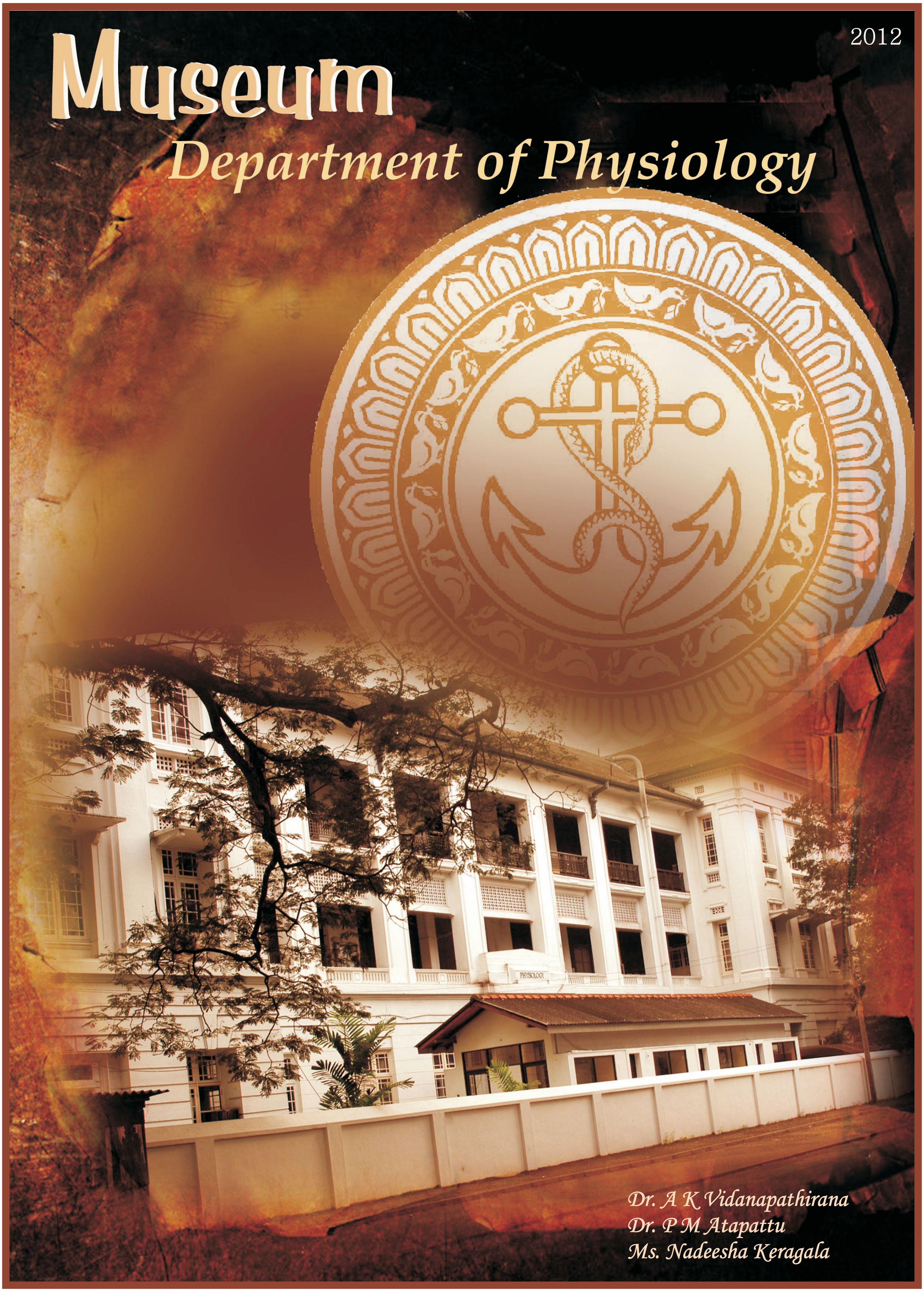
2012

Museum

Department of Physiology



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Preface

The Department of Physiology of Faculty of Medicine, University of Colombo was established in 1870 at the time of inception of the Colombo Medical School. There were various types of equipment in the department that were utilized for teaching, practical, research and maintenance purposes. The department retains a few 'antique' instruments used for physiological experiments in the previous century. Some of them are quite "elegent" and are markedly different from what we see today.

Our efforts in making a Physiology museum in the department were aimed at collating all these remaining items and preserving them for the future generations. We have a small collection at present on which we hope to expand to achieve the dream of a grand Physiology Museum.

This booklet contains information gathered through a literature search of books and website based data. We have tried to search for a detailed history on each of these instruments and included it wherever possible. For some of the equipment included in this booklet, we have also included the interesting facts that are relevant to the equipment so that the reader will get a broad understanding on these items and their applicability. Since we could not find a significant amount of published material, on these equipment we had to rely on both commercial and academic websites to find out further details.

This is the first step of the physiology museum project, which we are eagerly looking forward to expand in the coming years and with the future generations of physiologists. We invite our readers to provide us with more information to expand this booklet. We also gratefully request you to donate any antique equipment relevant to physiology possessed by you so that it will enhance our collection.

Contents

Aldis Slide Projector

The slide projector in our museum is a product of Aldis Bros. Ltd. in England. It has a motor of 200-250 volts and the lamp's maximum rating is 1000watts.

