

THE VALUE AND OPPORTUNITIES OF VIRTUAL EXHIBITS

For *PRESERVING AND EXPLORING THE HISTORY OF MEDICAL PHYSICS*

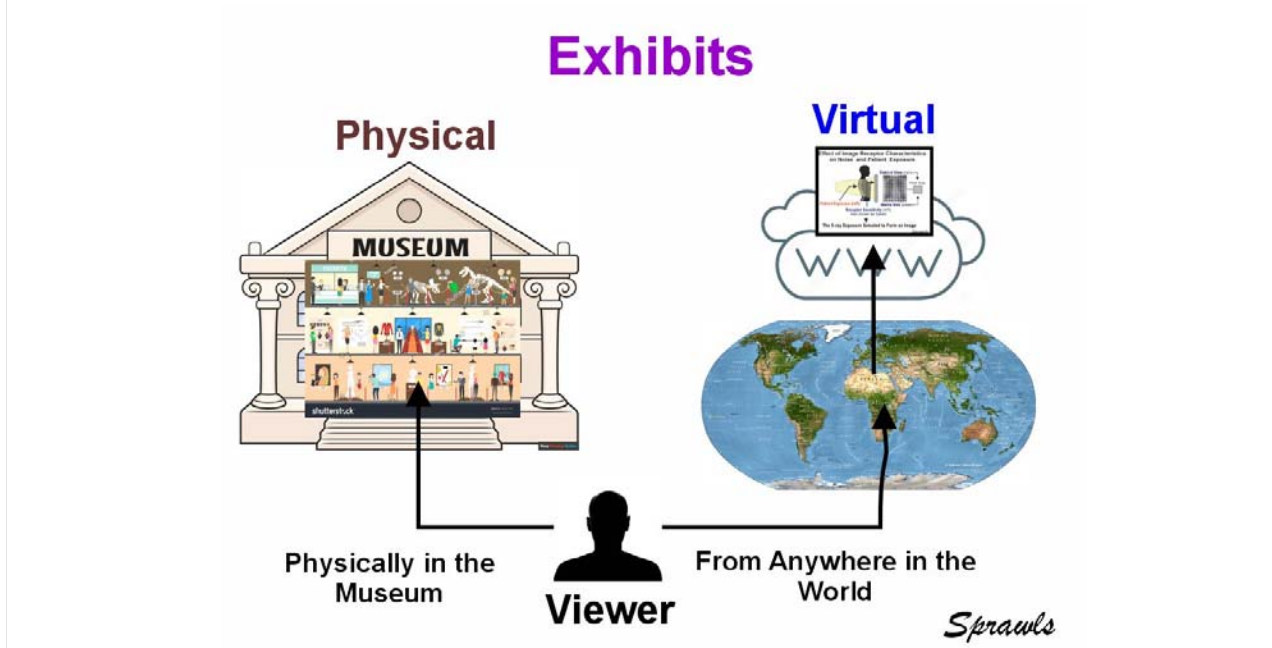
P. Sprawls¹

¹ Emory University Radiology and Imaging Sciences, Atlanta, USA
Sprawls Educational Foundation, www.sprawls.org

I. INTRODUCTION

Exhibits, as considered here, are displays created and designed to provide an observer/viewer with a learning experience about specific objects(artifacts), artistic creations, or events, that are of historical significance. They can be either *physical* or *virtual*. Both types have their distinct values, but also their limitations.

A great value of *exhibits*, compared to other resources, such as printed publications, for exploring history, is that they provide for *physically viewing* items and activities of the past in a guided learning experience. Vision is the most significant of the human senses for developing a comprehensive knowledge of physical items and activities, especially when it is augmented with additional information as will be described below.



Physical Exhibits

Physical exhibits are generally displayed in museums or at conferences where people can view and perhaps physically interact with them. The *great value* of physical exhibits is the ability to directly observe and interact with and feel connected to the objects or topics of the exhibit. A *major limitation* of physical exhibits is they are only available to people who are physically present and looking directly at the exhibit.

Virtual Exhibits

Virtual Exhibits are *digital representations* (usually images along with descriptions) of items of the physical universe including instruments, equipment, systems, procedures, projects, and events that are made available on the internet/WWW.

The *immense value* of virtual exhibits is their availability on the internet/web as an open resource for all to connect with and learn about from anywhere in the world. Virtual exhibits relating to medical physics are now posted by both physical and virtual museums along with a variety of educational institutions and organizations.

