# Reorientation of Pathology Museums

**H.A. Parshwanath**
Professor of Pathology
& Former Joint Director of Medical Education
Govt. of Karnataka, Bangalore

[ Received:17-5-2017 , Revised:20-5-2017 , Accepted:26-5-2017]

## INTRODUCTION

Museum is a building place to exhibit the objects of illustrating arts or science. It is a temple of educating the medical fraternities of all the disciplines of medicine and thus fulfilling the needs of a teaching-learning aid. The importance of concept and the role of museum is much well emphasized. It is a mission to create awareness in the path of study in detail and understand the finer aspects to constitute towards medical knowledge and better diagnosis. Pathology is the grammar of Medicine and Surgery. It is considered as the key place or center and excellent place of learning the medical education. It is the heart of clinical studies in general and is regarded as the *sanctum sanctorium* of the Department of Pathology. It is not merely used as a place for conservation and preservation as storage and is a mission to create and spread awareness among the learners, teachers and also the public. It is aided in pervading and disseminating information. It helps in studying the dynamic course of the diseases through the pathologic morphology. It is an ideal place of learning surgical pathology and hence is considered as the prerogative and keystone of Department of pathology.

"A museum should not only be a place for the storage and exhibition of preserved and mounted specimens, it should also provide a suitable location for the display of quite different materials"

**-**Dr. Peter Hansell (Dept. of Pathology & Illustration, Westminister Medical School)

"Pathology museum is a library of specimens on which the books are written".

**-**William Boyd

The constitution and institution of museum has formed the frentic pace of development of pathology.

"Learning and research endeavours are the dynamic processes in the reorientation task of building new shape with positive scope".

**Correspondence:**
H.A. Parshwanath
Professor of Pathology
& Former Joint Director of Medical Education
Govt. of Karnataka, Bangalore
Mobile: 9880443281
Email:parshwanath@jainheritagecentres.com

Museum helps to medical researchers, educators / teachers and students in the process of teaching-learning purposes. Latest developments in medical sciences in technology act as stimulus. The concept of museum is widespread regionally and globally. It should be well organized and updated periodically or frequently to reach the zenith of quality. It should be made more attractive. One has to aim at achieving positivism and pragmatism with a stress on the practical value of facts and figures to gain practical advantage of ideas.

It is the sheet anchor of Department of pathology

## HISTORY

History of Medicine dates back to the earliest centuries. It was when the occurrence of diseases was attributed to the curse of Gods and Godesses, act of evil beings or the consequences of the misdeeds of the people. Various superstious acts and practices were performed and prayers for relief from pains and sufferings than specific treatment.

The quest for knowledge of human body structure, functions, dysfunctions or malfunctions is a continuous process. Susruta, the Father of Indian surgery is time honoured luminary in the Indian medical history. 'Susrutasamhita' was compiled between 800-400 A.D. including surgeries conducted successfully by him including surgeries like intestinal an anastomosis. Ancient body was dissected by susruta by about 500 B.C.

The study of gross organspecific pathology is an integral, indispensable and inseparable part of pathology teaching i.e., the morphological study of specimens is the doorway and also the art of organizing the museum. Govanni B. Morgagni (1622-1771), the Italian anatomist and pathologist is considered as the pioneer with beginning of the study of Morbid Anatomy (Pathologic Anatomy) through

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autopsy. John Hunter (1728-1793), the greatest Scottish surgeon and anatomist of all times, with his elder brother William Hunter (1718 1788), the reputed anatomist and obstetrician started the first ever scientific designed museum of pathologic Anatomy. John Hunter had the passion for pathological science and self directed approach to study materials, self dependent study and perpetual learning process. He made anunique collection of more than 13,000 surgical / pathological specimens and arranged them into separate organ systems. He also included many clinical pathology specimens as well and thus developed the first museum of comparative Anatomy and pathology in the world. This later became the Huntarian Museum of Royal college of surgeons in England. He was considered as the Father of pathology Museum. The era of gross pathology has 3 more illustrious and brilliant physician pathologists in London. They werecolleagues at Guy's Hospital, London Richard Bright (1789-1858), Thomas Addison (1793-1860) and Thomas Hodgkin (1798-1866). Morbid Anatomy attained its Zenith with the appearance of Carl F. Von Rokitansky (1804-1878). He was a self taught German pathologist. He performed nearly 30000 autopsies. Later he wrote a book on Pathologic Anatomy. Rudolf Virchow, the renowned Father of cellular pathology, founded a museum in the Institute of pathology of the chariton (charite) on 27th June 1899. It housed 23,066 specimens at the time of his death (1902). However most of the collections was destroyed as the result of war during 1939-1945. The University of Florence was the first museum to house wax works depicting pathologic conditions (19th century). The war casualties hit both the museums and its staff with brutal force. Only about 1800 specimens 'survived' the inferno without further greater damage. After the war ended the museum could no longer be used in its original form for decades. However, charity pathologists made great efforts to build up the museum collection again. They and officers decided not to revitalize the original pathological museum. But it was decided to create conceptually much different and broader oriented "Berlin Museum of Medical History". This was finally opened in the same site in 1998.