Slide projector

A slide projector is an opto-mechanical device to view photographic slides. Slide projectors were common in the 1950s and 1960s as a form of entertainment; family members and friends would gather to view slideshows. There are many types of projectors which use various mechanisms to focus the image;

carousel slide projectors (includes tray-style projectors)
dual slide projectors
large format slide projectors
overhead projectors
single slide projectors (manual form)
viewer slide projectors
slide cube projectors
stereo slide projectors (projects two slides simultaneously with different polarizations; slides appear as three-dimensional with polarizing glasses)

A brief History of Slide Projectors

The following account on the development of slide projectors will give you an idea on how different options were added to the projectors.

1937-1940 Kodaslide projector- this was the 1st 2" x 2" slide projector which was top loaded one at a time, "gravity fed" with lever.

1939-1947 Kodaslide model 1-This had a smaller footprint and was side-loaded, new slide pushed one in gate out the other side.

1947-1951 Kodaslide projector, model 1a- This created a brighter, sharper image using 150 watt lamp, compared to 100 watt in older models. First heat absorbing glass for transparency protection was introduced in this model.

1947-1956 Kodaslide projector, master model- Was designed for large lecture halls and auditoriums. It was the first projector with extra bright 500 watt to 1000 watt lamps. It consisted of a wide range of lenses (5 - 11 inches) and a powerful fan for maximum cooling.

1951-1956 Kodaslide merit projector- This adopted earlier slide feeding principle and inserted slides one by one from the top.

1952-1955 Kodaslide highlux iii projector- This was similar to merit projector except, an 'extra bright' 300 watt lamp, compared with 150 watt in standard kodaslide. There was also a base blower fan for increased cooling.

1954-1958	Kodaslide signet 500, models 1, 2 and 2f-This was brighter with a 500 watt lamp. It consisted of three ways of changing slides (drop through, push through, magazine changer). It was also the first projector with a remote control and filmstrip projection. A new receiver bin was introduced for stacking projected slides in original order.
1958-1962	Kodak cavalcade projector, models 500, 510, 500c and 520c- This introduced the first straight tray and the first timer (automatic viewing of slide from tray). There was a push button control from remote or manual rotation of hand wheel on side and a built-in movable pointer to silhouette arrow on the screen.
1958-1960	Kodak 500 projector- This was the most portable projector with a self-contained carry case and weighing less than 9 lbs. It introduced two options; a readymatic changer (36 slides) in stacks and a metal magazine (30 slides) for storing and showing.
1959-1962	Kodak cavalcade repeating projector, model 540- This was the same as cavalcade projectors above, but designed for continuous play of 40 slides in straight tray, targeting retail stores, conventions, etc. It was also the first compatible projector with synchronized sound programs from tape recorders.
1961-1966	Kodak carousel projector, model 550- This projector had the first round tray ("carousel") with 81 slides per tray. There was a low lamp setting switch with 500 watt lamp and a remote control (forward, reverses and focus).
1964	Kodak carousel models - With this Germany begins manufacturing 50 Hz projectors (stuttgart) with professional models that were not marketed in USA.
1964-1972	Kodak carousel 800 projector- This was more reliable and reduced in size (12 lb.) It also had the first dissolve control capable (7-pin connector introduced).
1967-1969	Kodak ektagraphic slide projector- This was the first professional unit for higher-end market (non-'consumer' models). There was slide registration with precision controlled shutter control for multi-projector shows.
1969-1971	Kodak ektagraphic projector, models af, e and b- This was the first autofocus projector with features mixed across models for different market needs.

1971-1984	Kodak ektagraphic projector, models e-2, b2, f-2, af-3- Contains current engineering activities to make more robust autofocus override for remote operation from 500 watt to 300 watt. They introduced an automatic dark screen when no slide is projected.
1972-1981	Kodak carousel h models, 600h, 650h, 750h... 850h- These introduced 300 watt version with slower speed fan resulted in quieter operation.
1975-1984	Kodak ektagraphic projector, model af-2k, af -1- This was the first 60hz ektagraphic projector.
1979-1984	Kodak ektagraphic projector, model b-2ar. This model introduced the first automatic switching for voltage and frequency.
1979-1984	Kodak ektagraphic projector, model s-av 1020, 1030, 2000, 2030, 2050- These were the first German-made projector that was sold in USA.
1981	Kodak carousel projector, models 4000, 4200, 5200, 5400... 5600- These contained the first built-in screen viewer (carousel) and the first built-in room light outlet (carousel).
1981-2004	Kodak ektagraphic iii projectors, models e plus, a, amt, ats, br, abr 1986 "np" versions of carousel and ektagraphic It has the first polycarbonate housing, the first self-contained with a removable lamp module (door attached).
1992-2004	Kodak ektapro projectors, models 320, 3000 ... 9020- This was the first rs-232 computer compatible with random access of slides in a tray, built-in dissolve and metal housing.
1994-2004	Kodak ektalite projectors, models 1000, 1500, 2000, international versions of 1995-2004 There were new looks for carousel and ektagraphic with updated housing designs.

Edridge-green Bead Box

This simple instrument was used for testing colorblindness.

Edridge-Green Bead box

This was invented in the late 19th - Early 20th century and used for testing colorblindness. It was first manufactured by Des Edridge-Green and Frederick William in 1891 London, England.

The Edridge Green Bead box is a varnished wooden case with a hinged lid and two body sections. The upper section had four compartments and a trap-door base. This was covered by a cardboard top with four holes for red, yellow, green and blue, through which beads of the appropriate color could be dropped. The lower section was a pull-out drawer by which the beads could be retrieved. A pair of tweezers was provided for the precise selection of the beads.

