate Bartisch's massive ophthalmology textbook, *Ophthalmodouleia* (1583), from an Early New High German dialect into English.



Cover image: Jaeger von Jaxtthal, Eduard. Watercolor painting of amaurosis arthritica (glaucomatosa), circa 1850s. Courtesy of the College of Physicians of Philadelphia.

The cover illustration is a scan of the original watercolor painting done by Dr. Eduard Jaeger von Jaxtthal, (1818-1884, Vienna) in the early 1850s. He described it as follows in his 1854 work, *Über Staar und Staaroperationen*:

> Amaurosis arthritica (glaucomatosa) in a 68-year-old woman who had the process for one half a year. The diseased optic nerve is light yellow, green color and swollen (bulged forward, elevated, domed, convex). The blood vessels show through this swelling with a dark reddish hue. In the retina the vessels are very distended and more apparent. This is especially true of the veins, which are a very dark blue, cherry red color. The darker retina reveals numerous smaller and larger grayish flecks (residuals of blood extravasations). The limited area in the circumference around the optic nerve has an intense bright yellow color. (Translated by Donald L. Blanchard, M.D.)

Because of costs and difficulties with reproducing color images at that time, the image above was printed there in black and white. This was the first published illustration of a glaucomatous optic nerve head with a description. However, using a variety of lenses and observing parallax, Dr. Adolph Weber soon corrected this misconception of a swollen, bulged-forward, elevated, domed or convex optic nerve head with that of a depression.

Earliest Ophthalmoscopes and Retinal Illustrations

In 1851, Hermann von Helmholtz (1821–1894) introduced the world to the visualization and understanding of the retina. Hurdles to sharing and developing this advancement were formidable in the new field of retinal illustration.

The viewing of the ocular fundus, which is the back, interior part of the eye that includes the retina, was challenging with the ophthalmoscopes of the time. The refraction of the patient and the physician both needed to be corrected by lenses in the system. Proper alignment was critical and difficult to maintain.

Illumination was by candle, filtered sunlight, or lantern: all of which were dim and variable by today's standards of electric ophthalmoscopes. Gradually ophthalmologists learned to use ophthalmoscopes and new models sprang up, mostly in Europe to reduce various impediments of visualizing the retina.

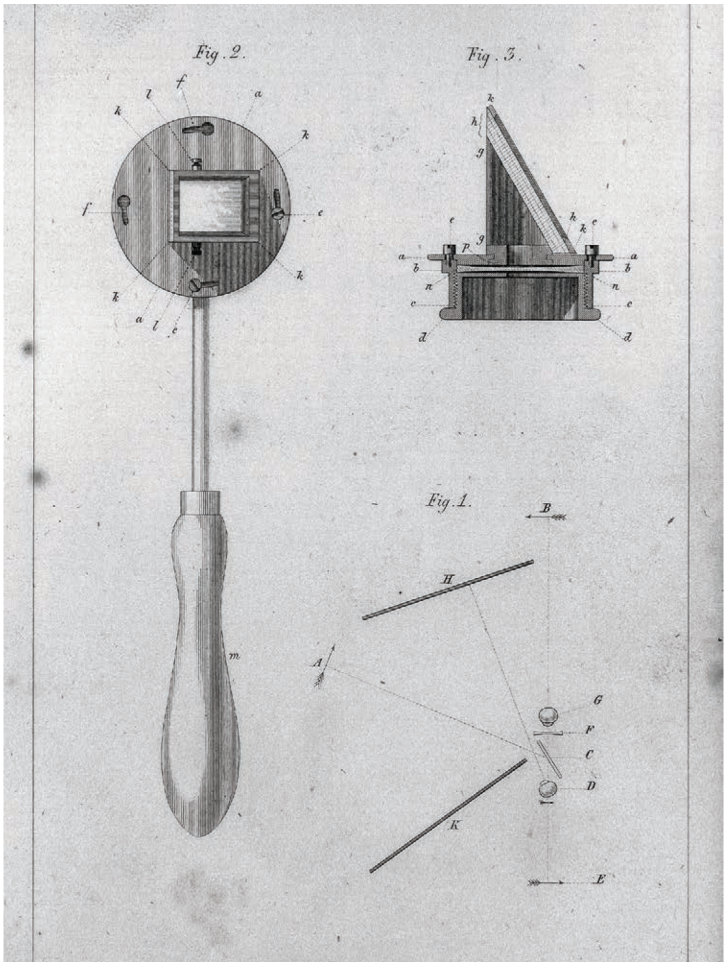
Sharing the new knowledge was by word of mouth and through books and articles, but most dramatic were the early painted illustrations. It was rare for ophthalmologists to be skilled artists, and skilled artists mostly were untrained in recognizing ocular disease or in the use of the ophthalmoscope. Reproduction of the retinal colors was in its infancy with a limited number of colors and shades available for mass printing efforts. Means of illumination drastically changed the perceived colors as well. Artists had been previously hand coloring each copy of printed materials.

A new exciting era had begun.

Portrait of Hermann von Helmholtz, no date. Credit: Wellcome Collection. (CC BY)

Herrmann von Helmholtz's monumental invention of the ophthalmoscope was described by him in a letter to his father in 1850:

> I have made a discovery during my lectures on the Physiology of the Sense-organs, which may be of utmost importance in ophthalmology. It was so obvious, requiring, moreover, no knowledge beyond the optics I learned at the Gymnasium, that it seems almost ludicrous that I and others should have been so slow as not to see it. It is, namely a combination of glasses, by means of which it is possible to illuminate the dark background of the eye, through the pupil, without employing any dazzling light, and to obtain a view of all the elements of the retina at once, more exactly than one can see the external parts of the eye without magnification, because the transparent media of the eye act like a lens with magnifying power of twenty. The blood-vessels are displayed in the neatest way, with the branching arteries and veins, the entrance of the optic nerve into the eye, &c. Till now a whole series of most important eye-diseases, known collectively as black cataract, have been terra incognita, because the changes in the eye were practically unknown, both during life and, generally speaking, after death. My discovery makes the minute investigation of the internal structures of the eye a possibility. (Reprinted in Rucker, C.W. *A History of the Ophthalmoscope*. Rochester, MN: Whiting, 1971.)

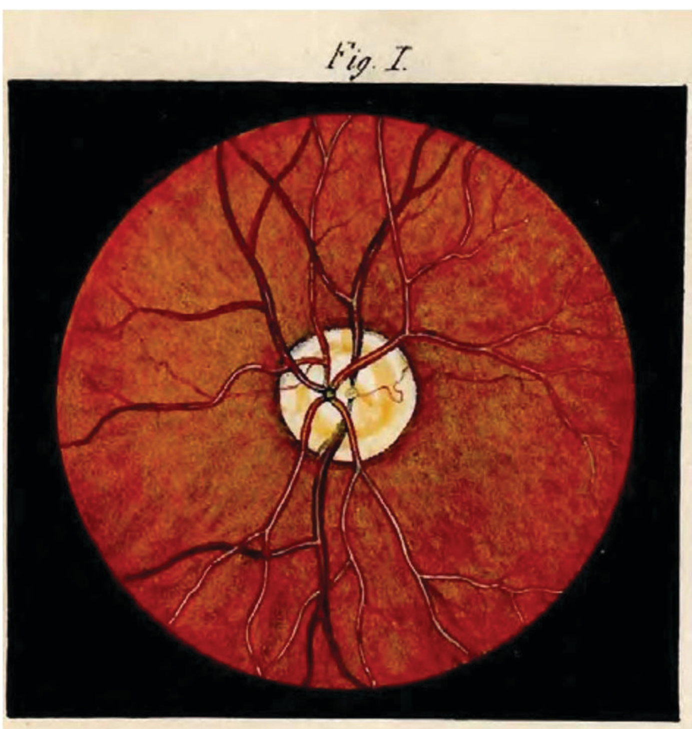


Helmholtz's ophthalmoscope, circa 1850s. Credit: Wellcome Collection. (CC BY)

Helmholtz's direct ophthalmoscope gave an upright view of the fundus with 15 times magnification. In *System of Ophthalmology* (1958), Sir Stewart Duke-Elder explained:

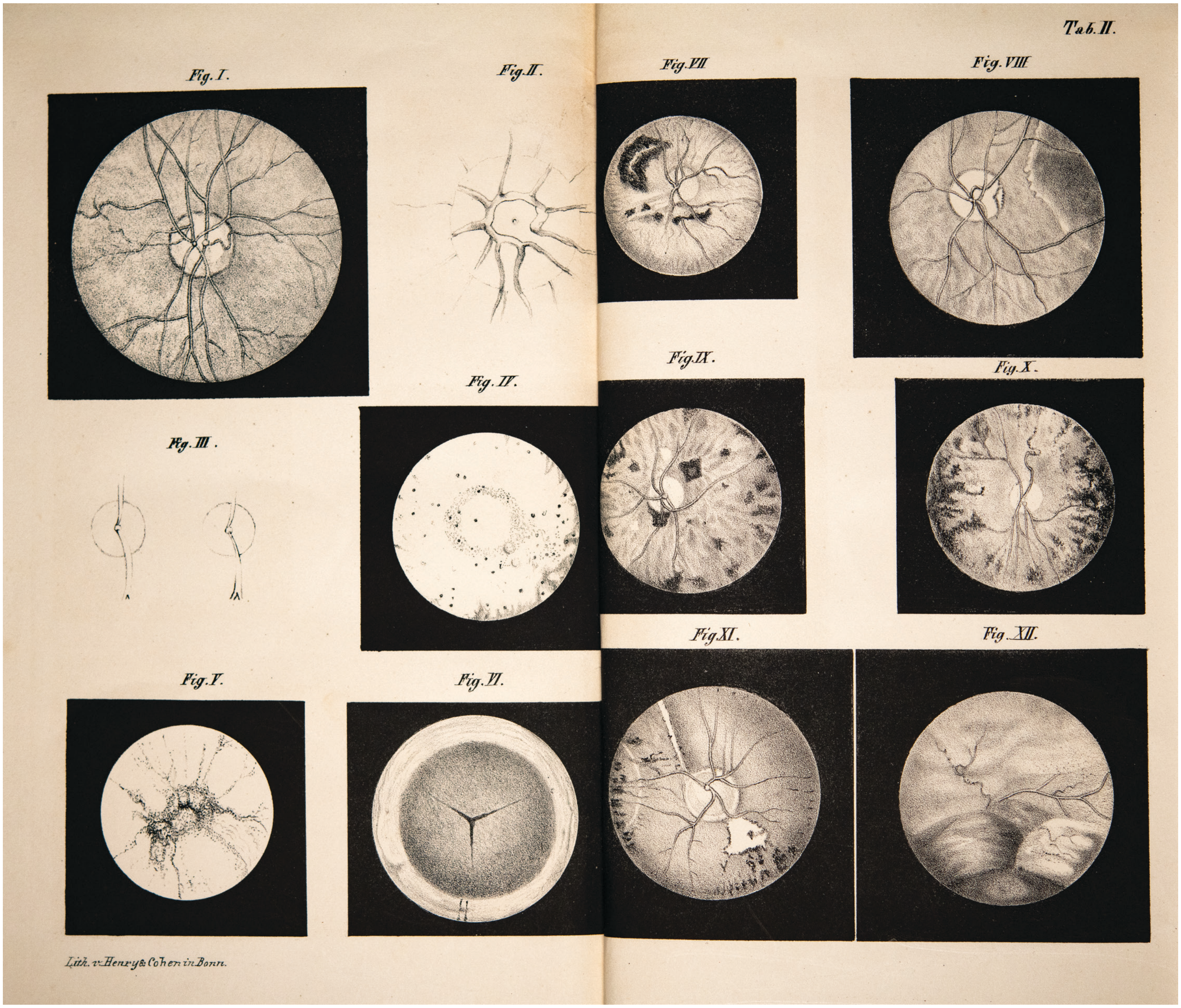
> For this examination with reflections he used four plane parallel, small glass plates. This speculum was semi-transparent. The path of the light rays for illumination and observation course along together across the glass plates. For the greatest intensity of illumination, the light should come in at an angle less than 60 degrees.