## PLANNING OF MUSEUM

Museum should have adequate space both for the display of specimens and for students to study. The hall should be well ventilated and lighted i.e., adequate good natural light. Fluorescent lighting offers great advantage over the other types in being veryadaptable when used in conjunction with the reflectors.

The specimens were displayed in huge vitries on five floors showing almost all diseases then known. Also the series of the same disease forms like tuberculosis demonstrated variations of particular illnesses in the affected specific organs. He had sought many years for his museum. There were about 1500 specimens collected by his predecessors when he took charge. But by further collection of specimens primarily by the increased activity of his own institute in dissection and the preparation of museums. He created a history in this regard without any comparison. "No Day without Specimen" was his motto. The first building of the museum had a space of 2000 $m^2$.

Virchow designed the museum in 3 ways:

1) Planned to have a Teaching and Research collection on the top of 3 floors. Students and colleagues wereable to view the specimens from their studies.

2) An exhibition was open to the public in two lower floors.

3) Specimens were presented to the students in the lecture hall from all levels of the museum facilitating his listeners. He said, "Learn by seeing medically".

Virchow's pathological museum was kept open to the public until 1904. However World War I and the following economic crisis in Germany put an end to this practice. Later it served for a longer time exclusively as a teaching and study collection for medical education purposes. The same principles and data were followed by his successors. Finally there were around 35000 pathologic- anatomical specimens filling the museum in the beginning of world war II.

The newer ideas and informations pervading and disseminating towards the infrastructure should be taken into cognizance. Rapid increase in widening the horizons of knowledge about the same has increased the present scene globally.

**Divisions of Museums:** Ideal medical museums should have various Divisions and Blocks to display specimens. Uniqueness in the matter of contents, display, organization and elegance be observed.

i) Evolution of pathology (Records of History of Medicine)

ii) System oriented Display

iii) Current topic & Disease oriented display.

iv) Specimens Fluid, Wet and Plastinated.

v) Recent specimens

Vi) Similies / aphorisms (medical proverbs), sayings as putforth by Hippocrates(460-377 B.C.)

It should contain relevant charts / Flow charts, sketches and diagrams insame or different colors (macro/micro), posters, models, illustrative materials like black & white and colour photography, radiographs, tables showing disease mechanisms,

descriptive catalogues, pictures, photos of luminaries, precise and relevant clinical history of patients and laboratory diagnosis of selected disorders helping and facilitating the understanding of difficult concepts of recent advances- molecular basis of diseases (cancer, HIV, Receptors, etc.,) suitably displayed and made readily available and accessible to the students to learn. Up-to-date view of central body of pathology be made. It should be made attractive. Spectacular advances or 'break throughs' such as Human GenomeSystem have taken place in recent years in the development of museums in the light of globalization and modernization.

Special display cabinets with semipermeable displays on selected diseases may be incorporated in a conventional medical museum. Further, the layout is equipped with light points for microscopic lamps or a portable 6' fluroscent tube is advantageous. The mounted fluorescent tube can also be used to display giant sections, culture plates and transparencies.

The museum is being adaptable when used in conjunction with the necessary equipments and amenities. It helps to study the progress of medical science and improvements occured and functional conditions reoriented.

**MUSEUM MOUNTING TECHNIQUES:**

Human bodyis greatly revered in medical education. The surgical specimens or tissue samples from the operation theatres and those from the clinical and medicoleagal autopsies constitute the main sources in the study of museum. These are preserved for subsequent gross display in the museum or for microscopy i.e., preparation of good museum for mounting involves meticulous planning at the time of biopsy or at the time of obtaining the specimen, grossing and careful handling thereafter. Crafting or trimming a specimen requires a more skilled workmanship. Flexible material is noteworthy to work with making it suitable for mounting. It is imperative to pay attention to the preparation storage, mounting and preservation of the museum specimens.