The procedure

The Edridge-Green color perception bead test used to determine diachroism and trichroism using 21 colored beads. The subject is asked to use a pair of tweezers to place the small colored beads in the holes in the top tray marked red, green, yellow and blue. The beads are of different colors and hues and the originals would may have been marked; R for red P for pink, DB for dark brown, B for brown, Y for Yellow , YW for yellowish white, CY canary yellow, GY for greenish yellow, A for amber, C for citron, YG for yellowish green, PG for pale green, G for green, LB for light blue, SB for slate blue, PB for peacock blue, U for ultramarine, PP for pale pink, DP for dark pink, W for white and T for transparent.

When finished the beads in each drawer were examined and any irregularity in the pattern noted. The pattern of irregularities was diagnostic of the type of color blindness.

Frost's Artificial Eye

What we have in our museum is a model of the eye which could probably have been used to teach the anatomy of the eye and related physiological mechanisms.

The history

William Adams Frost (1853-1935), an English ophthalmologist, invented this 'artificial eye' to teach medical students about defects in vision. The glass lenses on the wooden stand can be placed to show short-sightedness, long-sightedness, and astigmatisms.

Artificial eyes like this one were also used to give students practice using an ophthalmoscope, so they would be able to diagnose eye complaints.

The Frost's artificial eye, London, England, 1870-1885(Science Museum, London)

Holmgren's Wool Test Box

This box is used to test for color blindness, in which the subject matches variously colored skeins of wool.

This test is also known as 'Professor Holmgren's Test for Color Blindness' and 'Holmgren-Thompson Wool Test for Color Blindness'.

Holmgren's Wool Test/ Holmgren-Thomson wool

This test was used by physicians and laymen, primarily for the detection of color-blind employees of railway and shipping lines. The subject was asked to match the worsteds (smooth woolen yarn/cloth) with the test wool. If he chose the wrong colors instead of the properly-matched colors, the subject was said to be color blind. For example, with the Pink Test worsted, if the subject chose blue or violet, the subject would be termed red-blind. If he chose green or gray, the subject was said to be green-blind.

Much of the success of the Holmgren-Thomson test can be attributed to the simplicity and portability of its design. This test represents one of the earliest examples of a physiological test used on a large group of people.

Holmgren's wool box

The test box we have in our museum is somewhat different from the common descriptions. The wool skeins in our box do not have any labels on them.

The box manufactured by the American Optical Company, Southbridge, Pennsylvania in 1900 had 40 wool skeins of size l x w x h; 27 x 12 x 4 cm. They were marked as green "A"; purple "B"; red "C".

The test kit consisted of three test worsteds and forty match and confusion worsteds. Each wool skein has a brass plate with a number marking "1", "2" "3" etc., with a moveable brass disc to cover the number.

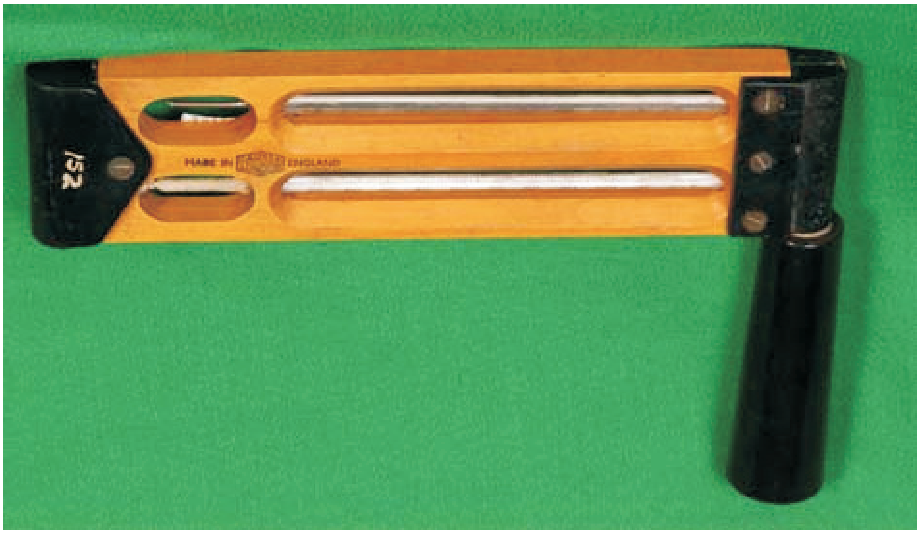
The History of the test

Alaric Fithiof Holmgren (1831-1897), the inventor of the above test, was a Swedish physiologist who made his reputation by studying the retina's electrical response to light. Early in his career, Holmgren studied under Herman von Helmholtz and Emil DuBois-Reymond. Holmgren's original test was directly inspired by a well-publicized railway accident at Lagerlunda, Sweden, in 1876. Holmgren suspected that the engineer of the train suffered from color-blindness and he set out to test this heory by examining 266 employees of the Uppsala-Gabole line. As he suspected, thirteen of these employees were found to be color blind. Holmgren's test quickly established itself as a systematic, reliable way of detecting color blindness in railway and shipping employees. In 1877 he published Om färgblindheten i dess förhallande till jernvägstrafiken och sjöväsendet (soon afterwards issued in English as Color Blindness in its relation to Accidents by Rail and Sea). His testing methods were similarly described in English by Charles Roberts in 1881.