The *creation of virtual exhibits* provides an opportunity for individual medical physicists to become “archivists and historians” and use their experiences, memories, and collections of items (artifacts), to contribute to, and receive recognition for the preservation and presentation/publication of our rich history and heritage.

The objective of this article is to encourage medical physicists to create exhibits by providing examples and links to existing virtual exhibits, comparing virtual and physical exhibits, and describing the characteristics and design of exhibits that can provide effective learning experiences.

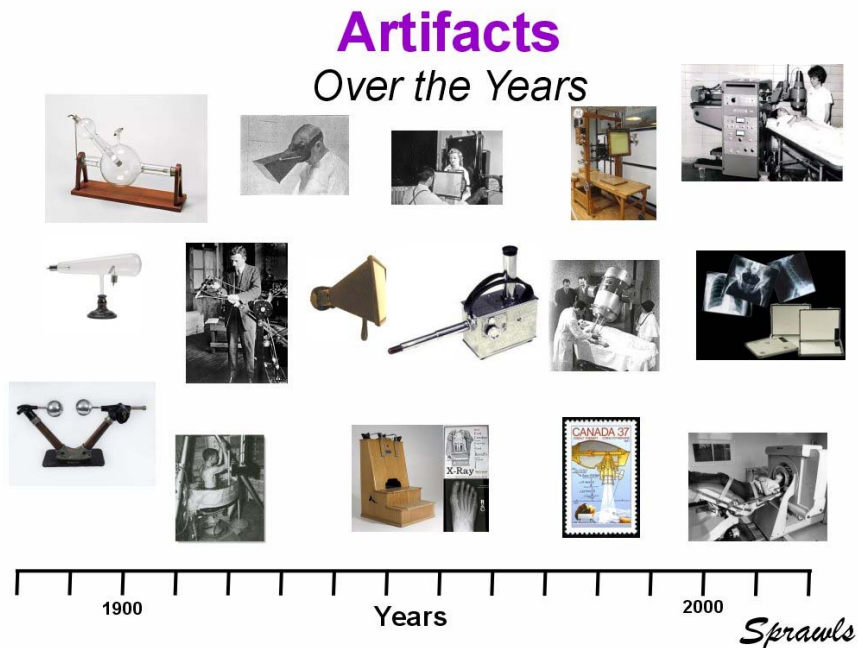
II. COLLECTING AND PRESERVING ARTIFACTS

An *artifact*, as considered here, is an object or item created and used by humans in the past that has potential historical value in helping to understand the activities of previous generations. They are distinctly different from *specimens* of naturally occurring objects like minerals, fossils, plants, etc. that are also displayed in museums. In the field of medical physics, old instruments and equipment are example artifacts as illustrated here.

A comprehensive knowledge of these artifacts provides an understanding of the foundation, innovations, and developments of medical physics and the contributions of our many pioneers, from Roentgen up to more recent times.

Physical museums and displays in institutions (especially physics departments) around the world are preserving many valuable artifacts from the past.

The reality is that *artifacts* are continuing to be created during the times of our careers.



Because of the dynamic nature of medical physics and clinical applications many of the instruments and systems, both diagnostic and therapeutic, that we have experience with, have, or are becoming *artifacts* and need to be preserved for future generations to learn about.

A major challenge is that current physical museums and academic institutions do not have the resources, especially space, to preserve and display many of these more recent artifacts.

Accepting that reality opens the opportunity for medical physicists living now to become “historians” and preserve the artifacts that were used, and at their institutions in more recent years. Not in physical museums, but with virtual exhibits.

Some examples from my personal experience will be shown here as examples.

III. MUSEUMS

Museums are almost “magical” places, that at least in our minds, can take us back into the past, or even into the future. They provide *learning spaces* in which people can interact with and explore objects and events in guided learning experiences. *Museums* are collections of *exhibits*. Generally, each exhibit provides an opportunity to focus attention on a specific item or topic.

The two major types of museums are *physical* and *virtual*. It is the long established, and often large *physical museums* that provide us with access to the largest collection of instruments and equipment of the past, but these have several limitations, including expense and access limited to those who can physically visit. *Virtual museums* are becoming more significant and valuable in several ways and is the topic of this article.