The study of gross organ pathology is an inseparable part of teaching and diagnostic approach. Care should be taken at the level of conduction of autopsy or in the grossing section of the department. In general specimens collected from the operating theatre on proper treatment may provide the best specimens to the museum.

"Pathology had its beginning on the Autopsy table

-Professor William Boyd

The term histopathology is used synonymously with Anatomic pathology / pathologic-Anatomy / Morbid Anatomy / Gross Anatomy.

Furthermore, clinical manifestations of disease with pathologic findings at autoply is the major method of studying disease. The synthesis of clinical data is vital in terms of the proper and adequate collection of record of medical history pertaining to the clinical manifestations and treatment of diseases of the patients deceased should always be given due importance. A radical and dramatic change in the modern medical education training should be taken into cognizance and concerned with as its progress is a continuous laboured process from the time of its genesis.Classical and unusual specimens are useful as teaching aid to UG and PG students of various disciplines.

Greater opportunity and incentiveness be given to medical students to comprehend the importance of utilizing the knowledge of museums despite the advances in the easy availability details of specimens, photographic illustrations through online or on CD's. The teaching personnel should evince the newer remedial measures to overcome the flaws by impressing the role of museums in the integrated medical curriculums. Museum teaching should be a continuous process and it should be only recognized and emphasized as a place physical stay and study. The hubris of science of medicine has led to the experimental growth of medical knowledge. It should be remembered that pathology has evolved as an elegant and serendipitous science of discovery towards the period of technological sophistry.

**Fixation:**It is essential that the museum specimens maintain the original shape, size, volume and colour. Hence, fixation is required to prevent putrefaction by bacterial attack and autolysis, to preserve the architecture by rapidly coagulating or solidifying the cell protein and colloid material and subsequently hardening the same.

**Precautions before fixation :**

Specimens containing much blood should be washed in saline instead of water to prevent loss of morphology due to haemolysis. The anatomical position of it with other structures is maintained for proper display of the lesion. Bilestained specimen should be stored separately. It is packed if cavitory i.e. cavities should be inflated with fixative. These should be packed with cottonwool. Delicate structures such as circle of willis requires gelatin embedding.

Specimens remain in the mounting medium from 10-35 years duration. Change in colour of solution indicates change of mounting medium.

**Note:** Embalming an autopsy body to collect specimens is less frequently done in pathology

department.

Formal saline (Formaline 40%) is the time honoured and primary fixative and preservative chemical. The use of 10% neutral buffered formaline as a fixative gives satisfactory results to preserve the specimens. Formaline fixative should be replenished to ensure that the fluid does not dry out as it may lead to deposition of Paraformaldehyde crystals on the specimens. Optimal color preservation and restoration in gross specimens is observed in order to avoid graytan, 'Pickled in formaline appearance', Primary 10% formalive fixative is in common use. The specimens are immediately transferred to the fixative after removal from the body. Other fluids include glycerine, carbolic acid, extran etc. After primary fixation specimens are transferred to special fixative.

Modified Kaiserling solution as preservative (1897) is most widely used and it gives the best results of technique. It has 3 solutions I, II, III. It is a good mounting medium.

**Modified Kaiserling's Fluid-I**: It preserves the color of the R.B.C.s

Formaline (40%) 400 ml Fixation
Potassium Nitrate 30 G
Potassium Acetate 60 G Help in maintaining neutral PH
Distilled / Tap Water to make it 1000 ml.
Duration of fixation :3 14 days depending upon the size of specimen
(average : 5 days)

**KaiserlingFluid II :**It is a colour reviver. Overuse can lead to permanent bleaching solution.

Potassium acetate : 4 G
Glycerine : 2000 4000 ml.
Phenol : 20G (It prevents the growth of fungi)
To restore colour 80% - 95% of ethyl alcohol is used
(30 minutes to 4 hrs. depending upon the size of specimen)

**Kaiserling Fluid III :**(Mounting Fluid Medium)

Glycerin 300 ml. It keeps specimenmoist, clear look.
It hasRefractive Index same as glass.
Sodium acetate 100 G It gives clear look of the specimen.
Formaline 5 ml (Preservative)
Tap water to make it 1000 ml.
0.4% Sodium hydrosulphite is added immediately before sealing the jar
maintaining of colour.