The original Holmgren test of 1879 was the first successful attempt to standardize the detection of color-blindness. Seebeck and Wilson had made a similar attempt in the 1850's but their efforts were ignored and forgotten (Boring, 1942). Holmgren based his test on the Young-Helmholtz theory of color perception which stated that there were three sets of color perceiving elements in the retina. According to the theory, a defect in one of these elements caused a variant of color-blindness. Holmgren designed the test to require matching, rather than naming of colors. The original test was more cumbersome than the kit used later; it had over 160 wools: 3 test colors, and 20 match and confusion colors (8 shades each).

Dr. William Thomson devised his test under similar circumstances. In 1879 the American government commissioned Thomson to devise a color-blind test for railway and shipping employees. Thomson worked to simplify Holmgren's method so that a "non-professional" could conduct the testing and transmit the results to an expert for interpretation. In a series of variations to Holmgren's test, Thomson reduced the number of matching colors, and numbered the worsteds.

Hygrometer Whirling



Hygrometers are instruments used for measuring relative humidity.
This is a traditional hand-held hygrometer.

Measuring humidity and its uses

Hygrometers are used in greenhouses, industrial spaces, saunas, humidors, museums, residential settings to aid humidity control (too low humidity damages human skin and body, while too high humidity favors growth of mildew and dust mite), and in meteorology.

There are several methods used for measuring humidity. A simple form of a hygrometer (psychrometer) consists of two thermometers, one with a dry bulb and the other with a bulb that is kept wet to measure wet-bulb temperature. Hair curvature is another old method of measuring humidity. Modern electronic devices use temperature of condensation, changes in electrical resistance, and changes in electrical capacitance to measure humidity changes.

What we have in our department museum is a traditional hand-held hygrometer. In this psychrometer, there are two thermometers, one with a dry-bulb and the other with a wet-bulb. Evaporation from the wet bulb lowers the temperature, so that the wet-bulb thermometer usually shows a lower temperature than that of the dry-bulb thermometer. Relative humidity is computed from the ambient temperature as shown by the dry-bulb thermometer and the difference in temperatures as shown by the wet-bulb and dry-bulb thermometers. Relative humidity can also be determined by locating the intersection of the wet-bulb and dry-bulb temperatures on a psychrometric chart.

The history

One of the most precise types of wet-dry bulb psychrometer (Assmann psychrometer) was invented in the late 19th century by Adolph Richard Aßmann (1845-1918). In this device, each thermometer is suspended within a vertical tube of polished metal, and that tube is in turn suspended within a second metal tube of slightly larger diameter; these double tubes serve to isolate the thermometers from radiant heating. Air is drawn through the tubes with a fan that is driven by a clockwork mechanism to ensure a consistent speed.

Other types of hygrometers frequently use a human or animal hair under tension. The traditional folk art device known as a "weather house" works on this principle. In order to see changes that occur over time, several hygrometers record the value of humidity on a piece of graduated paper so that the values can be read off the chart.

Latest developments include electronic hygrometer in which Dewpoint is the temperature at which a sample of moist air (or any other water vapor) at constant pressure reaches water vapor saturation. At this saturation temperature, further cooling results in condensation of water. "Cooled mirror dewpoint hygrometers" are the most precise instruments available. Modern instruments use electronic means of recording the information. The two most common electronic sensors are capacitive or resistive.

Light Microscope

The microscope is an instrument used for viewing objects that are too small to be seen easily by the naked eye.

The light microscope in the museum was used with a lamp as the light source for magnification.

History of the Microscope

The earliest simple microscope was merely a tube with a plate for the object at one end and, at the other, a lens which gave a magnification less than ten diameters - ten times the actual size. These excited general wonder when used to view fleas or tiny creeping things and so were dubbed "flea glasses."

The invention of microscopes is related to the invention of lenses and telescopes.

Circa 1000AD - The first vision aid was invented (inventor unknown) called a reading stone which was a glass sphere that magnified when laid on top of reading materials.

Circa 1284 - Italian, Salvino D'Armate invented the first wearable eye glasses.

1590 - Two Dutch eye glass makers, Zaccharias Janssen and his son Hans Janssen, experimented with multiple lenses placed in a tube. The Janssens observed that viewed objects in front of the tube appeared greatly enlarged, creating both the forerunner of the compound microscope and the telescope.

1609 - Galileo, father of modern physics and astronomy, heard of these early experiments, worked out the principles of lenses, and made a much better instrument with a focusing device.

1665 - English physicist, Robert Hooke looked at a sliver of cork through a microscope lens and noticed some "pores" or "cells" in it.

1674 - Anton van Leeuwenhoek of Holland built a simple microscope with only one lens to examine blood, yeast, insects and many other tiny objects and he was the first person to describe bacteria. He also invented new methods for grinding and polishing microscope lenses that allowed for curvatures providing magnifications of up to 270 diameters, the best available lenses at that time. He is considered as the father of microscopy.

Robert Hooke, the English father of microscopy, re-confirmed Anton van Leeuwenhoek's discoveries of the existence of tiny living organisms in a drop of water. Hooke made a copy of Leeuwenhoek's light microscope and then improved upon his design.