Physical Museums

Physical museums, often referred to as “brick and mortar” are usually in buildings and the exhibits contain physical objects. They are the institutions that have enriched our society for centuries by preserving and presenting elements of our history and heritage, connecting us to the great inventors and artists in the world, the opportunity to visually visit the many societies, cultures, and regions of the world, observe and learn about many, many natural species, and their roles in our environment, and much more. A major role of physical museums has been *collecting and preserving, archiving*, physical objects and items that have potential historic, scientific, or artistic value. They can range in size from one exhibit in the Physics Department of a university displaying their old instruments or equipment up to some of the world’s largest.

- The Smithsonian on the web at: <https://www.si.edu>
- Deutsches Museum on the web at: <https://www.deutsches-museum.de/en>

There are also many museums around the world that provide exhibits specifically on medical physics, radiology, and related topics that can be found through this website: https://www.radiology-museum.be/DOX/links_andere_collecties.pdf.

In addition to the preservation and presentation of history and arts, many museums provide opportunities, especially for young people, to engage, explore, and learn about modern science and technology.

Virtual Museums

Modern digital technology for creating, processing, and managing images, especially the internet, provides the infrastructure for *virtual museums*. In virtual museums physical objects are represented with images along with supporting documentation that can be viewed and studied from anywhere in the world. This provides many opportunities and values for preserving and passing on our medical physics history and heritage. Physicists, and especially Medical Physicists, practice their profession using a variety of physical devices, instruments, and equipment for medical procedures. All of these have evolved over the years. These devices from the past, now recognized as *artifacts*, are major elements of our history and heritage. While some physical museums have the actual physical items, instruments, equipment, etc. on display, it is the virtual museums that provide an opportunity for physicists and other interested persons anywhere in the world to view and learn about these elements of our rich history and heritage.

The value of a museum, both physical and virtual, in providing an effective learning experience depends on the design and content of the individual *exhibits*. There are many different designs of museum exhibits, depending on what is being presented. Many, especially looking to the past, focus on objects that are of historic significance, generally designated as *artifacts*. Other exhibits connect us with events, activities, procedures, systems, etc. that are more comprehensive than focusing on individual objects.

Connecting and Experiencing the Past

The traditional and major purpose of many museums is to connect with items and events that are the elements of our rich history and heritage. Museums consist of *collections* of *exhibits* containing *artifacts* (items and objects from the past that are of historical significance). To be of significant educational value, each exhibit should provide information about the artifacts describing their origin, characteristics, applications, and perhaps their historical significance. Along with providing exhibits, a major function of museums is to collect and *archive* (store and preserve) *artifacts and can* have large collections of artifacts in addition to those in the exhibits.

Museums usually focus on specific topics including art, nature, science and technology, cultures, and regional histories.

Our interest is in museums for preserving and providing access to the history of Medical Physics and clinical applications. Over the years, the practice of Medical Physics, especially Clinical Medical Physics, has used a variety of instruments and equipment that has evolved with the many developments in technology. The technology, instruments, and equipment of the past is a significant part of our history and heritage, in several respects. It gives us insight into how medical physics was practiced and especially its contributions to clinical medicine, both diagnostic imaging and radiation

therapy. The opportunity to physically interact with, at least visually, the item of the past provides a special opportunity to in our minds “experience” and learn about our professional history and heritage.

A longstanding and continuing challenge for medical physicists and historians is providing meaningful exhibits that have good educational value and are accessible to individuals, especially medical physicists, wherever they might be in the world. This is with the two major types of museums: *physical* “brick and mortar” in buildings and *virtual* museums on the internet. Each type of museum has both its special values, and its limitations. A factor that contributes to the value of a specific museum, both physical and virtual, is the characteristics and quality of the exhibits. For maximum value and exhibit should be more than just a display of artifacts. Displaying artifacts without supporting information is one of the limitations of many museums. This generally does not have the resources to develop and display the additional information but is valuable for showing what old items looked like and demonstrating that they are being preserved.

Medical Physics Virtual Museums provide two major opportunities. One is the ability to explore and connect with items and events of the past that are elements of our rich history and heritage displayed in virtual museums anywhere in the World. The other is the opportunity for us medical physicists today, to participate in the preservation of our history by creating exhibits for virtual museums. This can be from our memories and experiences from the past, old instruments and equipment at our institutions, and other items of historical significance we have collected and saved and would like to show and discuss with others. We now consider this opportunity with an emphasis on the characteristics of exhibits that contribute to their educational value.

Exhibits, both physical in “brick and mortar” museums and virtual on the internet are major resources for preserving and exploring the history and heritage of medical physics and related topics, especially clinical applications.

