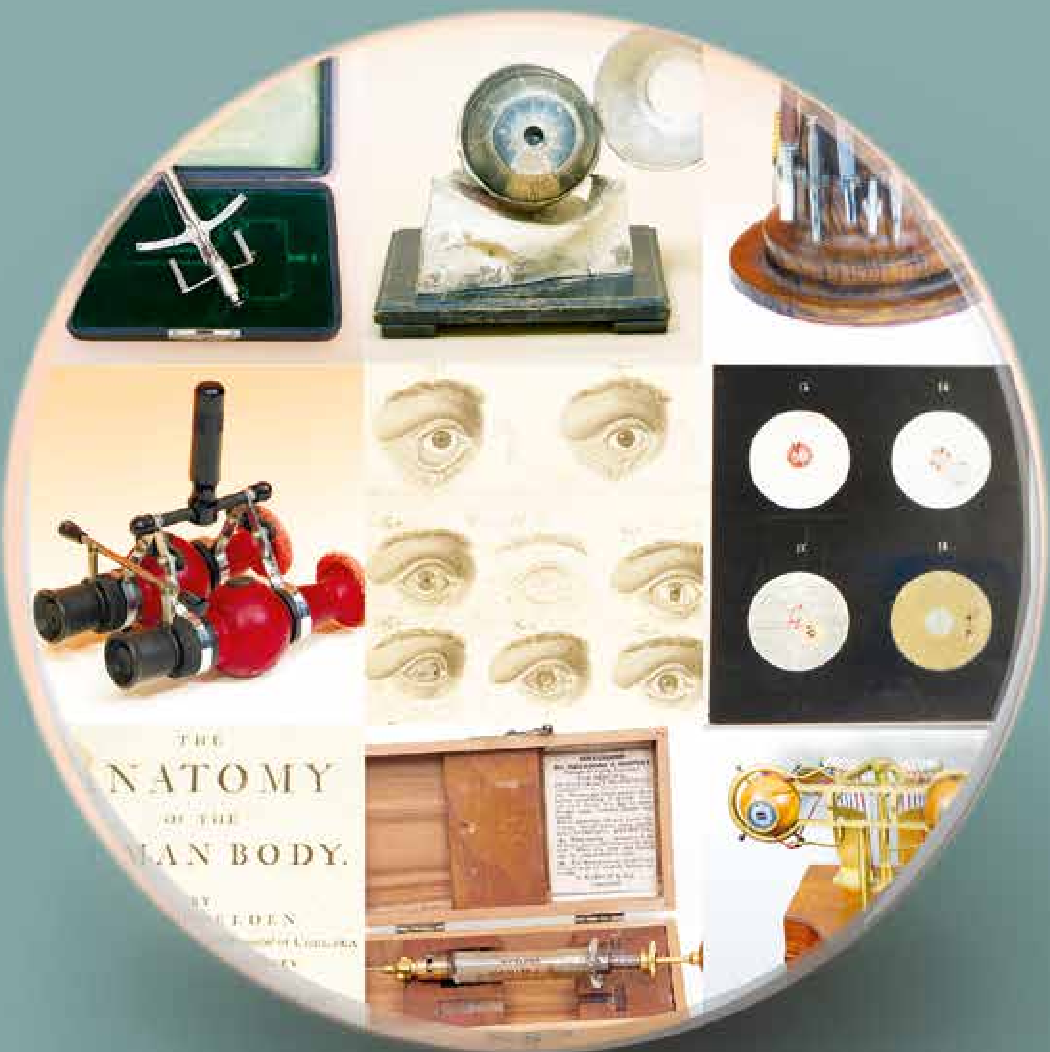
THE EYE
IN HISTORY

A compilation of articles on Instruments, Books and Individuals that shaped the course of Ophthalmology

Mr. Richard KEELER
FRCOphth (Honorary)

Professor Harminder S DUA
Chair and Professor of Ophthalmology, University of Nottingham
MBBS, DO, DO (London), MS, MNAMS, FRCS (Edinburgh), FEBO, FRCOphth,
FRCP (Honorary, Edinburgh), FCOptom. (Honorary), FRCOphth. (Honorary), MD, PhD.