The specimens of brain and spinal cord dry very fast when exposed to air. Hence these should not be allowed to dry at any point of time. These should be sprayed with water continuously. The specimens of foetuses with the congenital anomalies should be washed in normal saline and preserved in 5% formaline.

Pulvertaft R.J. (1936) described the method where restricting the colour to the tissues could be achieved by the addition of a reducing agent sodium hydrogen sulphate to the mounting medium. It is stated that mounted specimens with Palvertaft Kaiserling technique have shown little fading even after 25 years.

**Went Worth Method :** Glycerol is omitted from the final mounting medium. Sodium phosphate tribasic is used.

**SchultCarbon Monoxide Method :**Carbon monoxide converts the Hb into the more stable compound carboxyhaemoglobin. Its disadvantages include unrealistic explosive colours during the processing.

**JNMC :**10% Formaline
Sodium metabisulphate
Potassium metabisulphate
Camphor It prevents bad odour
Tap water
After preparing mounting fluid it is kept for two days. It can be used if there is no colour.

**Aergerter fluid medium:**The colour of the structures such as lungs and intestines etc. can be retained using the colour fixing fluid.

| | |
|---|---|
| Sodium Chloride | 140G |
| Sodium bicarbonate | 80G |
| Chloral hydrate | 625G |
| Formaldehyde (40%) | 512 ml |
| Tap water | 20 litres |

**Jore'sFixative :**

| | |
|---|---|
| Sodium chloride | 4.8 G |
| Sodium Sulphate | 11.0 G |
| Sodium Carbonate | 8.4 G |
| Chloral hydrate | 10.0 G |
| Formaldehyde (37%) | 30.0 G |
| Aqua ad. | 1000 ml |

The dissected specimen has to be kept at 4°C in it for 24-48 hrs. It is a successful and good surgical and autopsy histological preservative for several years. It is found that organs retain their appearance indefinitely. It is comparable with that in 10% formaline.

**McCormick's colourRestorative :** Its constituents are -

Dibasic sodium phosphate (Anhydrou)3.8 G

Monobasic sodium phosphate102 G
Sodium chloride8 G
Potassium Nitrite0.34 G
Potassium Nitrate0.51 G
Ascorbic Acid1.7 G
Formaldehyde (37%)50 ml
Aqua Ad1000 ml

**Mounting of Museum Specimens:**

**1)Glass Jars :**Borosil variety of glass has good transperancy available along with the lid. Specimens are fixed on glass rods with nylon threads. Glass rods can be bent by using Bunsen burner. These are sealed with a mixture of Paraffin wax and plaster of paris. These can also be sealed with asphalt rubber compound (Picein). The edges are painted with black enamel…. They appear neat. These are more advantageous as these are cheap and more transperant. These are unaffected with any kind of fluid. The disadvantages include heaviness and chances of high breaking are more.

**2)Acrylic Jars:** These are made of imported acrylic sheets. These have good transparency and long lasting. The sealing of jars is done with available adhesive and painted with black enamel paint.

**3)Perspex Jars :** Museum specimens are generally and universally mounted in glass jars of Perspex boxes. These are made of perspex sheets used as a centerplate which can be bent using pasteur pipette as a gas jet. Using center plates or glass rods to which the specimens are fixed or sutured.

These may be designed to fit each specimen exactly. Copper rod heating elements connected with transformer to pass a current of 700 amp at half holt. Covering of the polyethylene Terephthalate (PET, PETE or Polyester) is commonly used as an alternative for carbonated beverage and water bottles. Further covering of the PET sheets by a black polythene sheet enhances the contrast of the specimen being displayed. It maintains the integrity, colour or contour over a period of 12 months. It provides sufficient alcohol and essential oil barrier properties. It has generally good chemical resistance and also high degree of impact resistance and strength.

These bottles are long lasting, translucent, thin, unbreakable, light weight and inert. One of the great advantages of mounting in Perspex is its flexibility when heated. Hence it can be molded or bent to satisfy the requirements of the individual specimens i.e., PET with scissors or sheets can be easily cut withblade and sutured to the specimens adapting properly to the size of the jar. It does not visually hinder the display. A 3 mm hole is bored on the upperlid of the box through which the mounting fluid is filled. A hinge-like preparation of the plastic bottles gives a stable support to the specimen.

**Gelatin Embedding** It has the disadvantage that gelatin tends to become yellow with age and also to undergo liquefaction with resultant formation of air bubbles. The durability of the Perspex boxes offers most of the advantages over the old method of gelatin embedding.