18th century	-	Technical innovations improved microscopes, making microscopy popular among scientists. Lenses combining two types of glass reduced the "chromatic effect" -the disturbing halos resulting from differences in refraction of light.
1830	-	Joseph Jackson Lister reduces spherical aberration or the "chromatic effect" by showing that several weak lenses used together at certain distances gave good magnification without blurring the image. This was the prototype for the compound microscope.
1872	-	Ernst Abbe, then research director of the Zeiss Optical Works, wrote a mathematical formula called the "Abbe Sine Condition". His formula provided calculations that allowed for the maximum resolution in microscopes possible. Then several European countries began to manufacture fine optical equipment but none finer than the marvelous instruments built by the American, Charles A. Spencer, and the industry he founded. Present day instruments, changed but little, give magnifications up to 1250 diameters with ordinary light and up to 5000 with blue light.
1903	-	Richard Zsigmondy developed the ultra-microscope that could study objects below the wavelength of light. He won the Nobel Prize in Chemistry in 1925.
1932	-	Frits Zernike invented the phase-contrast microscope that allowed for the study of colorless and transparent biological materials for which he won the Nobel Prize in Physics in 1953.

materials for which he won the Nobel Prize in Physics in 1953.

1931	-	Ernst Ruska co-invented the electron microscope for which he won the Nobel Prize in Physics in 1986. An electron microscope depends on electrons rather than light to view an object, electrons are speeded up in a vacuum until their wavelength is extremely short, only one hundred-thousandth that of white light. Electron microscopes make it possible to view objects as small as the diameter of an atom.
1981	-	Gerd Binnig and Heinrich Rohrer invented the scanning tunneling microscope that gives three-dimensional images of objects down to the atomic level. Binnig and Rohrer won the Nobel Prize in Physics in 1986. The powerful scanning tunneling microscope is the strongest microscope to date.

Metronome

A metronome (metron = measure, nomos = regulating) is a device that produces a regulated pulse which could be aural, visual or tactile. Metronome was a useful practice tool for musicians that date back to the early 19th century and was used to establish a steady tempo in the performance of music.

This mechanical metronome is used for the Harvard step test.

Mechanical metronomes

There are a variety of metronomes ranging from simple mechanical, electrical to complex software metronomes.
This is the type available in our museum and is commonly used for the Harvard Step test. This mechanical metronome uses an adjustable weight on the end of an inverted pendulum rod to control the tempo. The rate is controlled by changing the position of the weight on the pendulum. The weight is slid up the pendulum rod to decrease tempo, or down to increase tempo. This mechanism is also known as a double-weighted pendulum. There is a second, fixed weight on the other side of the pendulum pivot, hidden in the metronome case. The pendulum swings back and forth in tempo, while a mechanism inside the metronome produces a clicking sound with each oscillation.

A brief history

According to Lynn Townsend White, Jr., Abbas Ibn Firnas (810-887), made the earliest attempt at creating some sort of metronome. The mechanical metronome was invented by Dietrich Nikolaus Winkel in Amsterdam in 1812. Johann Mälzel copied several of Winkel's construction ideas and received the patent for the portable metronome in 1816. Ludwig van Beethoven was the first notable composer to indicate specific metronome markings in his music, in 1817

Ophthalmoscope

We have a Gowllands ophthalmoscope in our museum.

History of Ophthalmoscope

Invented by Hermon Von Helmholtz in 1851 the ophthlmoscope revolutionized ophthalmology. Prior to his invention, ophthalmologists could not view the posterior section of the eye and struggled to explain certain classes of eye disease. Soon after, scientists such as Albert von Graefe in Berlin, Edward Jaeger in Vienna, and William Bowman in London, started using it, and every look into the eye became a discovery.

In 1851, Helmholtz had published his Beschreibung eines Augen-Spiegels 2, which gave a full account of the optical principles involved. He had demonstrated that there were 3 essential elements to the working of an ophthalmoscope: a source of illumination, a reflecting surface to direct light toward the eye, and a means of correcting an out-of-focus image on the fundus.

In the beginning, the light source was a naked flickering candle, which was later replaced by the oil lamp and then the paraffin burning lamp. In 1885, William Dennett, a New York ophthalmologist, demonstrated the first ophthalmoscope that used an electric bulb. It was not a success, mainly because of the unreliability and short life of the bulb. Thomas Reid of Glasgow, placed a bulb inside the column of his instrument, but he used a prism instead of a mirror to project the light. James McKenzie Davidson of Aberdeen, published an article in the Lancet of January 1886 showing a diagram of an electric ophthalmoscope. The third electric ophthalmoscope was designed by Henry Juler of London which went into production. Various models using this method became popular.

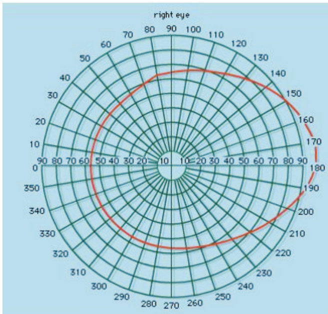
Perimeter

The perimeter measures the visual field limits.

The perimeter can also be used to map out the blind spot.

The perimeter

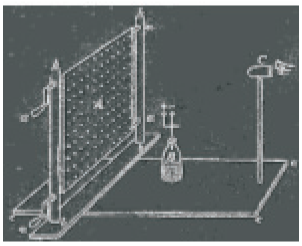
The perimeter consists of a metal quadrant rotatable about one end to produce a hemisphere. The fixed end is mounted on a stand in front of a large black disc. At the center of the disc there is a small white disc/mirror used as a point of fixation. The quadrant is marked off in degrees to read the position of the rider. There is an adjustable chin-rest on the opposite side for the patient to keep the eyes at an adjustable level. One eye is tested at one time while the other eye is covered.
This image is a perimeter chart showing normal visual field; figures on the perimeter indicate degrees of arc.