A hole was soon added to the ocular piece to allow freer passage of light to the observer.



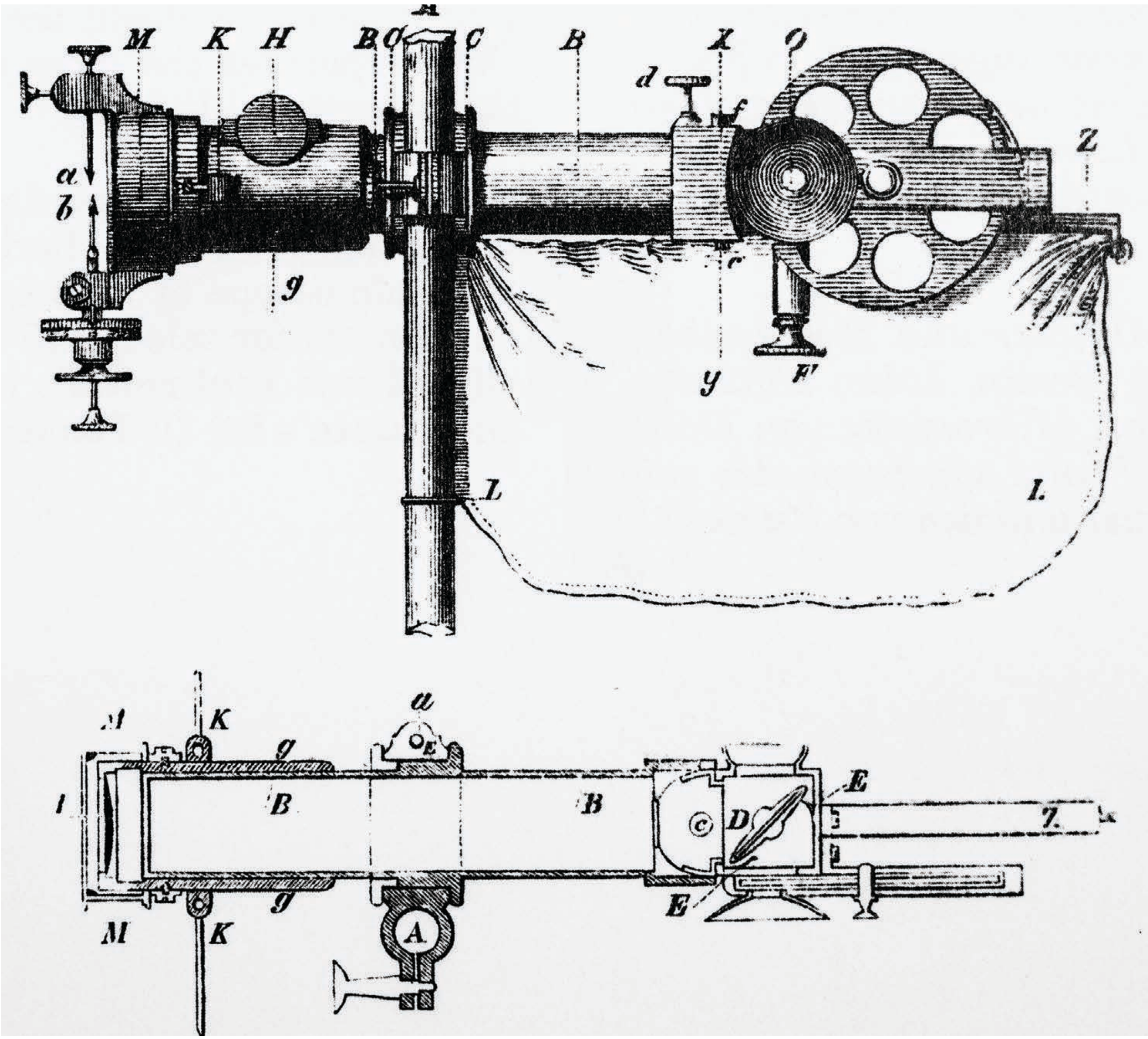
Ocular fundus. From *Dissertatio ophthalmologica inauguralis*, by Van Trigt, Adrien Christoph. 1853. P.W. van de Weijer, 1853. Image in the public domain.

This is the first published color painting of the ocular fundus after the discovery of the ophthalmoscope by H. Helmholtz. It was part of a medical school dissertation written by Adrien Christoph Van Trigt (1825–1864) in the Netherlands in 1853. The red lines are arteries. The blue lines are veins. The reddish orange background is the blood vessel-rich choroid filtered through the retina. The white circular structure is the optic nerve head, where all the retinal nerve fibers come together and pass in to the brain.

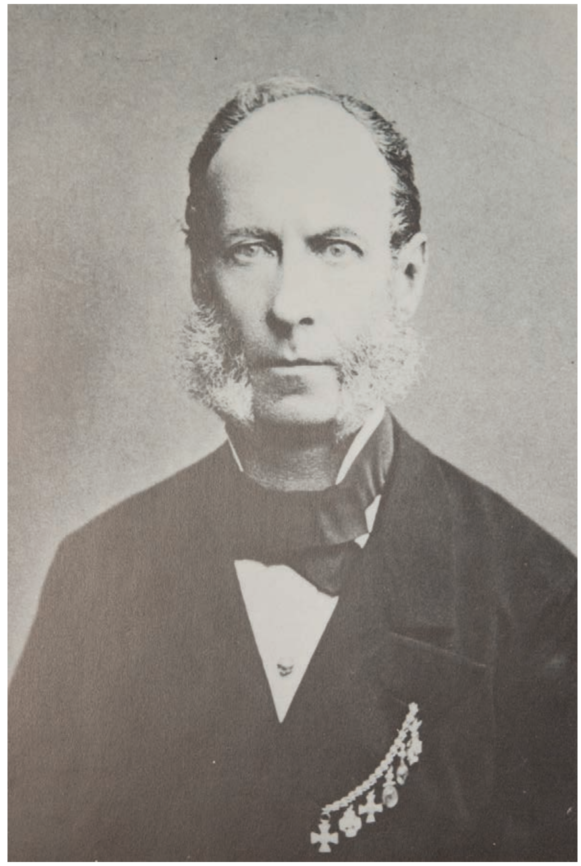


Tab. II. From *Der Augenspiegel: Seine Anwendung Und Modificationen Nebst Beiträgen Zur Diagnostik Innerer Augenkrankheiten*, by Adrien Christoph Van Trigt. Lahr: Geiger, 1854. History of Medicine Collection, Historical Collections & Archives, OHSU Library.

In his preface to *Der Augenspiegel*, Van Trigt writes, “It is not a sanguine hope that the new, more revolutionary advance by the use of the ophthalmoscope will help to reaffirm the high esteem which ophthalmology has long held amongst medical doctors.” (Translated by Donald L. Blanchard, M.D.)



Donders' style of indirect ophthalmoscope used by Van Trigt. From *The Ophthalmoscope: A Contribution to the History of Its Development up to the Beginning of the 20th Century*, by Alfred Schett, trans. Donald L. Blanchard, M.D. v. 2. Oostende, Belgium: J.P. Wayenborgh, 1996. Rare Books Collection, Historical Collections & Archives, OHSU Library.



Portrait of Eduard Jaeger von Jaxtthal. From *Jaeger's Atlas of Diseases of the Ocular Fundus: with New Descriptions, Revisions and Additions*, by Eduard Jaeger von Jaxtthal and Daniel M. Albert. W.B. Saunders, 1972. Casey Eye Institute.

Eduard Jaeger von Jaxtthal was a Viennese ophthalmologist who published multiple and early atlases of the retina. His work was painstakingly done, sometimes requiring 20-40 sittings of 2-3 hours each.

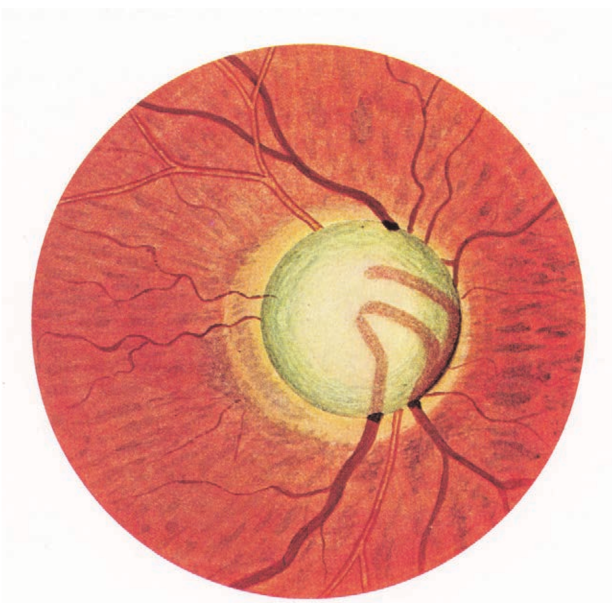


Figure 68.

Early drawing of the glaucoma cup. From *Jaeger's Atlas of Diseases of the Ocular Fundus: with New Descriptions, Revisions and Additions*, by Eduard Jaeger von Jaxtthal and Daniel M. Albert. W.B. Saunders, 1972. Casey Eye Institute.