IV. LIBRARIES AND HISTORICAL PUBLICATIONS

A distinction is made between Museums and Libraries. Both are significant in the preservation and providing access to history. History is published in a variety of books and journals that are available in *Libraries*, both physical and online. A major resource for exploring the history is the journal: *Medical Physics International History Series* online at: www.mpjournal.org/history.aspx.

V. EFFECTIVE EXHIBITS OF ARTIFACTS

An *effective exhibit* is much more than just displaying an artifact or *image* of an artifact (instrument, equipment, etc.). An effective exhibit should provide a comprehensive *visually based* learning experience, displaying the artifact and providing related details.

This is through physical interaction with the artifact, usually visual, along with text and diagrams to enhance the learning experience. References or links to other sources, especially publications, provide more detailed information and add value.

The example shown here is an exhibit of a Wimshurst Machine (used in the early days to provide high voltage for x-ray production) It combines four factors to convey “the full story”.

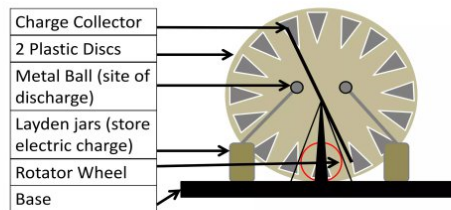
Wimshurst Machine

Perry Sprawls, Ph.D,

Image



Diagram



Discussion

In the Wimshurst machine two insulated disks with metal sectors are rotated in different directions. Electrostatic charges build up on the metal sectors and collected by metal points close to the moving sectors. The charge builds up on Leyden jars (capacitors) to a high voltage and was used in early X-ray generators.

Reference

<https://en.wikipedia.org/wiki/Wimshurst.machine>

Sensory Interaction with Objects

A major value of a *museum exhibit* is providing a physical connection between a person and artifacts. This is most often a visual connection but sometimes the opportunity to touch and explore in more detail. In physical museums the interaction with the exhibit is generally for a short time and often when standing. The first need is for the exhibit to attract attention. A posted title for the exhibit might help, but usually it is the ability to view the item or condition, either directly or virtually with images that establishes an interaction and attracts attention.

The effect of viewing an object is it contributes to the formation of *sensory conceptual knowledge* in the mind including many physical characteristics that cannot be conveyed in any other form. When an item is of historical significance, viewing it helps connect us to the times and events in which it was involved.

However, just viewing an item, especially complex items, like the Wimshurst Machine, does not provide for an understanding of how and item functions or its applications. its many characteristics, functions, and applications. For that additional information is needed.

Functional Diagrams and Illustrations

Diagrams and illustrations, like often used in textbooks and classroom teaching, can provide valuable illustrations of how artifacts (instruments and equipment) function and are used.

Discussion with Text

Learning by viewing an item can be enhanced if it is guided by text calling attention to specific features and adding additional details and information. This is what we do in classroom teaching. Exhibits benefit from a relatively short discussion, especially discussion that focuses on the characteristics of the item. For physical exhibits when the viewer is usually standing, the discussions should be short and “to the point”,

References, Especially Online References

With the limited information that can be displayed in an exhibit, links to references with additional details add value. Online references are especially useful as they can be viewed as an extension of the exhibit. For the Wimshurst machine here is an example: https://www.youtube.com/watch?v=XMO2NGrW1mU&ab_channel=HistoryofScienceMuseum.

Some virtual museums that provide exhibits with images, discussions, and some with references are:

- Oak Ridge Associated Universities (ORAU) Museum of Radiation and Radiology
On the web at: <https://www.orau.org/health-physics-museum/index.html>.
- University of Nebraska Physics and Astronomy Department Museum
On the web at: <https://www.unl.edu/physics/historical-scientific-instrument-gallery>.
- The Cathode Ray Tube site, *150 years of CRT evolution*. The Dutch collection.
On the web at: <https://www.unl.edu/physics/historical-scientific-instrument-gallery>.
- Museum of X-Ray Tubes of Opole University of Technology
On the web at: <https://muzeauczelniarne.pl/en/museum-of-the-opole-university-of-technology-and-x-ray-tubes/>.
- Dr. Zahi Hakim Museum
On the web at: <https://medicine.lau.edu.lb/related-entities/zahi-hakim-museum/collection/>.
- The AAPM Virtual Museum
On the web at: <https://museum.aapm.org/>.

