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RADIOLOGY PAST, PRESENT AND FUTURE: RADIOLOGY REVOLUTIONIZING MEDICINE. BENEFITS OF RADIOLOGY IN GLOBAL HEALTH

Daniel J. Mollura, MD
President and CEO
RAD-AID International

THE NEED FOR GLOBAL RADIOLOGY

Radiology has revolutionized medicine in the last 100 years in which imaging is now used in virtually every specialty of health care for diagnosis and treatment, and a vital component of public health care programs.

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THE NEED FOR GLOBAL RADIOLOGY

World Health Organization Reports that one-half to two-thirds of world's population lacks adequate access to radiology imaging services:

3.5-4.7 billion people

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Presentation

- Brief history of radiology
- Examples of radiology in global health
- Disparity of access to radiology worldwide
- Outreach efforts to increase access to high quality radiology services

Origins

- Wilhelm Röntgen
- Experiments with vacuum tubes containing current, and noticed flourescence on a screen even though visible light could not pass through.
- Persisted in trying to explain the origin of this image, as a new ray, “X-ray”, November 8, 1895.

Origins

- First Image several weeks later
- 1903 first images of pneumonia
- Coolidge Tube 1913
- Bucky Grids 1913-1920
- Trudeau Group for radiographic criteria in diagnosing TB, 1916.

1918 the Pivotal Year for Radiology

- Influenza Epidemic
- World War I
- U.S. mobilization for WW I implemented large scale x-ray services to diagnose lung disease

1918 the Pivotal Year for Radiology

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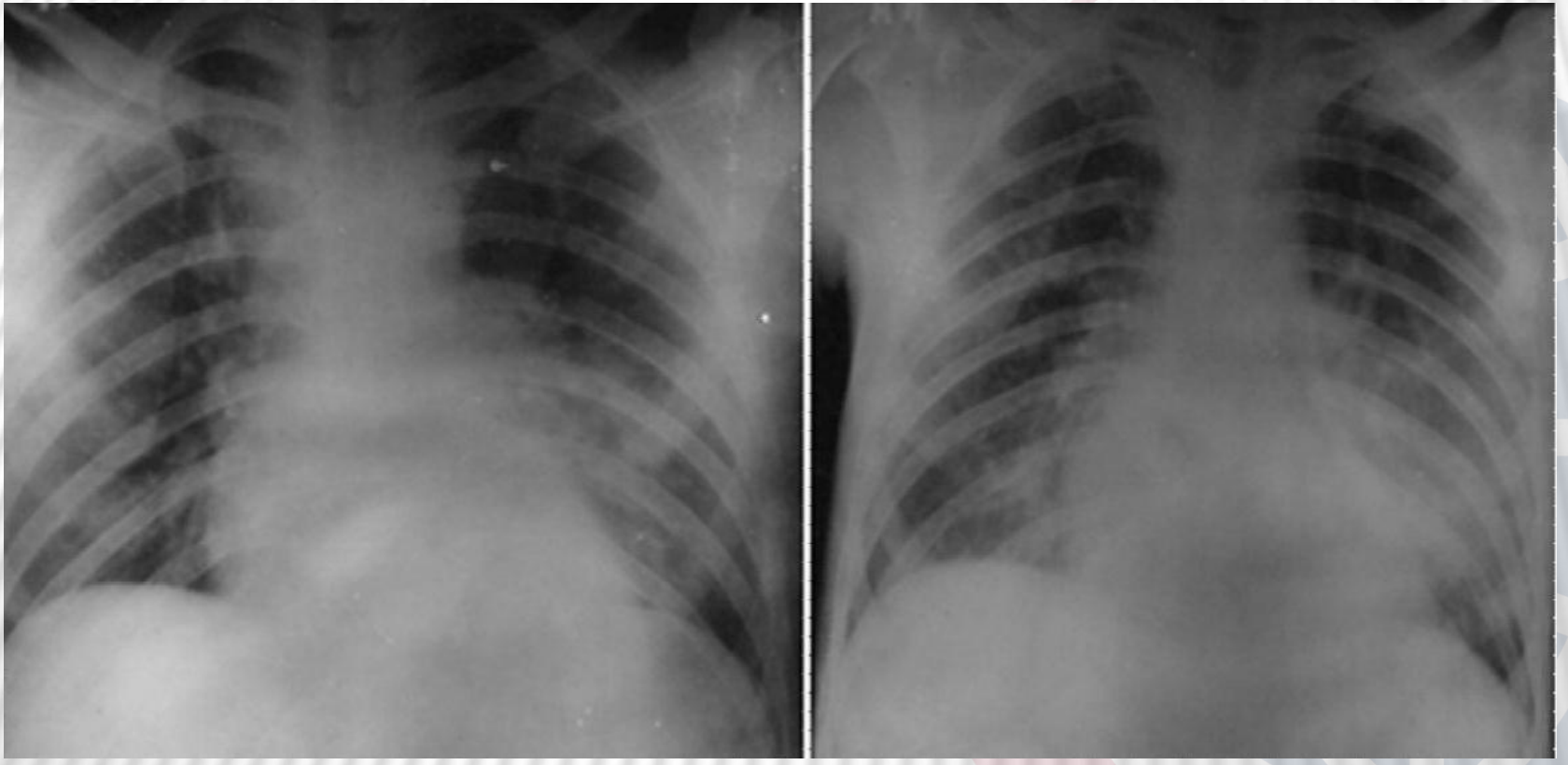
1918 the Pivotal Year for Radiology



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1918 the Pivotal Year for Radiology

- X-ray in World War I and Influenza epidemic became standard practice for diagnosis, screening and triage used in lung disease and trauma

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1918 the Pivotal Year for Radiology

Reflecting on WW I, Hickey wrote in 1923,

We can safely say that the average internist, during his military service, became rapidly educated to seek the assistance of the roentgenologist-…. Not only did the military surgeon become rapidly accustomed to a more liberal employment of these examinations, but the returned soldier, when confronted by illness himself or of his family frequently suggested the use of x-rays to which he had become accustomed during his time of military service.