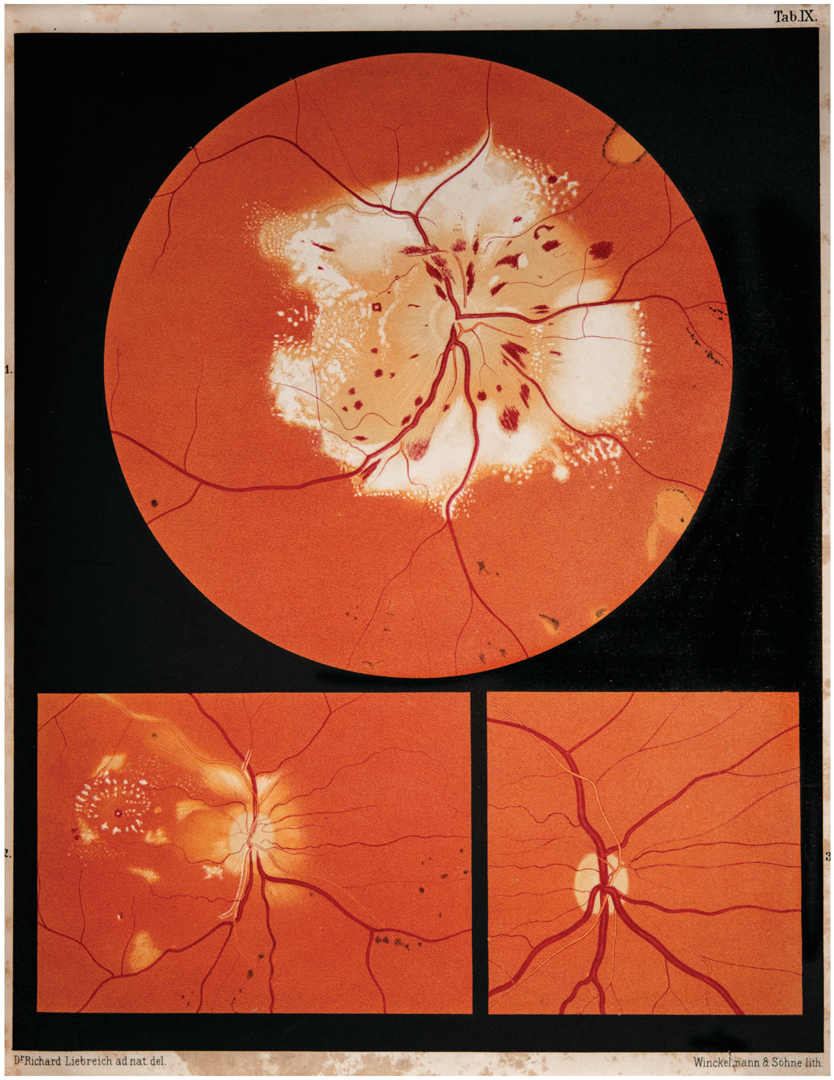
A contemporary review of this revised edition of Jaeger's atlas remarked:

> This reprinting of the plates from Jaeger's 1869 atlas of the fundus oculi is a worthy contribution to the history of ophthalmology and a fine esthetic experience for the viewer. It was certainly a labor of love on the part of Professor Daniel M. Albert (now at Casey Eye Institute). He is the editor who retrieved the original paintings from the archives of the College of Physicians of Philadelphia. The paintings reached that repository as a bequest from Dr. William F. Norris, the senior author of the Norris and Oliver ophthalmology text so familiar to a previous generation of American medical students. Dr. Norris, the first Clinical Professor of Ophthalmology at the University of Pennsylvania, purchased the paintings from the estate of Jaeger after the death of the latter in 1884. The faithfulness of reproduction by Jaeger of normal and pathological detail is truly remarkable. (Albert M. Potts, M.D. *JAMA*. 1972; 221(9): 1056-1057.)

Chorioretinitis. From *Bildliche Darstellung Der Krankheiten Des Menschlichen Auges: Mit Einer Schwarzen Und Sieben Colorirten Kupfertafeln Und Zahlreichen in Den Text Gedrückten Holzschnitten*, by Christian G. T. Ruete. Leipzig: Teubner, 1854 (volume 1 & 2). Courtesy of Bavarian State Library.

Christian Georg Theodor Ruete (1830–1917) was a German academic ophthalmologist who ultimately became Full Professor of Ophthalmology and Director of the Eye Clinic at the University of Leipzig. He modified Helmholtz's original ophthalmoscope and developed an easier-to-use indirect ophthalmoscope, which gave less magnification and a wider field of view; so that the fundus and external eye were both in focus at the same time. This also optically required the ophthalmologist and patient to be separated further than the direct method with its smaller field and greater magnification.

He published his findings in *Bildliche Darstellung Der Krankheiten Des Menschlichen Auges.* This was the first extensive text of retinal diseases, with multiple supplements issued in the 1850s with color illustrations of the fundus. These were mostly forms of chorioretinitis, or inflammation of the retina and choroid, which is a lining of the retina deep in the eye. The causes included infections and retinal detachments, as shown in this illustration. Despite the remarkable advance in understanding and diagnosing retinal diseases with the ophthalmoscope, there were nay-sayers. Ruete responded, "Preposterous men who in idle chatter try to denigrate or to doubt the value of the ophthalmoscope will in my opinion soon be forced to retract in shame; they will lose all credibility, like the opponents of auscultation and percussion." He was proven correct.



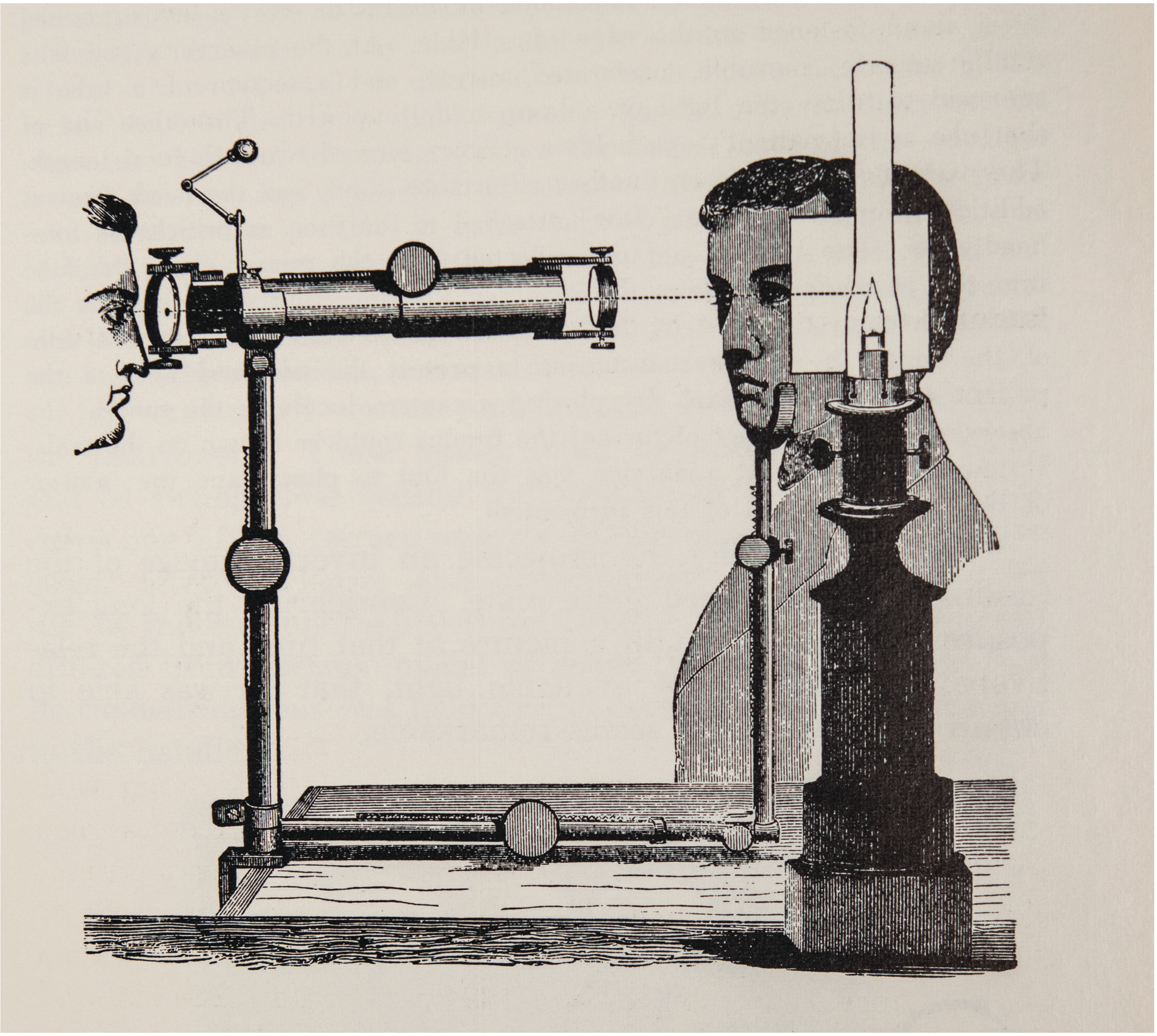
Retinitis albuminurica. From *Atlas der Ophthalmoscopie : Darstellung Des Augengrundes Im Gesunden Und Krankhaften Zustande : Enthaltend 12 Tafeln Mit 57 Figuren in Farbendruck*, by Richard Liebreich. Berlin: Verlag Von August Hirschwald; Germer Baillière, 1863. History of Medicine Collection, Historical Collections & Archives, OHSU Library.

Richard Liebreich (1830–1917) was a German ophthalmologist and physiologist. In 1863 he published his highly acclaimed ophthalmological atlas. In this atlas, Liebreich writes:

> I had the good fortune to be associated with our great physiologist Helmholtz as his assistant, when, in 1851 he invented the Ophthalmoscope in Koenigsberg, and thus I first became acquainted with it through the inventor himself. I soon afterwards in Berlin made the acquaintance of A. von Graefe, who was just then commencing his brilliant career. With him, and on his patients, I made the first practical applications of the new instrument.
>
> The uncertainty with which, step by step, we advanced upon an unknown territory, soon showed the necessity of securing what had been won by means of drawings and seen with the Ophthalmoscope.

Illustrated above here is Liebreich's painting of retinitis albuminurica, due to Bright's Disease, now called glomerulonephritis and associated with renal failure, hypertension, and diabetes.

Compare these large, clear illustrations to Christian Ruete's small inverted pictures of the fundus, 1854 (previous page).