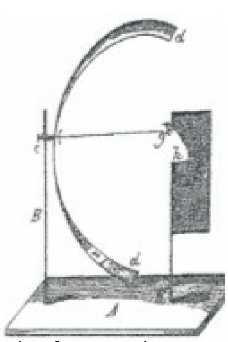


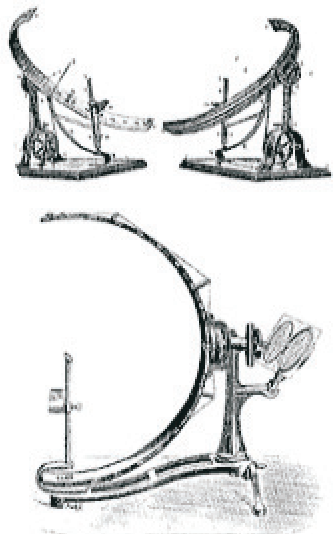
Brief history on perimetry

1856 Von Graefe introduced the concept of diagnostic perimetry using a tangent screen.

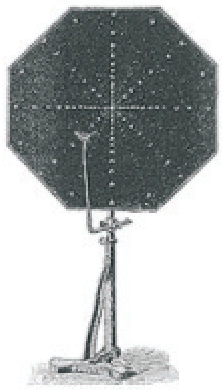
1869 Hermann Aubert and Richard Förster of Breslau developed an arc perimeter for the practicing ophthalmologist; it was popular and was known as the Förster perimeter (top figure). This perimeter was improved in newer models (bottom figure) and dominated the field for the next 15 years.


tangent screen

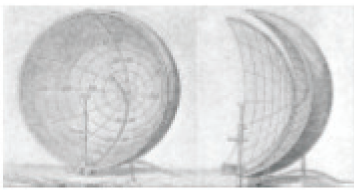

simple arc perimeter



1871 de Wecker improved von Graefe's tangent screen by equipping it with a chin rest and a stand and marking it with concentric circles, starting at 10°; a selection of colored test objects were also offered.

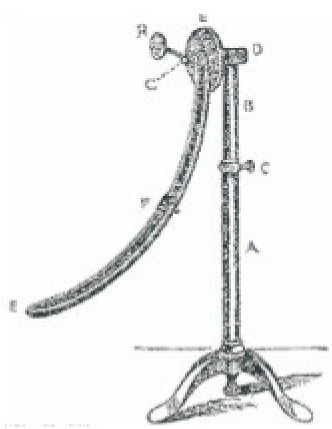


1872 Scherk developed a bowl perimeter to eliminate the distracting background that was always present in an arc perimeter.



1873 Brudenell Carter made a simpler perimeter with an arc of only one quadrant. He recommended uniformity in the plotting of visual fields, which resulted in universal acceptance of a method of mapping of visual fields.

1882 Priestly Smith's developed an improved perimeter.

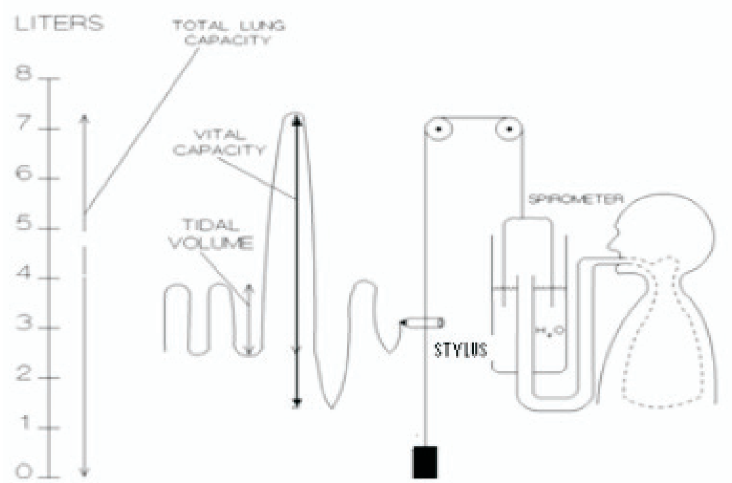


Spirometer

The spirometer records the amount of air and the rate of air that is breathed in and out over a specified time.

Some interesting facts about spirometry

A kymograph (which means 'wave writer') attached to the spirometer gives a graphical representation of spatial position over time. It basically consists of a revolving drum wrapped with a sheet of paper on which a stylus moves back and forth recording perceived changes of motion or pressure. The output produced by a spirometer is called a kymograph trace. From this, vital capacity, tidal volume, respiratory rate and pulmonary ventilation can be calculated.



A brief history of spirometry and lung function

129-200 A.D. Galen has done a volumetric experiment on human ventilation. He asked a boy breathe in and out of a bladder and found that the volume of the gas was unchanged after a period. Galen has not done absolute measurement of lung volumes.

1718 Jurin J. blew air into a bladder and measured the volume of air in the bladder by the principles of Archimedes. He measured 650 ml tidal volume and maximal expiration of 3610 ml.

1749 Bernouilli D. described a method of measuring an expired volume.

1788 Goodwyn E. found that the vital capacity could reach as much as 4460 ml.

1793 Abernethy tried to determine how far expired gases had been depleted of oxygen. He measured a vital capacity as 3150 ml.

1796 Menzies R. plunged a man into water in a hogshead up to his chin and measured the rise and fall of the level in the cylinder round the chin. With this method of body plethysmography he determined the tidal volume.