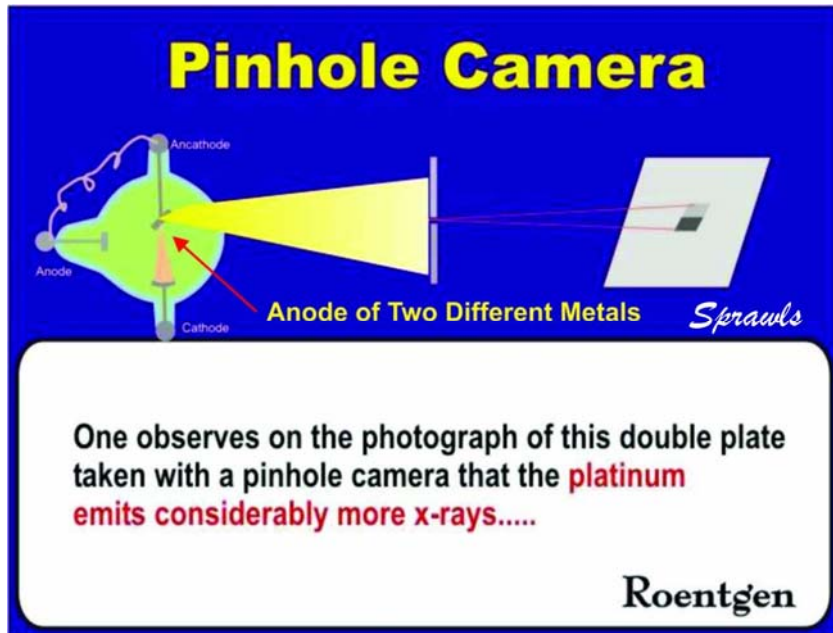
VI. EXHIBITS OF HISTORICAL ACTIVITIES AND EVENTS

It is not just the objects, *artifacts*, that represent our history, but also many activities and events that are historically significant. These can be represented by pictures, photographs or drawings illustrating the activity. Labels are added within the pictures or brief legends. Text is added to describe the activity and its historical significance. For historical events where there are no available pictures, illustrations for exhibits can be created from published descriptions, Roentgen's discovery, and extensive research on the characteristics of "a new kind of rays" is an example shown below.

An effective exhibit is one that "takes us back in time" and enables us to, *in our mind*, be present and observe events.

Roentgen's Discovery and Research

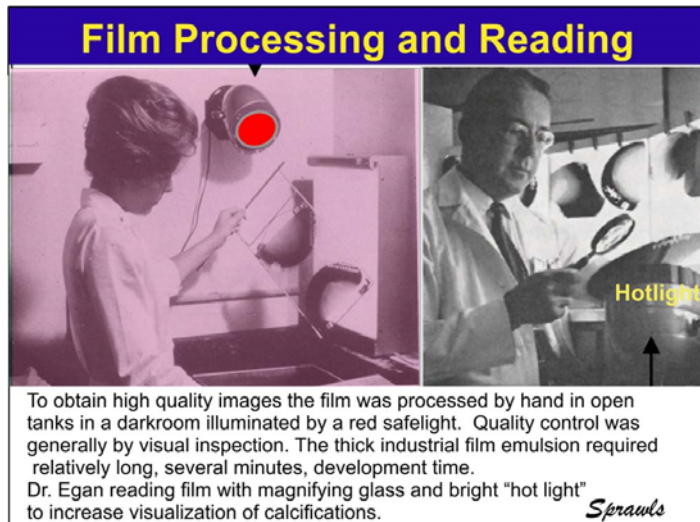
The discovery of a "new kind of radiation" and intense research to determine its characteristics by Prof. Wilhelm Roentgen was the beginning of medical physics and clinical applications of radiation as we know it today. The results of his research were described with words in several publications but without illustrations. To help "take us back in time" and observe the experiments, a series of visuals have been created and published as a virtual exhibit as illustrated here.