Liebreich's Ophthalmoscope. From *A Practical Treatise on Diseases of the Eye*, by Eduoard Meyer. 1887. Credit: Wellcome Collection. (CC BY)

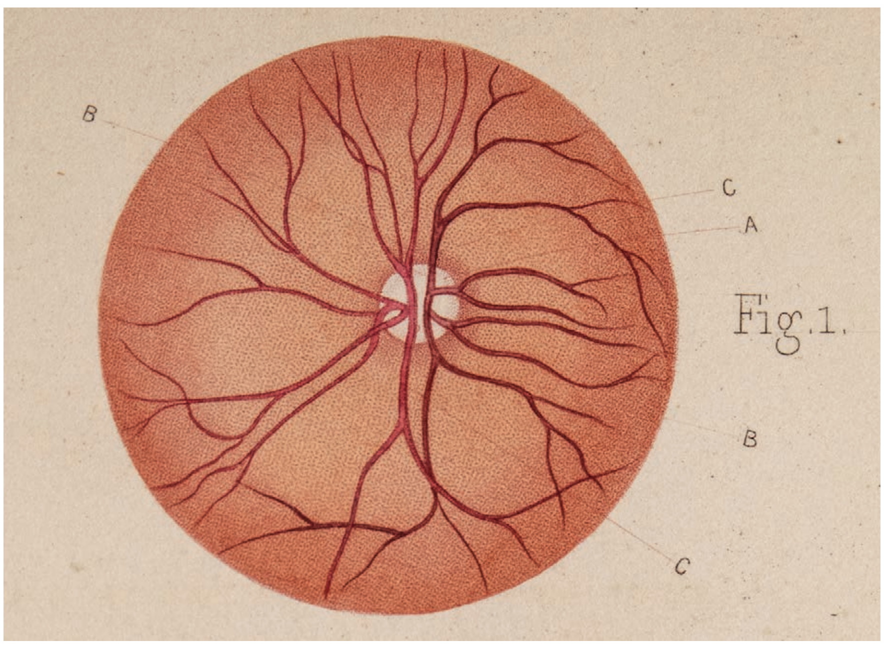
Misinterpretations of Retinal Anatomy in the Illustrations

Ophthalmic surgeon Jabez Hogg (1917-1899), repeating a frequent comment of early retinal artists, commented:

> I have only to observe, that although I have endeavored to make the colored illusions of eye diseases more perfect and correct than in my former edition, yet, from the difficulty in finding a skilled artist, competent to read off appearances which are plain enough to the practiced eye of the surgeon (added to the great expense incurred by printing in colours, which precludes continued corrections), I have not by any means succeeded to the extent I could have desired. (Hogg, J. *A Manual of Ophthalmoscopic Surgery*. London, 1863.)

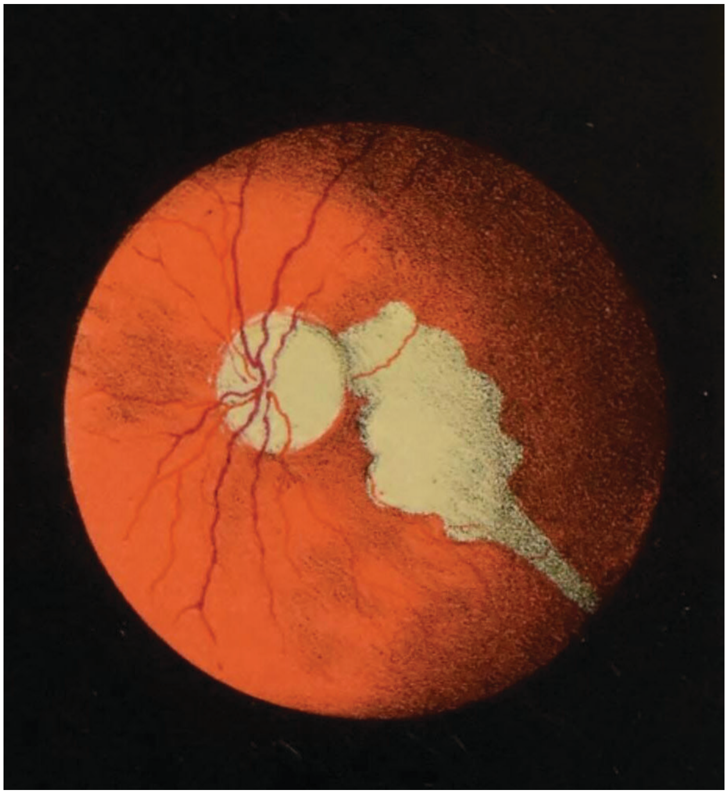
Bizarre blue portions and distorted color choices in the fundus illustrations were surmised to be due to retinal fatigue on the part of the artist after looking at the reddish orange retina so long, in addition to the oil used in lanterns for illumination.

A recurring comment in texts concerned how little was known of retinal conditions before the discovery of the ophthalmoscope and how much was still to be learned. We see drawings of small lithographs in monochrome. Pictures often showed small protruding discs without cups, thread-like sparse retinal vessels, which all come together at one point in the center of the disc, and a choroid with no detail or with non-anatomical structure. A lack of knowledge about the role of genetics and various systemic diseases, as well as what is normal anatomy, hampered the understanding and representation of the diseased retinas these ophthalmologists were reporting about early on.



Normal fundus. From *Traité pratique des maladied des yeux*, by Thomas Wharton Jones. Paris, 1862. Private collection of Donald Blanchard, M.D.

Thomas Wharton Jones (1808-1891) was a prominent British ophthalmologist, who was approached by Charles Babbage with a prototype ophthalmoscope in 1847 prior to Helmholtz's invention in 1851. Jones was highly myopic and could not visualize the fundus with the lenses that Babbage used. Jones was unconvinced of the value of such an ophthalmoscope and both of them dropped the idea. By 1862, the third edition of Jones' manual of ophthalmology was translated into French and a number of illustrations of the retina through an ophthalmoscope were included. Normally, the central retinal artery is nasal to the adjacent central retinal vein and both immediately branch off the disc to the four quadrants of the retina. Jones' illustrations start out with a "normal fundus" bizarrely showing the central retinal artery being to the left and just extending to the left superior and inferior off the disc. The central retinal vein is to the right and basically just extends to the right superior and inferior. This is anatomically impossible.

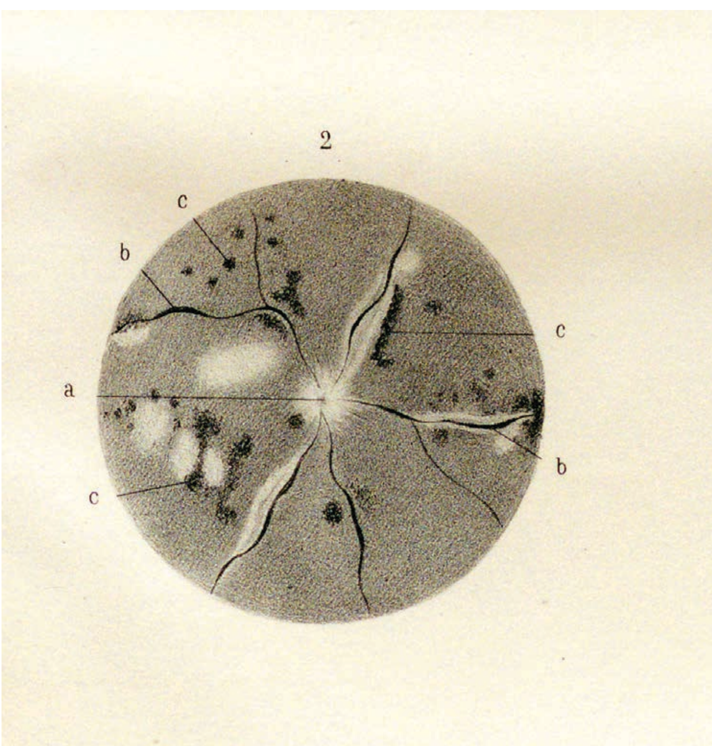


Detachment of the retina. From *A Manual of Ophthalmoscopic Surgery*, by Jabez Hogg. London, 1863. Private collection of Donald L. Blanchard, M.D.

Jabez Hogg published numerous colored lithographs and black and white wood block illustrations of the retinal fundus beginning in 1857. He publicly apologized for their quality, adding, "The uncoloured wood cuts very imperfectly represent the appearance of the fundus."

The picture here is of an injury inflicted by the firing of a blank cartridge. He labeled the illustration, "Detachment of the retina, extending to the optic nerve."

A reviewer commented about Hogg's works, "The conditions in these miniatures call for some imagination if they are to be interpreted in the light of our present-day knowledge."



Apoplexy of the retina. From *Thèse pour le Doctorat en Medecine*, by Louis De La Calle. Paris, 1856. Private collection of Donald L. Blanchard, M.D.

Louis De La Calle was a French ophthalmologist who for his M.D. thesis of 1856 chose the new topic of ophthalmoscopes. He studied under Louis-Auguste Desmarres in Paris. A reviewer commented that the pictures "do not throw any light on pathological conditions." The picture here is labelled apoplexy of the retina. A) is the blurred disc, B) is varicose bulges to veins, and C) is blood effusions being resorbed.