Théa
Driving innovation

TABLE OF CONTENTS

Edition

PERRIN'S PHANTOM EYE: THE ART OF EDUCATION

Fundus cameras, digital photography, video imaging, interactive DVDs and the like are standard teaching aids available to most ophthalmology residents learning their trade. Visualisation of changes both on and in the eye has never been easier but has not always been so. For approximately 15 years after the invention of the direct ophthalmoscope, many ophthalmologists and students were not entirely sure of what they were looking for when examining the fundus of the eye. The introduction of the artificial or "phantom eye"(fig.1) in 1866 by Maurice Perrin (1826–1889) could be considered as a major advance in ophthalmic education.

A full set of the Perrin's "eye" had twelve brass shells on which various eye conditions were meticulously painted in fine detail. These shells were mounted in the back of a hollow brass globe (fig.2) and could be viewed with an ophthalmoscope. Three eyepieces, with different pupil apertures of 7 and 3 mm diameters, could be screwed on to the front of the globe giving the possibility of demonstrating the conditions of myopia, hypermetropia and astigmatism.

Perrin received his doctorate in Paris in 1851. In 1871 he was promoted to the position of Medecin-Inspecteur which was the highest rank in the military medical service in the French Army. He was also professor at the Val-de-Grace medical school in Paris. Perrin also published an atlas of fundus conditions in his book "Atlas des maladies profondes de l'oeil comprenant l'ophthalmoscope" in 1879 (fig.3).

Fig.1 ► *The introduction of the artificial or "phantom eye"*

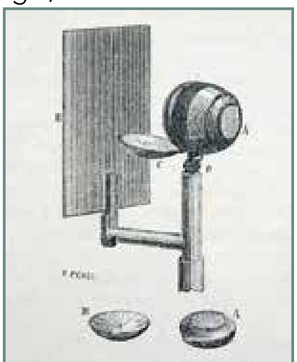


Fig.2 ► *Hollow brass globe*

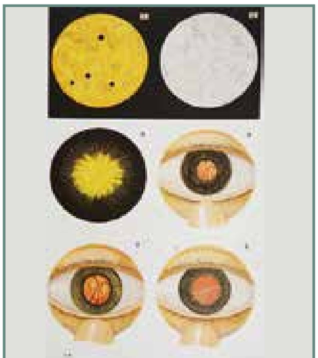


Fig.3 ► *A page from the atlas*

DOUBLE OPTOMETER: WHEELING IT IN

A refractive error is an inability of the eye to bring objects into proper focus. The eye can be long-sighted when the focusing power is less than it should be, requiring convex or plus lenses; short-sighted, when the power is more than what is should be, requiring concave or minus lenses, or astigmatic, requiring in addition to a plus or minus lens, a cylindrical lens. Attempts to correct refractive errors started hundreds of years ago. Inevitably, instruments were developed to make refraction easier, quicker and more accurate. Today, uncorrected refractive errors remain the commonest cause of visual impairment, the world over.

In early days, when methods for testing for refractive errors did not exist, the public bought their spectacles, mainly for reading (presbyopic correction), from street vendors by self-selection. They tried a few and bought the one that suited them best. The spectacles had the same spherical power in each eye and getting the correct one was hit-or-miss as it may have corrected or nearly corrected only one eye. Not surprisingly this remained a very cheap method of getting reading glasses and is in vogue to this day. One can walk into any high street drug store, try a few from a rack of different powers and walk out with a pair that seems most suitable!