1799 Pepys W.H. jun. found the tidal volume to be 270 ml by using two mercury gasometers and one water gasometer.

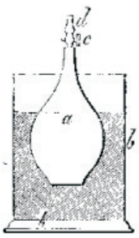
1800 Davy H. measured his own vital capacity as 3110 ml, his tidal volume as 210 ml with a gasometer and the residual volume as 590-600 ml by a hydrogen dilution method.

1813 Kentish E. used a simple 'Pulmometer' to study ventilatory volumes in disease. An inverted bell jar standing in water, with entry at its top controlled by a tap, and graduated in pints down the side.

1831 Thrackrah C.T. describes a 'Pulmometer' similar to that of Kentish, but air enters the glass jar from beneath.

1844 Maddock, A.B. publishes in the Lancet a letter to the editor about his '"Pulmometer".

1845 Vierordt published his book 'Physiologie des Athmens mit besonderer Rücksicht auf die Ausscheidung der Kohlensäure'. He did a very exact determination of the volumetric parameters. For his experiments he used an 'Expirator'.

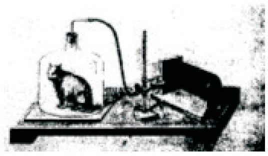


1852 (1844) Hutchinson, John publishes his paper about his water spirometer which is still used today with little alterations. Hutchinson recorded the vital capacities of over 4000 persons with his spirometer. He showed the linear relationship of vital capacity to height.

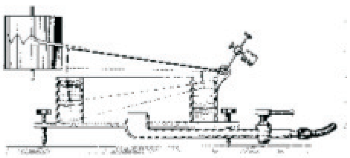
1854 Wintrich developed a modified spirometer, which was simpler to use than the spirometer of Hutchinson. Wintrich did an examination of about 4000 persons with his spirometer and concluded that 3 parameters determine the vital capacity: body heights, weight and age.

1859 Smith E. developed a portable spirometer.

1866 Salter added the kymograph to the spirometer to record time and the volume.



1868 Bert P. introduces the total body plethysmography. He presented his studies to the 'Société de Biologie' under the title 'Changement de pression de l'air dans un poumon pendent les deux temps de l'acte respiratoire' ['Alterations of the pulmonary air pressure during the two periods of respiration']



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Stick Barometer

The barometer is the instrument used to measure air pressure.

What we have in our department museum is a stick barometer which was initially made by Baird and Tatlock in about 1920-30.

Interesting facts on the barometer

The word barometer is derived from the Greek word "baros", meaning weight, and the Greek word "metron", meaning measure.

The barometer utilizes the principal of a vacuum to measure the weight of the air. For a simple explanation of a vacuum, just consider your everyday use of a straw to sip water.

History and evolvement of different types of

In early 17th century Italy, there were many Italian scientists independently working on the principles of a vacuum and air pressure. The mercury barometer was invented in 1643 by Evangelista Torricelli, a student of Galileo, in Florence Italy. At first it was found, when turning a glass tube full of mercury upside down, that there was a vacuum at the top; then it was discovered that the height of the mercury column varied slightly as both its altitude was changed and as the weather changed.

Barometers made before 1680 are extremely scarce since they were originally very crude and were used by scientists as tools of discovery. Later, the simple plank with a tube attached became the stick barometer, with its ornate case work, engraved silvered-brass register plate, tube and cistern cover. Most of the barometers have evolved in Europe. Until about 1780 barometers were still the preserve of scientists and the wealthy, but they had started to move out of Italy, up through France and into England. The Italian craftsmen responsible for making barometers, there were many from the northern towns of Venice and Milan, still famous for their glass blowing abilities. They arrived in England in the late eighteenth century.By 1750 wheel barometers were being made in France. These were some of the first wheel barometers and they eventually made their way to England, again with the north migrating Italian craftsmen, by about 1800. So by 1810 we had the two dial wheel, or banjo barometer and the door stick barometer. The 1810 stick barometer, however, did not require any mechanism, and the reading of the air pressure is taken directly from the height of the mercury in the tube, exactly as it had been in 1643. Over the next 40 years, the "2 dial 8 inch banjo" morphed into 3,4 and 5 dials, with 4", 6", 10", 12" and larger diameter dials; the pediment changes from architectural to swan neck, round top and onion top; and the wood changes from mahogany to rosewood (which was frequently inlaid with mother-of-pearl or brass) to oak.

America also began to take an interest in the barometer, with patents being recorded as early as 1845. One of the earliest records of interest in the barometer in America occurred on July 5, 1776, when Thomas Jefferson bought a barometer made in London, at Sparhawk's, a small antique shop in Philadelphia, which he happened to be visiting.

By 1870, mercury barometers had virtually ceased to be made, apart from the curious Admiral Fitzroy Barometer, helped on the way out by the invention of the Aneroid barometers, almost 200 years to the day after Torricelli's discovery. In 1844, the first commercially viable aneroid barometer was made by Lucien Vidie in France. It comprised an evacuated drum whose minute expansions and contractions under pressure changes were transferred to a needle moving over a dial.
'Aneroid' is a Greek word meaning "without liquid" (i.e. no mercury). Therefore the aneroid barometers, at once solved one of the major and many minor problems associated with the mercury barometer. They were portable, small, inexpensive, robust, and accurate. Within 20 years of their introduction they had spelt the end of the mercury barometer. Within 25 years aneroid barometers were being manufactured by the thousands, in both 4½ and 7 inch diameter, with a hanging ring on the top. The larger ones frequently had a circular hole cut in the face so that the mechanism could be viewed, and had twin curved thermometers below, in alcohol and mercury, reading in both Centigrade and Fahrenheit.