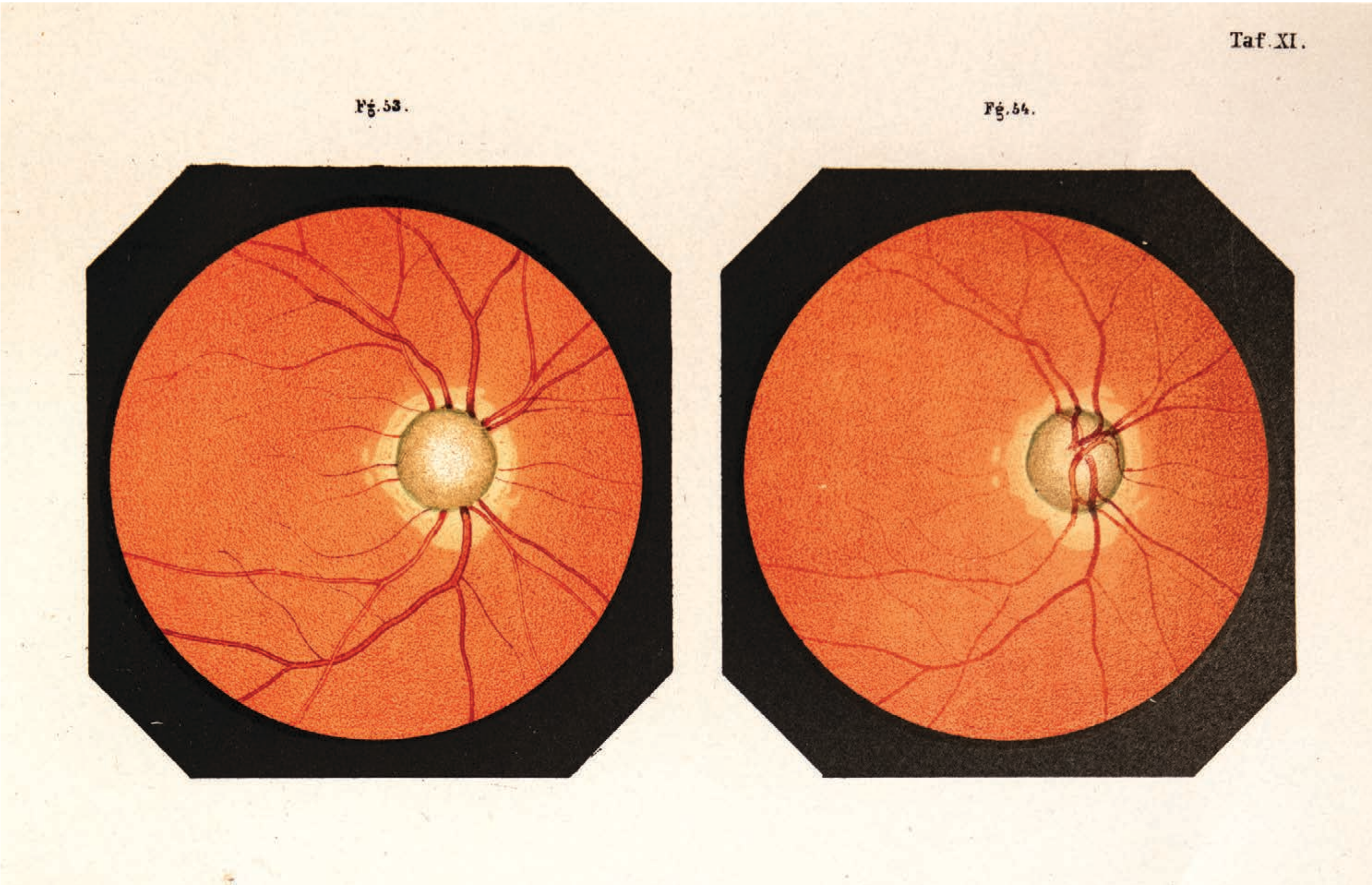
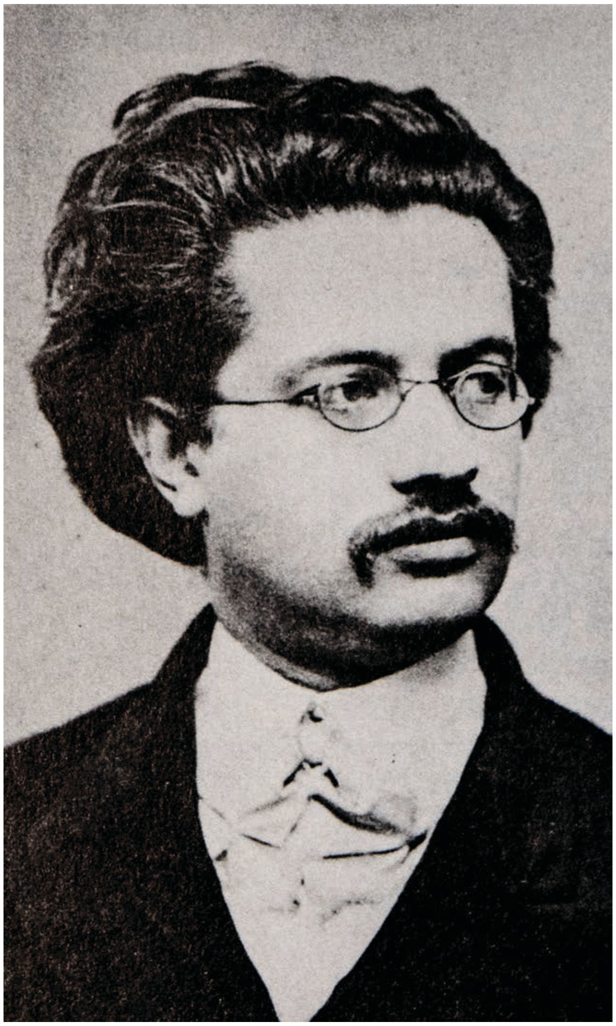


Plate IX. From *Ophthalmoskopischer Hand-Atlas*, by Eduard Jaeger von Jaxtthal and Maximilian Salzmann. Leipzig: Deuticke, 1894. History of Medicine Collection, Historical Collections & Archives, OHSU Library.

The text of this book is in German and this has sometimes led to the misinterpretation of figure 53 and 54 being deceptively identified as showing reversible cupping after Jaeger did an iridectomy surgery for acute glaucoma. Actually, the two paintings were done in the same time frame. The difference in appearance of the optic nerve is due to focusing on the base of the cup in figure 54, and focusing on the retinal layer and its vessels in figure 53.



Portrait of Ludwig Mauthner. From *The Ophthalmoscope: A Contribution to the History of Its Development up to the Beginning of the 20th Century*, by Alfred Schett, trans. Donald L. Blanchard, M.D. v. 2. Oostende, Belgium: J.P. Wayenborgh, 1996. Rare Books Collection, Historical Collections & Archives, OHSU Library.

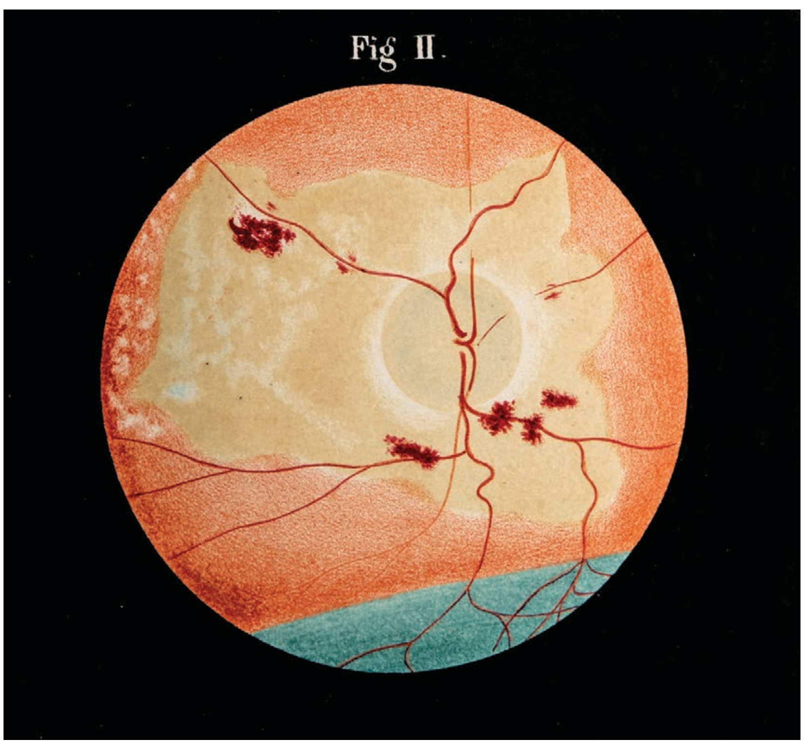
Ludwig Mauthner (1840–1894) is generally given credit for the first report of Choroideremia, a rare inherited disorder that causes progressive vision loss, in 1871. However, his report lacked an illustration, and included a family history that does not match today's understanding of its inheritance pattern.

Case report:

> To the relevant questions the 32-year-old patient gave the following information. "For as long as I remember, I know I have always had poor vision. Though I see the objects located in the direction straight in front of me, I see nothing beside that, that is to the right or left, above or below. I have always seen better during the day than at night. Anytime it is full dusk, I see actually as good as nothing. I have also remarked that I see better in Summer than Winter. Since I recovered from Typhus 15 years ago my eyesight has become decidedly worse. I have seven brothers and sisters, of whom one brother, who is 26 years old, has the same sort of poor vision, as I myself present with. My parents see very well, although a brother of my father also sees poorly, and my grandmother on my father's side became completely blind in her 70s".
>
> His eyes were myopic with decreased central and severely restricted peripheral vision. How great was my [Mauthner's] astonishment when with my ophthalmoscope I saw nothing of the usual yellow red, but rather only a bright whitish green reflex with pigment clumping. Somewhat like a coloboma. This has to do with the defect in the choroid in both eyes.
> (Translation by Dr. Donald L. Blanchard)

Choroideremia. From *Textbook of the Fundus of the Eye*, by Arthur J. Ballantyne and Isaac C. Michaelson. Baltimore, MD: Williams & Wilkins, 1970. Casey Eye Institute.

Modern understanding is that Choroideremia is an X-linked recessive rod–cone, choroidal dystrophy, meaning only females can pass the dystrophy to their sons and females can carry the gene but do not manifest the symptoms. Males cannot pass the gene to their sons, but can pass the gene to their daughters. This does not fit the inheritance pattern of Mauthner's supposed index case report. Genetic studies and therapies are actively being worked on at Casey Eye Institute for true Choroideremia.



Bright's Disease. From *The Ophthalmoscope, translated Robert Brudenell Carter*, by Adolf Zander. London: Robert Hardwicke, 1864. Private collection of Donald L. Blanchard, M.D.

Adolf Zander was a German ophthalmologist who published an early work on the ophthalmoscope in 1862. It was enlarged and translated by Robert Brudenell Carter in 1864. Its illustrations were described as "decidedly quaint lithographs." This illustration is of a patient with Bright's Disease, now called glomerulonephritis and associated with renal failure, hypertension, and diabetes. Retinal vessels here are sparse and contrary to normal anatomy, branches of the same vessel cross each other. The disc is pale with a faint blue background coloration. The macula, which is the central portion of the retina that is responsible for central vision, is edematous with hemorrhages and exudates, meaning it is swollen with fluids and cells leaked out of blood vessels into nearby tissues. A bluish color is visible in the pattern of exudates. The lower part of the retina is detached with a smooth blue contour.

Early Era of Kenneth C. Swan, M.D. and John E. Weeks, M.D. at the University of Oregon Medical School

Portrait of Kenneth C. Swan, M.D., no date. Historical Image Collection, Historical Collections & Archives, OHSU Library.

Kenneth Carl Swan, the "father" of ophthalmology in Oregon, was born in 1912 in Kansas City, Missouri. He received his M.D. from the University of Oregon Medical School (UOMS) in 1936 and completed his postgraduate education at the University of Wisconsin and the University of Iowa.