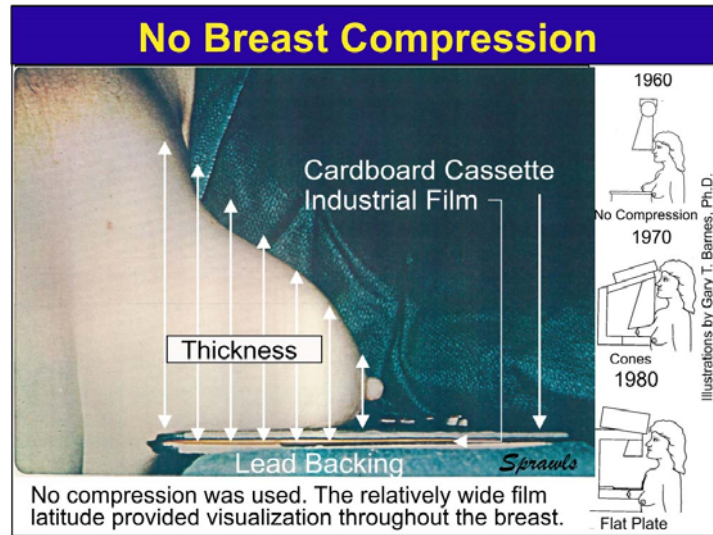


This is one of the series of exhibits in the virtual museum display at: <https://museum.aapm.org/exhibit/01-roentgen-discovery-and-research/>.

The Early Developments in Mammography

Early in my career, I was conducting research and developing clinical applications in mammography in collaboration with Dr. Robert Egan, generally recognized as the father of mammography, especially in America. The combination of memories and artifacts saved from that time are the foundation of the virtual exhibits shown here.





The series of exhibits on this topic can be viewed at: <https://museum.aapm.org/exhibit/06-mammography/>.

VII. CREATING AND PUBLISHING EXHIBITS

Virtual museums provide an opportunity for individuals, institutions, or organizations to contribute to the preservation and presentation of the history of medical physics and related clinical applications. It is a special opportunity for medical physicists, especially senior medical physicist, with years of experience to use their memories along with their collections, or “archives,” of items used during their careers that have historical significance, both now and in the future. This includes preserving the history of physical instruments and equipment *that will not be placed in physical museums*, along with activities and events that occurred in the past. Preserving history is not just looking back into the past, it also includes the preservation of more recent medical physics items, activities, and applications.

A creation can consist of a single exhibit, or visual illustration with supporting information, or a series of exhibits on a specific topic.

Academic Institution Historical Websites

Many academic institutions and physics departments have history sections on their websites. These could be appropriate for posting virtual exhibits relating to developments and activities by faculty and staff that are, or will be, of historical significance.

The AAPM Virtual Museum

The Virtual Museum of the AAPM (American Association of Physicists in Medicine) provides a place where individual medical physicists can display exhibits, they develop.



For information on contributing exhibits please go to: <https://museum.aapm.org/contact/>.

VIII. MEDICAL PHYSICISTS AS HISTORIANS AND ARCHIVISTS

Traditionally, it is professional historians along with museum curators and archivists that collect, preserve, and display representations of physical items and events that are of historical significance. These are in physical displays and museums around the world.

Now, the technical capability to create *virtual exhibits* and publish manuscripts (like this one) provides the opportunity for any interested medical physicist to become a historian and archivist, especially in relation to the practice and applications of medicine during their careers. In this respect, we medical physicists have the advantage of experiencing or observing this era in the continuing evolution and developments in medical physics and clinical applications. We often have the comprehensive knowledge and perspective to create exhibits and write manuscripts that can provide interesting learning experiences for future generations.

Historical Manuscripts

The journal, *Medical Physics International History Series*, publishes articles on the history of medical physics and related clinical applications. On the Web at: <http://www.mpijournal.org/history.aspx>.

Virtual Exhibits

This article provides guides for designing and examples of *effective virtual exhibits*. The creation and posting of exhibits can be a significant contribution to preserving our history, and a rewarding personal experience.

About The Author



Dr. Perry Sprawls

Perry Sprawls, Ph.D. is a clinical medical physicist and educator in medical imaging physics and clinical applications.

A major interest and activity have been the history of medical physics and related clinical activities. Much of this history, the developments, and innovations of the imaging modalities, mammography, CT, MRI, and Digital Radiography, occurred during his 50+ year career working with each as a clinical medical physicist. It is this experience that provides the background and knowledge to help preserve and share this history through publications (sprawls.org) and development of virtual exhibits. He has served on the History Committees of the AAPM and IOMP with an emphasis on encouraging other medical physicists to participate in the historical process. This also continues in his role as Founding Co-Editor of the *Medical Physics International Journal History Series*.

Author: Perry Sprawls
 Institute: Emory University and Sprawls Educational Foundation
 Website: www.sprawls.org
 Country: USA
 Email: sprawls@emory.edu