One of the early instruments for testing the refractive requirements for a patient was the "Box" lens set (see page 32). Several pairs of spectacle frames supporting different powers or combination of powers of lenses, with a handle at their base, could be held before the patient's eyes. This was an improvement but not by much. This method was superseded by the first trial set introduced by Georg Fronmuller of Furst in 1843. The trial set had a wide range of lenses, both plus and minus, in small increments that enabled more accurate assessment of the patient's refractive error but was essentially subjective. The early trial sets did not have any cylindrical lenses, which was a major drawback.

An optometer is an instrument designed for testing the refractive error of the eye. The instrument was christened 'optometer' by a Scottish physician, William Porterfield (1695-1771) over 300 years ago. The image above is the "Davidson" Double Optometer patented in 1893 and manufactured for the general practitioner. It was named after the firm of F Davidson that provided a range of ophthalmic instruments from 140 Great Portland Street, London, W1. It is a simple instrument made of wood in which the lenses from minus 8D to plus 7D were placed around the circumference. Additional spherical or cylindrical lenses could be placed in a single cell lens-holder behind the chosen lens in the wheel, to make a sphero-cylinder combination. The company's catalogue (fig.1) shows a test chart clipped to the stand and a set of cylinder lenses in a case in front of it. The wheel optometer of Davidson and others provided a quick method of introducing a lens in front of the patient's eye but only one eye could be tested at a time. Emile Javal (1839-1907) invented the optometer with two wheels, one in front of the other (fig.2). One wheel contained a range of plus and minus spherical lenses, the other cylinder lenses. Through brilliant, precision engineering the axis of each of the cylinder lenses could be rotated by turning the lower brass knob. The axis of the cylinder was read from the pointer on the upper dial. In the 1880s a Swiss company introduced, a Double optometer (fig.3) with each side having two wheels one in front of the other, like the Javal Optometer. However, the cylinders could not be rotated, reducing its accuracy. The wheel optometer was the forerunner of the modern phoropter.

This image was provided to the Br J Ophthalmology by courtesy of Richard Keeler and published on Cover of BJO Dec 2011. It is reproduced here.