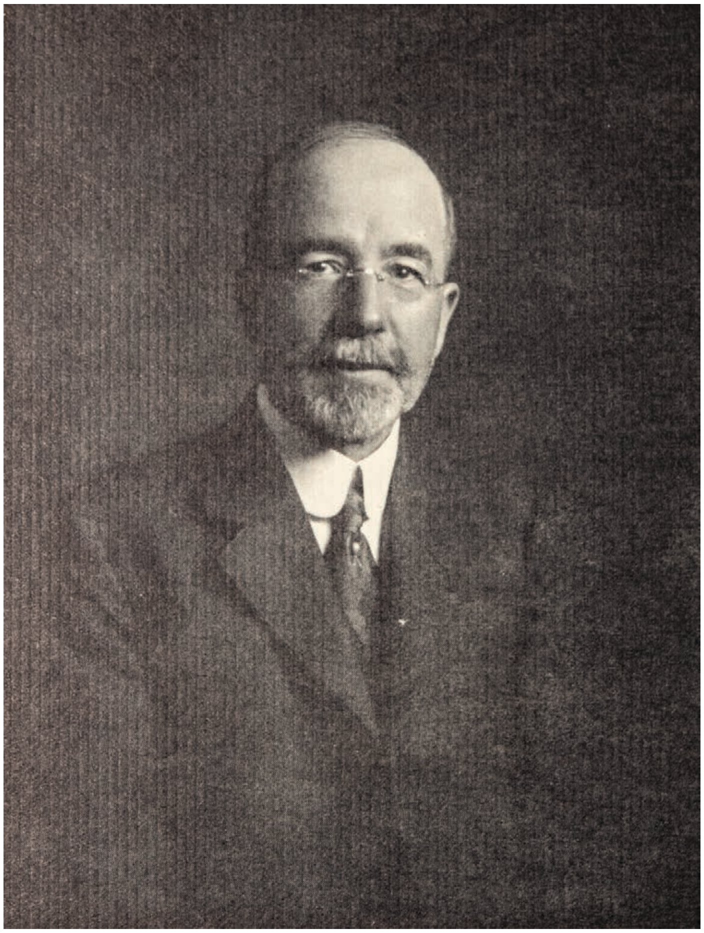
Dr. Swan returned to Portland in 1945 to join the faculty at UOMS (now OHSU), where he founded the first full-time department of ophthalmology in the Pacific Northwest and became the school's first full-time clinical professor. He chaired the department until his retirement in 1978. Swan also began the first three–year residency program in ophthalmology in the Pacific Northwest.

During the 1930s and 1940s, he conducted research that led to the creation of new drugs, for which he became internationally known, including the artificial tear, methylcellulose. His accomplishments included a partnership with Dr. Leonard Christensen that led to the development of the world's first microscope for ocular surgery; his role in the development of new therapies for childhood glaucoma; binocular vision disorders and traumatic eye wounds; and the Swan-White compound, whose derivatives are still used in eye examinations today.

Dr. Swan also proved to be a very successful fundraiser. In 1949, with generous support from the Oregon State Elks, he was able to establish the first children's eye clinic in an academic setting in the United States. During the 1980s, Swan partnered with then-chair of the Department of Ophthalmology, Fredrick Fraunfelder, M.D., to raise OHSU's first significant capital campaign, a $31 million effort to construct the Casey Eye Institute, which brought ophthalmic education, research and treatment into one center.

Dr. Swan was a teacher and mentor to more than 100 ophthalmologists, six of whom went on to chair departments at US medical schools. His numerous honors included the American Ophthalmological Society's prestigious award, the Howe Medal for distinguished service.

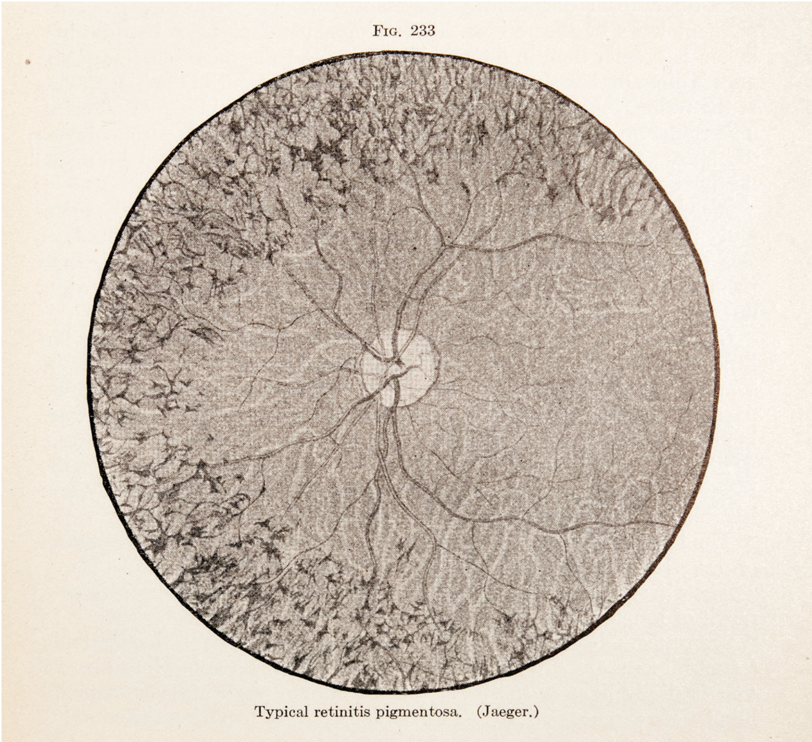
Adapted from the 2007 exhibit, Artifacts in the Kenneth C. Swan Papers.



Portrait of John E. Weeks. From *An Autobiography*, by John Elmer Weeks and Jennie Post Weeks. Portland, OR: Metropolitan Print Co., 1954. Casey Eye Institute.

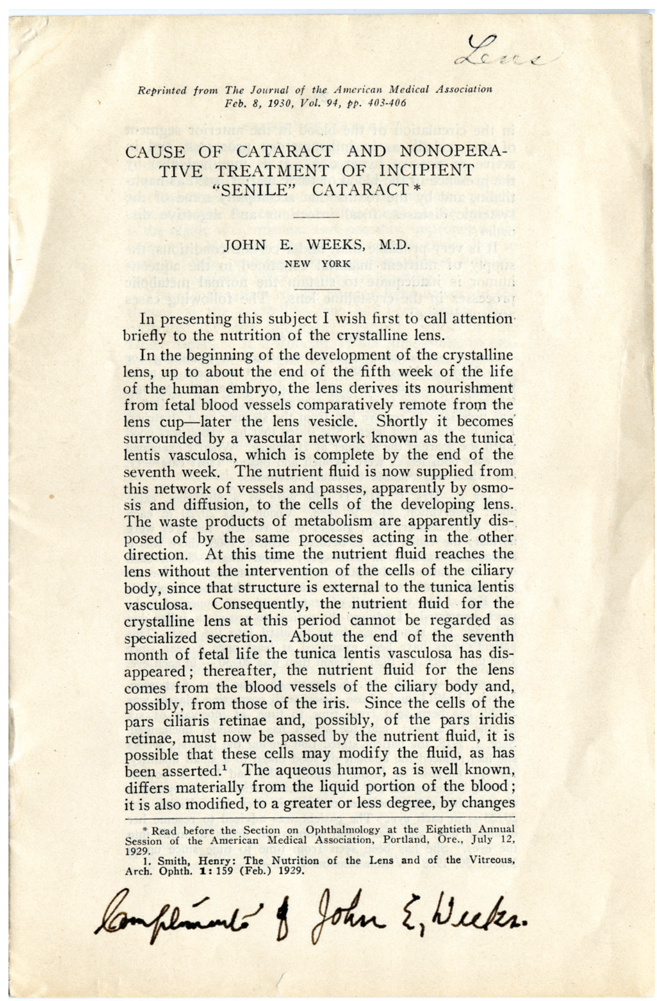
Dr. John E. Weeks, in UOMS Library next to his plaque for his contributions to the library and original eye clinic, circa 1940. Historical Image Collection, Historical Collections & Archives, OHSU Library.

The original UOMS ophthalmology department was on the 10th floor of the University Hospital (constructed in 1955), which included an inpatient unit and outpatient clinics. It extended onto the overpass, which connected to the then-active Multnomah County Hospital. It was named after Dr. John E. Weeks, a semi-retired ophthalmologist who had a long and distinguished career in New York as well. He was a good friend and important advisor to Dr. Swan in those early days of ophthalmology in Oregon.



Retinitis pigmentosa. From *A Treatise on Diseases of the Eye*, by John E. Weeks. Lea & Febiger, 1910. OHSU Library.

This illustration depicts retinitis pigmentosa, which is a group of eye problems that affect the retina. This condition changes how the retina responds to light, causing loss of vision. Note that the fundus illustration is a copy from Jaeger, produced fifty years earlier.



Lens

Reprinted from The Journal of the American Medical Association
Feb. 8, 1930, Vol. 94, pp. 403-406

CAUSE OF CATARACT AND NONOPERATIVE TREATMENT OF INCIPIENT "SENILE" CATARACT *

JOHN E. WEEKS, M.D.
NEW YORK

In presenting this subject I wish first to call attention briefly to the nutrition of the crystalline lens.

In the beginning of the development of the crystalline lens, up to about the end of the fifth week of the life of the human embryo, the lens derives its nourishment from fetal blood vessels comparatively remote from the lens cup—later the lens vesicle. Shortly it becomes surrounded by a vascular network known as the tunica lentis vasculosa, which is complete by the end of the seventh week. The nutrient fluid is now supplied from this network of vessels and passes, apparently by osmosis and diffusion, to the cells of the developing lens. The waste products of metabolism are apparently disposed of by the same processes acting in the other direction. At this time the nutrient fluid reaches the lens without the intervention of the cells of the ciliary body, since that structure is external to the tunica lentis vasculosa. Consequently, the nutrient fluid for the crystalline lens at this period cannot be regarded as specialized secretion. About the end of the seventh month of fetal life the tunica lentis vasculosa has disappeared; thereafter, the nutrient fluid for the lens comes from the blood vessels of the ciliary body and, possibly, from those of the iris. Since the cells of the pars ciliaris retinae and, possibly, of the pars iridis retinae, must now be passed by the nutrient fluid, it is possible that these cells may modify the fluid, as has been asserted.[1] The aqueous humor, as is well known, differs materially from the liquid portion of the blood; it is also modified, to a greater or less degree, by changes

* Read before the Section on Ophthalmology at the Eightieth Annual Session of the American Medical Association, Portland, Ore., July 12, 1929.

1. Smith, Henry: The Nutrition of the Lens and of the Vitreous, Arch. Ophth. **1**: 159 (Feb.) 1929.

Compliments of John E. Weeks.

Reprint signed by John E. Weeks, M.D. "Cause of Cataract and Nonoperative Treatment of Incipient 'Senile' Cataract," *Journal of the American Medical Association*, vol. 94 (Feb. 8, 1930). Private collection of Donald L. Blanchard, M.D.

Dr. Weeks used boric acid and glycerin eye drops to slow the advancement of cataracts. He felt the redness and inflammation of the conjunctiva after installation of these drops indicated an increased blood supply to the cataractous lens with reduction of subsequent loss of vision. This treatment is no longer recommended. He warned of seeking out quacks who would use ineffective treatments.

"Progressive changes produced in rabbit lenses by experimental calcium deficiency," produced for Kenneth C. Swan, M.D., circa 1940s. Private collection of Donald L. Blanchard, M.D.