**Mounting:** The specimen to be mounted is placed in a museum jar filled with freshly made solution to the brim level and sealed. Color is restored in 1-2 hrs. for most specimens. Larger specimens take more time. The position of the mounted specimens after the trimming and marking the sites of the lesions with pointers should be as far as possible in anatomical position.

The basis of colour restoration in formalin fixed specimens is the formation of a stable chromogen, nitrosohaemoglobin by the reaction of hemoglobin and haematin with nitric oxide which is formed by the reduction of nitrites by ascorbic acid. The color restoration usually lasts for upto one week. Repeated accentuation of colour is possible.

**Embedding In Solid Plastic Blocks** It appears to offer the ideal method of presenting museum specimens. But the color of the soft tissues may not be preserved. Such methods, while adequate for hard tissues, certain insects, plants are useless for normal pathological museum specimens.

Maintainance of vascular anatomy by injection technique is very essential and forms the basis for the reconstructive surgery. old and wornout specimens are removed periodically.

The techniques of mounting should be supplemented by displaying clinical, radiographic and histopathological photographs along side the museum. Relevant histological details should be available in smaller museums. The specimens should be clearly labelled. A set of brass discs can be used in place of the written labels. Now a days, a neat laminated computer printout could serve the labels and computer or CD could have the records containing the details of the specimens allows easy and rapid access to a description of the specimens. Slide projector, epidiascope, booklets giving detailed information of the exhibits displayed in showcases should be suitably labelled. Charts and models constitute important part of teaching aid in the museum. Ideally the chart should be 3'x2' in size. Publications by the research workers and scholars in connection with their studies in their respective fields and Reports, classification are made

available.Preservation and conservative rooms be installed with a curator.

**Plastination of Specimens:** This was putforth by G.VonHagensin in 1979. Its principle is to overcome the drawback in the tissues fixed in routine formaline. The different methods of plastination are used in the preservation technique of preparation of dry, permanent, clean colored, nontoxic, odourless, beautiful and natural looking colour preserving fixative. It protects from the toxic fumes of formaline, phenol, etc. It is a technique where the water and lipid content in the tissue is replaced by a curable polymer. It requires the use of acetone, absolute alcohol, silicone rubber, Resins catalyst-Accelerator, chloroform and fluroscentcolour paints. Silicone moulds are used to take casts. It also allows easy handling and examination of the specimens without gloves and study the pathological details of the biological specimens.

It has 3 methods:

**1)Whole Organ Plastination:**This technique helps for understanding the total structure and relationship of the part. The specimen is mounted on a suitable base and properly oriented. Colouring can be done at a any stage to highlight specific parts. It also gives the result of a durable, inexpensive, maintainance free real specimensoutbeating the routine specimens.

**2)Short Plastination :**This method provides the best appreciable interrelationships. Further comparison with C.T. Scans and MRI is possible.

**3)Luminal Cast Plastination:**This technique is useful to study the measurements-dimensions and architecture of different cavities of organs. It helps to study the arterial, venous, ductal branches and their variations. The principle involves filling up of the lumen with material and dissolving the surrounding tissue. Tracheobronchial regions (lungs), cerebral ventricles, bony labyrinth, vascular patterns of Kidney, liver, lung, spleen and coronary vessels are casted. The mucus, blood, secretions, etc., will be cleared.

## VIRTUAL MUSEUMS :

A virtual museum is an online museum. It is also called electronic museum, cybermuseum, web museum or digital museum. The virtual museum file server includes also a collection of specimens, drawings, diagrams, photographs, video segments, articles and host of many other items. Most of these are professionally structured and constructed. It offers a different kind of learning by the students. Above all it possesses the capacity to transmit valuable information across the globe and thus provides persistent ongoing'change, activity and progress'. It is a means for multidisciplinary studies to look at a perspective and widen the visionary outlook. The path of museum technology has found its never ending, fresh and vibrant arena in the media of information, education and multiplication of the new vistas in museum technology. The use of telecommunication has fastened the new digital dimensions in the medical education flora.

Substantial progress and spectacular advanced breakthrows have taken place in the recent years in museum technology.

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How to Cite this article :
Parshwanath HA. Reorientation of Pathology Museums. J. edu. res. med. teach, 2017;5(1):3-9.
Funding: Declared none Conflict of interest: Declared none