The Magnifying Glass

The magnifying glass is used to visualize minute objects which are not seen by the naked eye.

The Magnifying Glass

Modern magnifying glasses are double-convex lenses. When viewing objects the light rays are converged to the center of the lens, making the object look larger than it is to the eye. Each magnifying glass has a focal length, which is the distance from the optical center of the lens to the point where the light rays converge. The focal length of any lens is determined by the radius of the curve on the face of the lens.

Magnifying glasses are now manufactured with many configurations. The basic magnifying glass has the glass attached to a handle, which may be made from almost any stiff material. Many different sizes are available form the small round compact pocket magnifying glasses to the large rectangular full-page magnifiers. Many have built-in lighting systems to allow the user to see objects better.

The history

The magnifying glass is one of the oldest devices used to improve sight. Historians seem to agree that the Romans were the first to discover glass in the first century AD. The Egyptians had discovered an almost clear crystal, called obsidian that was used to view small objects

The Romans were probably looking through the glass and discovered that the objects looked larger. They experimented with different shapes and found that glass that was thicker at the center and thinner on the outside magnified the object that was being observed. They also discovered that the suns rays could be concentrated sufficiently to start a fire. They called these glasses "burning glasses". These glasses were similar to the shape of lentils, and so the word "lens" comes from the Latin word for lentil. The benefits of these lenses were not appreciated until the 13th century, when scientists used them to study tiny insects. They were then called "flea glasses".

During the 16th century, the first primitive microscopes were invented using multiple lenses and so a new industry was born. Magnifying glasses continued to be used for low levels of magnification, when compared to the magnification ability of the microscopes.

Thermometer

The thermometer in our museum is a 'Rotatherm product, which was used to measure the room temperature.

Thermometers

Thermometers measure temperature, by using materials that change in some way when they are heated or cooled. In a mercury or alcohol thermometer the liquid expands as it is heated and contracts when it is cooled, so the length of the liquid column is varies depending on the temperature. Modern thermometers are calibrated in standard temperature units such as Fahrenheit or Celsius.

History of the thermometer and development of temperature

100	B.C. - Greeks made simple instruments for measuring temperature.
1564-1642	Galileo Galilei is invented the 'modern thermometer' called an air thermometer, in which a colored liquid was driven down by the expansion of air.
1612	Italian physician Santorio Santorio (15611636), adapted Galileo's device to measure the body's change in temperature. He was the first to put a numerical scale on the instrument.
1686-1736	German physicist Daniel Gabriel Fahrenheit invented the alcohol thermometer in 1709 and the mercury thermometer in 1714. In 1724, he introduced the temperature scale that bears his name the Fahrenheit Scale.
1701-1744	Swedish Astronomer Anders Celsius invented the Celsius scale which was also referred to as the "centigrade" scale. The term "Celsius" was adopted in 1948 by an international conference on weights and measures.
1848	Lord Kelvin invented the Kelvin scale. He developed the idea of absolute temperature, what is called the "Second Law of Thermodynamics", and developed the dynamical theory of heat.
1867	English physician, Sir Thomas Allbutt invented the first medical thermometer used for taking the temperature of a person.

1939-1945	Pioneering biodynamicist and flight surgeon with the Luftwaffe, Theodore Hannes Benzinger invented the ear thermometer.
1984	David Phillips invented the infra-red ear thermometer.
1796	Menzies R. plunged a man into water in a hogshead up to his chin and measured the rise and fall of the level in the cylinder round the chin. With this method of body plethysmography he determined the tidal volume.
1799	Pepys W.H. jun. found the tidal volume to be 270 ml by using two mercury gasometers and one water gasometer.
1800	Davy H. measured his own vital capacity as 3110 ml, his tidal volume as 210 ml with a gasometer and the residual volume as 590-600 ml by a hydrogen dilution method.
1813	Kentish E. used a simple 'Pulmometer' to study ventilatory volumes in disease. An inverted bell jar standing in water, with entry at its top controlled by a tap, and graduated in pints down the side.
1831	Thrackrah C.T. describes a 'Pulmometer' similar to that of Kentish, but air enters the glass jar from beneath.
1844	Maddock, A.B. publishes in the Lancet a letter to the editor about his '"Pulmometer".
1845	Vierordt published his book 'Physiologie des Athmens mit besonderer Rücksicht auf die Auscheidung der Kohlensäure'. He did a very exact determination of the volumetric parameters. For his experiments he used an 'Expirator'.
1852 (1844)	Hutchinson, John publishes his paper about his water spirometer which is still used today with little alterations. Hutchinson recorded the vital capacities of over 4000 persons with his spirometer. He showed the linear relationship of vital capacity to height.

linear relationship of vital capacity to height.

1854	Wintrich developed a modified spirometer, which was simpler to use than the spirometer of Hutchinson. Wintrich did an examination of about 4000 persons with his spirometer and concluded that 3 parameters determine the vital capacity: body heights, weight and age.
1859	Smith E. developed a portable spirometer.
1866	Salter added the kymograph to the spirometer to record time and the volume.
1868	Bert P. introduces the total body plethysmography. He presented his studies to the 'Société de Biologie' under the title 'Changement de pression de l'air dans un poumon pendent les deux temps de l'acte respiratoire' ['Alterations of the pulmonary air pressure during the two periods of respiration']
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