This poster originates from a research project of Dr. Swan's from the early 1940s with red fundus reflection highlighting cataract formation in rabbit eyes from experiments with calcium imbalance.

Dr. Swan was a Pacific Northwest pioneer in the treatment of retinoblastoma with focal and orbital radiation, or unfortunately—in hopelessly far-advanced situations—with enucleation. This was especially difficult when the tumor was advanced and bilateral. He showed masterful compassion when he said:

> Final responsibility for the decision to proceed with treatment must be assumed by the parents; however, the decision to have the eye of a precious baby removed is difficult for parents to make alone. Without assuming undue responsibility, the ophthalmologist and his consultants can often give sympathetic guidance to enable the family to meet their problem rationally.

This illustration, done by the UOMS art department in 1951, is of the calcified remnant of a retinoblastoma five years after completion of focal radiation therapy. The patient retained "nearly normal visual acuity."

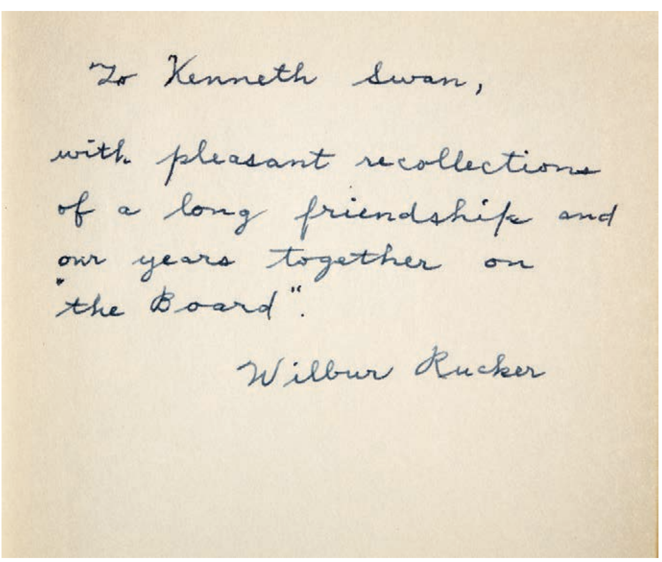
Retinoblastoma, created by UOMS art department, produced for Kenneth C. Swan, M.D., "Experiences with Tumors of the Retina," ***Archives of Ophthalmology*****, vol. 47 issue 4 (1951). Kenneth C. Swan papers [2007-011]. Historical Collections & Archives, OHSU Library.**

Horner, J. F. *Chronic tuberculosis of the choroid with closely aggregated tubercle-nodules (conglobate tubercles).* From *Atlas Manuel D'ophthalmoscopie*, by Otto Haab. Baillière, 1896. Casey Eye Institute.

This text in its various editions was a special favorite in the late 1800s and early 1900s. Dr. Swan and Dr. Weeks donated two copies each to the libraries at the medical school.

From Haab's introduction:

> Examination of the eye-ground by means of the ophthalmoscope is of the highest importance for the recognition not only of many affections of the eye itself, but also of a great number of diseases chiefly affecting organs outside of the eye, as the brain, the kidneys, or the circulatory system, and endangering life either by disturbing the general nutrition or by setting up a general infection. The wide lymph-spaces of the eye and the rich network of vessels in the retina offer a favorable soil for the development of many pathogenic germs and toxic substances present in the body. This is especially noteworthy in syphilis, both in the hereditary and in the acquired variety, although the effects of tubercular and rheumatic infection of the organism also not infrequently manifest themselves in the eye.
>
> For these reasons ophthalmoscopic examination of the eye-ground is one of the most important methods of medical examination.



Inscription to Dr. Swan from C. Wilbur Rucker. In *A History of the Ophthalmoscope*, by C. Wilbur Rucker. Rochester, MN: Whiting Printers & Stationers, 1971. Private collection of Donald L. Blanchard, M.D.

Dr. Swan, more than most, had a strong sense of the value of knowing the history of developments in disease therapy and understanding as well the pathway to better technology. This was sometimes difficult for ophthalmology residents to appreciate, when what they preferred to learn was what was then the most improved clinical management of abnormal ocular conditions.

Dr. Rucker inscribed his book to Dr. Swan. This was especially meaningful to Dr. Swan with that background in how best to teach and learn, and he had this copy near his bedside in his final days.

Dr. Swan photographing the fundus with a Bausch & Lomb ophthalmoscope, circa 1940s. Historical Image Collection, Historical Collections & Archives, OHSU Library.

This Bausch and Lomb binocular indirect mounted ophthalmoscope was an early acquisition of the eye clinic in the 1940s and used by years of ophthalmic residents. It gave an excellent magnified and three-dimensional view of the fundus. However, it was bulky and hard to focus and was affectionately termed "The Bazooka" by the residents.

With some modification it could be used as a fundus camera for photos of the optic nerve head disc and central macula and also even for cinematography of the pulsations of the vessels in the posterior retina. Some of the resultant films, edited by Dr. Blanchard, are stored in OHSU's historical collections as part of the Kenneth C. Swan papers (coll. no. 2007-011).

In an interview conducted on August 18, 1997 for the OHSU Oral History Program, Dr. Swan outlined his vision and mission statement for the University of Oregon Medical School Department of Ophthalmology:

> The missions of the Medical School were basically what they are today: research, teaching, patient care, and community service. For us in Ophthalmology, we had some specific goals—I should mention education. So, our goals in the Department were to meet those objectives, but to develop the resources. Planning is no good without the resources. And the resources, I think, are the **four F's**: developing a **faculty**, developing **facilities**, developing **financing**, and then developing the support of patients and the community; and in the process, serving those latter two groups. So that in determining the specific objectives, we had to review what the needs of the territory were and what we could see in the **future** development.

Read the full oral history interview online

Ophthalmoscopes from the History of Medicine

Liebreich pocket model ophthalmoscope. Artifact Collection, Historical Collections & Archives, OHSU Library. 77-206.69.8.

Richard Liebreich was born in Königsberg, previously the capital city of the province of East Prussia, in 1830. He studied there and later in Berlin. In Halle, he received his doctorate in 1853. He was a preparator for Helmholtz in 1851. Helmholtz had shown Liebreich his ophthalmoscope design.

In Graefe's clinic, Liebreich was soon entrusted with taking over the ophthalmoscopic practice in order to free up the master. The stand instrument of Ruete proved too cumbersome for daily use. The reduction of Ruete's model to a hand-held ophthalmoscope suggested itself. Liebreich sketched the model preferred by him in his treatise about ophthalmoscopy in 1857. In 1861, Hulke described the small and large instrument of Liebreich along with a construction drawing. The origin of this ophthalmoscope, which was in continuous use for fifty years, can be dated from around 1860.

The case commonly includes, in addition to the mirror, five corrective lenses in the lid compartment and two inverting lenses of 13 and 18 diopters in the bottom compartment. In the beginning of the 1870s, the metal mirror was replaced by glass. The center was free of coating.

Adapted from The Ophthalmoscope: A Contribution to the History of Its Development up to the Beginning of the 20th Century, by Alfred Schett, trans. Donald L. Blanchard, M.D. v. 2. Oostende, Belgium: J.P. Wayenborgh, 1996.

Loring ophthalmoscope. Artifact Collection, Historical Collections & Archives, OHSU Library. 77-206.22.1.

Edward G. Loring was born in Boston in 1837. He began his medical studies in Florence and Pisa and continued them at Harvard Medical School after returning to Boston. The work of Helmholtz, Donders, and Graefe interested him in ophthalmology.

Loring was active in his literary output, which he crowned with his textbook on ophthalmology in 1886. The first ophthalmoscope suitable for refraction was developed by him in 1869. His last model appeared in 1878 after a number of improvements.

The instrument has three so-called Rekoss discs, which could be put in alternatively. There are eight lenses in each disc: concave in one, convex in the other, and stronger lenses of both in the third disc. Loring chose the disc suitable for each patient. The concave mirror has a focal distance of 7 inches. The instrument was primarily for the determination of the refraction and for examination in the upright image. It could be used for the indirect method of examination with the help of an inverting lens of 2 ½ inches focal distance.

Adapted from The Ophthalmoscope: A Contribution to the History of Its Development up to the Beginning of the 20th Century, by Alfred Schett, trans. Donald L. Blanchard, M.D. v. 2. Oostende, Belgium: J.P. Wayenborgh, 1996.

Morton style ophthalmoscope. Artifact Collection, Historical Collections & Archives, OHSU Library. XXXX.040.

Andrew Stanford Morton (1848–1927) was born in 1848 and became a Bachelor of Medicine (M.B.) in Edinburgh in 1874. He received the Fellowship of the Royal College of Surgeons (F.R.C.S.), England in 1888. His small text, *The Refraction of the Eye*, appeared in 1881 and went through a number of editions.

Morton presented his model to the Ophthalmological Society of the United Kingdom in January 1885. He adopted the lens arrangement of John Coupler, who had published a report about his model in 1883. Twenty-nine lenses are mounted in a close chain. These rotate by means of a gear wheel. There are 12 convex lenses (red) and 17 concave lenses (white) as well as a combination disc which has an empty opening and the lenses plus 0.5 and 20 and minus 10 and 30 diopters.

Most of Morton's models were equipped with a large weak concave mirror and a large plan mirror (back to back) and a small angled concave mirror of short focal distance. In addition, there was an unframed inverting lens of 4.5 cm in diameter.

Adapted from The Ophthalmoscope: A Contribution to the History of Its Development up to the Beginning of the 20th Century, by Alfred Schett, trans. Donald L. Blanchard, M.D. v. 2. Oostende, Belgium: J.P. Wayenborgh, 1996.

John E. Weeks' electric ophthalmoscope. Private collection of Donald L. Blanchard, M.D.

This electric model was one of the first of its kind to be used, negating the need for lanterns or candles for illumination. The introduction of truer colors in the various atlases was an immediate benefit of this advancement in technology.

In his *Treatise on the Diseases of the Eye*, Dr. Weeks described it as a "Luminous Ophthalmoscope," continuing:

> In this instrument a small electric light, placed in the axis of the handle of the instrument, supplies the illumination. It may be used for all methods of ophthalmoscopy. It is very useful at the bedside, in examining the eyes of infants, and for cases in which intense illumination is required, as in neoplasms, opacities of vitreous, etc.

Keeler ophthalmoscope. Private collection of Donald L. Blanchard, M.D.

This British-made ophthalmoscope from the 1960s was the brightest battery-operated model available at the time. With its bright light and green filter, it was particularly good for viewing the superficial retina when looking for the nerve fiber layer or Gunn's Dots, which are tiny white dots sometimes visible overlying the large vessels near the optic nerve or the nerve fiber layers.