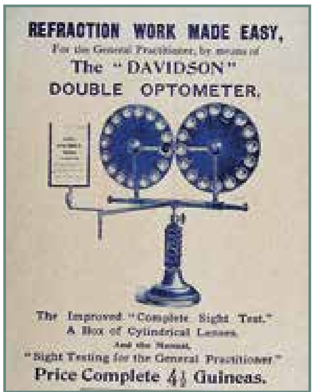


Fig.1 ► The company's catalogue

Fig.2 ► Optometer with two wheels

Fig.3 ► Double optometer

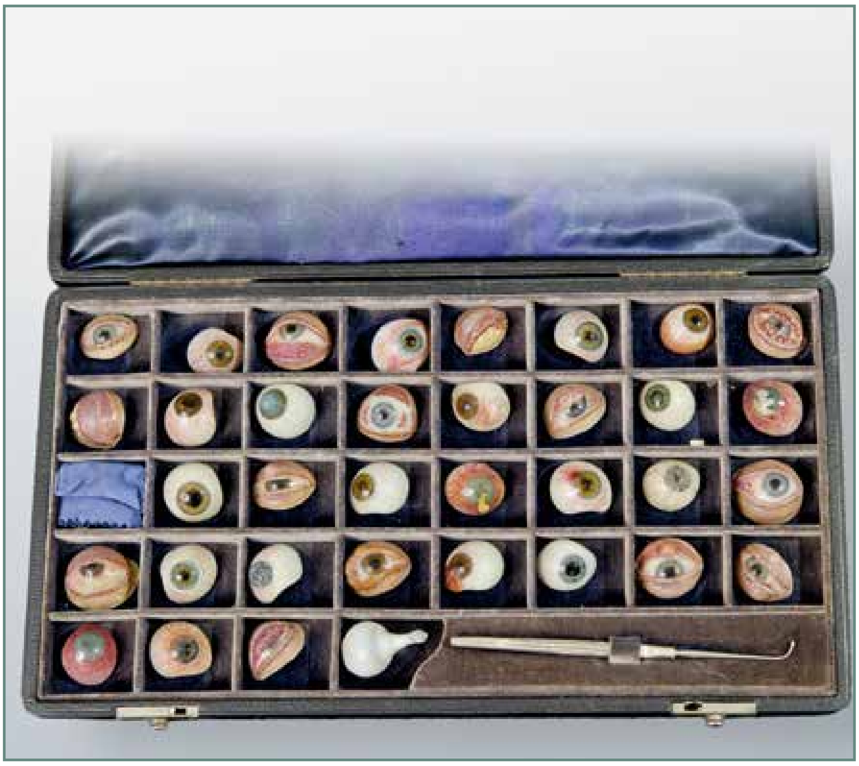
FOCIMETER: FOCUSING ON POWER

Focimeters allow accurate determination of the spherical and cylindrical power of lenses and also indicate the axis of the cylinder. The first focimeter or lensmeter was designed by Hermann Snellen in 1876 and was known as a phakometer (fig.1). It was constructed by Dirk B Kagenaar (1842-1927) in the laboratory of the Eye Hospital in Utrecht. It very much resembles an optical bench.

The focimeter illustrated here was manufactured by Carl Zeiss, Jena in about 1920. This stand mounted focimeter was self-illuminated with the instrument set at an angle to its base for operational ease and comfort. In use, the lens to be measured was placed in the middle of the instrument above the rectangular bar, which supported the edge of the lens and could be moved up and down for accurate centration. A cylindrical drum on the right was turned until a graticule in the eyepiece came into focus. The spherical and cylindrical power was read off an indicator on the drum.

Fig.1 ► *The first focimeter or lensmeter (Tonkelaar, Henkes, van Leersum 1996)*

TEACHING OCULAR PATHOLOGY: GLASS TO GLASS JARS



Most practising ophthalmologists today will recall looking at or studying eye pathology specimens preserved in glass jars in pathology museums. The image above illustrates a set of glass shells showing diseases and abnormalities of the eye, hand crafted in the late 1920s by ocularists in the ophthalmic drawing department of Theodore Hamblin Ltd at 15 Wigmore Street, London.

Unlike artificial eyes first described by Ambroise Paré 1510-90, the famous French surgeon, which fitted the socket of the eye and before cameras could capture images of external or internal eye diseases, this set fulfilled an important role in teaching students pathological conditions of the external eye.

The basic method of manufacture was the same as for artificial eyes invented by German craftsmen in 1835. To make these glass eyes a bulb was formed by heating the end of a tube of glass. Great skill was then employed to construct and paint the various conditions shown in the photograph.

Paintings of such conditions had been used since the second half of the 19th century and atlases of the fundus in colour had been available since 1863 when Richard Liebreich published the first atlas. Colour photography on glass plates of the external eye was difficult although Maitland Ramsay of Glasgow achieved outstanding results of patients' eyes up to and during the First World War. The first colour fundus photographs appeared in 1925.

In 1936 Kodachrome was invented and opened up a new convenient way of teaching diseases of the eye. The set shown here however captured dramatically the three-dimensional aspect of diseases that was not possible in prints and paintings. Some descriptions are enumerated below: Top row: (2) Ekzem (eczema) of the conjunctiva and cornea; (3) Egyptian disease of the eye. Second row: (2) Foreign body on cornea; (6) Spring Catarrh. Third row: (4) Siderosis; (5) Panophthalmitis caused by pick splint broken in vitreous body; (6) Rupture of one ekzem-pustule through the cornea with inveteracy in the iris (iris prolapse). Bottom row: (3) Staphyloma racenosum corneae; (6) Old macula cornea after ekzem.

Reproduced/adapted from Br J Ophthalmol, Teaching ocular pathology:glass to glass jars, R. Keeler, A. Singh, H. Dua, 92, 921, Jul 1 2018 with permission from BMJ Publishing Group Ltd.