Retinal Paintings from the University of Oregon Medical School Art Department

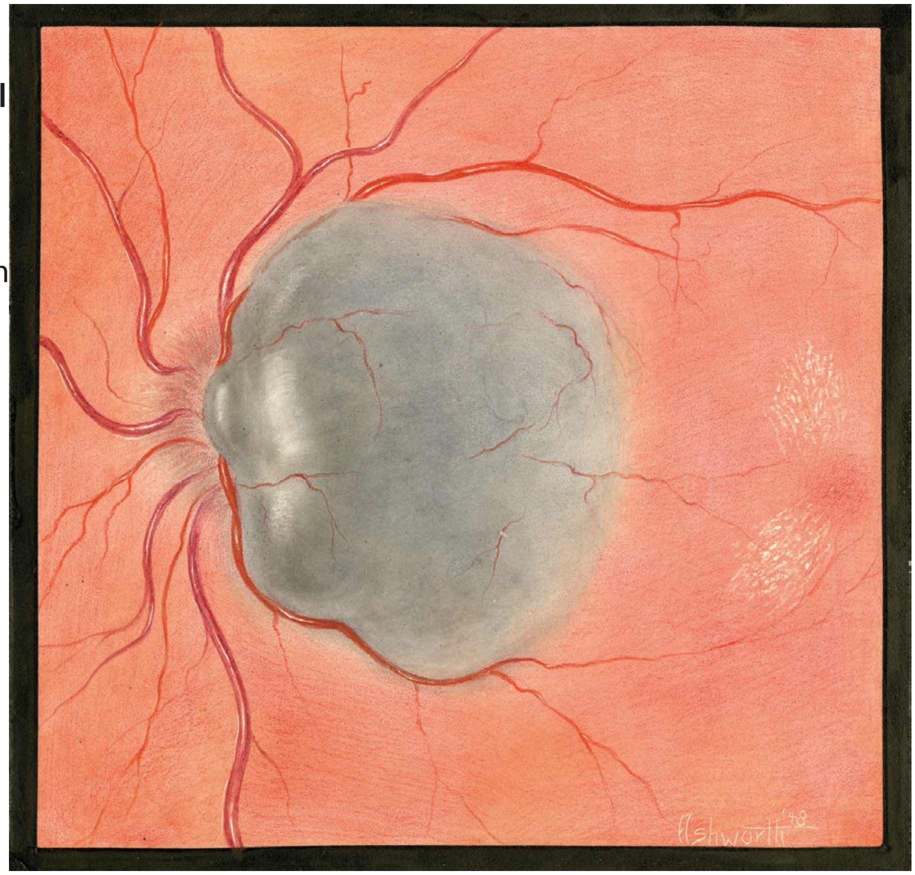
Francone, Clarice Ashworth. *Choroidal detachment*, no date. Kenneth C. Swan papers [2007-011], Historical Collections & Archives, OHSU Library.

From early in Dr. Swan's career in Oregon, he would have patients with unusual or difficult retinal conditions. When he wanted a permanent record of the patient's status on a given visit, he would have an artist come over to his office, and he would point out to the artist what the problem was and the artist would paint it. This would take hours.

This illustration is a choroidal detachment. The choroid is the layer of the eye behind the retina. In the earlier days of cataract surgery at the medical school, an incision of 160 degrees was made and the entire lens with its cataract was lifted out. Then, the wound was closed with very large silk sutures. The wound frequently leaked and due to negative pressure, the choroid detached with fluid and blood. This is very rare now with self-sealing microscopic incisions.

Francone, Clarice Ashworth. *Malignant melanoma*, 1948. Kenneth C. Swan papers [2007-011], Historical Collections & Archives, OHSU Library.

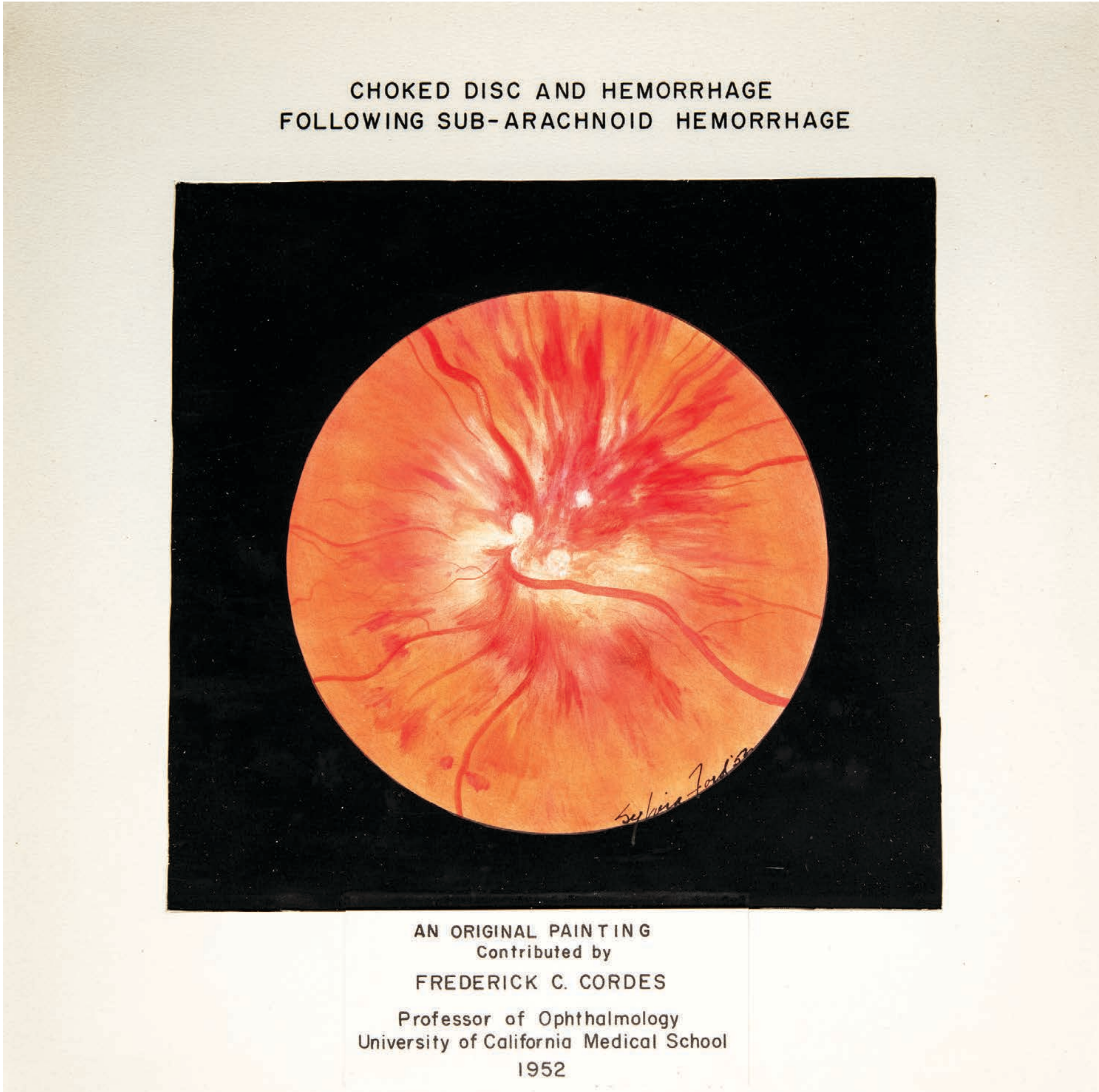
When this painting was done, the treatment was immediate enucleation of the eye. Many other means of treatment are now available for this form of cancer.



Allen, Lee. *Hemorrhagic macular degeneration*, 1940. Private collection of Donald L. Blanchard, M.D.

This painting is by Lee Allen, who was a very respected ophthalmic artist who worked closely with Dr. Swan in the 1940s before he came back to Oregon. This condition was then untreatable and rapidly progressed to severe loss of central vision.

At Casey Eye Institute, the Macula/Retinal Department currently has a number of treatment options, including surgery, laser, medical means, intra-ocular injections, and even gene therapy.



Ford, Sylvia. *Choked disc and hemorrhage following sub-arachnoid hemorrhage*, 1952. Private collection of Donald L. Blanchard, M.D.

Dr. Cordes gave this painting to Dr. Swan in the 1950s. It shows the extensive bleeding in the eye and swelling that can occur after brain trauma or spontaneous rupture of an aneurysm. This often left a permanent defect in vision and even death, but now at OHSU embolism treatment to close off the bleeding or clipping the neck of the aneurysm are performed.

Painting of a Normal Fundus

Tilden, David. *Painting of a Normal Fundus*, 1983. Private collection of Dr. and Mrs. Donald L. Blanchard.

This is one of the last ocular fundus illustrations done as artwork at the Massachusetts Eye and Ear Infirmary.

The pinkish-yellow oval structure is the optic disc, where all the retinal nerve fibers come together on the way to the brain. The central retinal vein comes off temporally (to the left) of the central retinal artery. The arteries are thinner and brighter. The veins are wider and darker. Further temporally the macula (center for clearest vision) is the area with no blood vessels but multiple blood vessels converging on it. The mottled area in the background is the choroid. It gives some oxygen and nutrients to the retina and absorbs scattered light.

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Jaeger von Jaxtthal, Eduard. Watercolor painting of amaurosis arthritica (glaucomatosa), circa 1850s. Courtesy of the College of Physicians of Philadelphia.

Portrait of Hermann von Helmholtz, no date. Credit: Wellcome Collection. (CC BY)

Helmholtz's ophthalmoscope, circa 1850s. Credit: Wellcome Collection. (CC BY)

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Chorioretinitis. From *Bildliche Darstellung Der Krankheiten Des Menschlichen Auges: Mit Einer Schwarzen Und Sieben Colorirten Kupfertafeln Und Zahlreichen in Den Text Gedrückten Holzschnitten*, by Christian G. T. Ruete. Leipzig: Teubner, 1854 (volume 1 & 2). Courtesy of Bavarian State Library.

Liebreich's Ophthalmoscope. From *A Practical Treatise on Diseases of the Eye*, by Eduoard Meyer. 1887. Credit: Wellcome Collection. (CC BY)

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Schett, Alfred. *The Ophthalmoscope: A Contribution to the History of Its Development up to the Beginning of the 20th Century*, trans. Donald Blanchard, M.D. v. 2. Oostende, Belgium: J.P. Wayenborgh, 1996. All images reproduced with permission from the author/copyright holder, Donald L. Blanchard, M.D.

About This Catalog

This catalog was produced in conjunction with an OHSU Library exhibit in Fall 2019.

All selections, text, and interpretation by Donald L. Blanchard, M.D.

Appreciation is expressed to Dr. Daniel Albert; his extensive knowledge of the history of ophthalmology was very helpful, especial in the Jaeger portions of the exhibit.

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