Hickey PM. The effect of the war on the development of roentgenology. AJR Am J Roentgenol. 1923; 10:70–5.

Mollura DJ, et al. J Am Coll Radiol . 2010 September ; 7(9): 690–697.

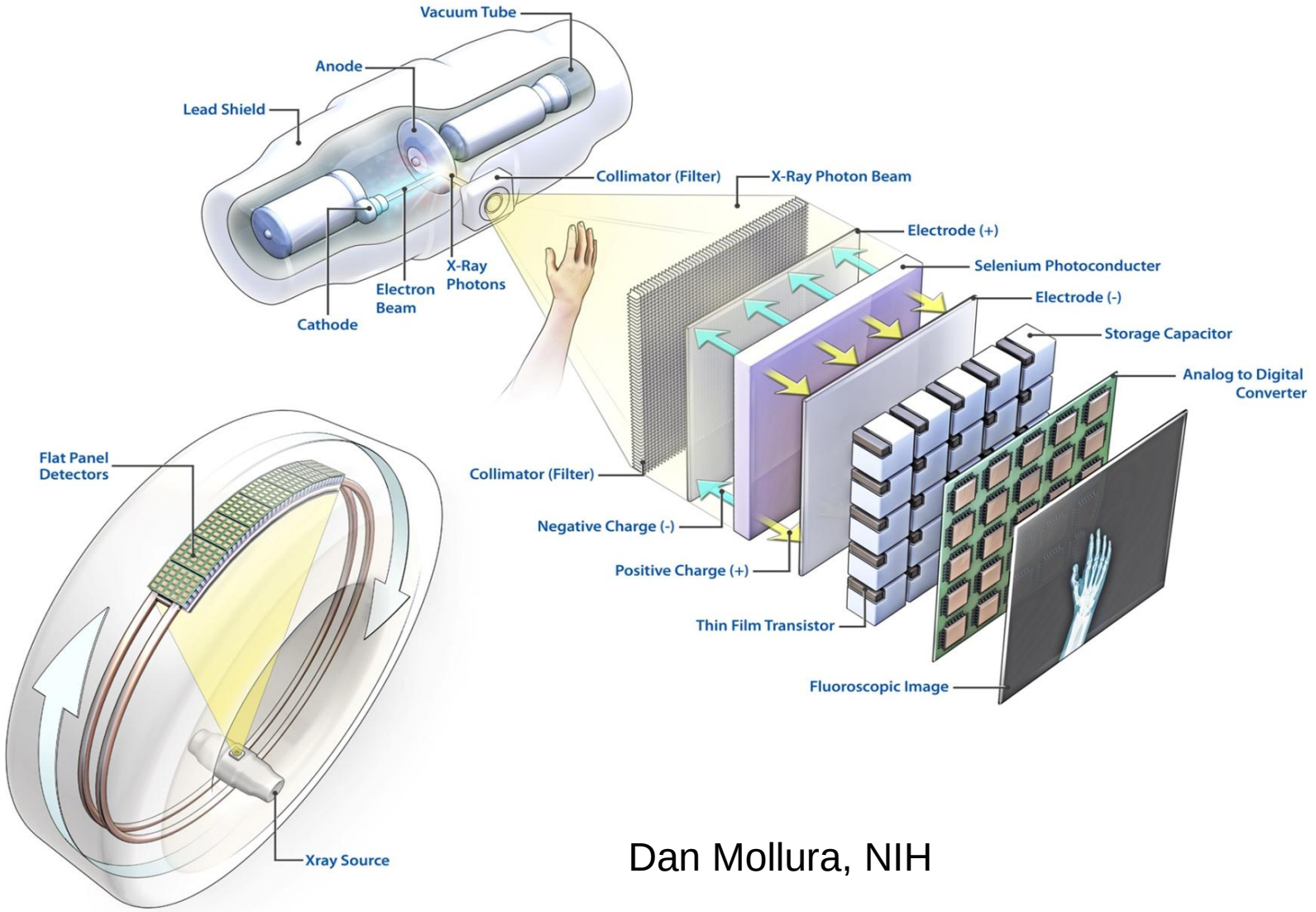
Acceleration of Radiology in 20th Century

- Late 1950 and early 1960s: Mammography
- Development of CT in 1960s with first CT performed in October 1971 and announced in 1972.
- Ultrasound, 1939-1960 development
- MRI, developed 1950s and 60s, first MRI in 1972
- 1896 (Henri Becquerel) and 1897 (Marie Curie) origins for radioactivity → nuclear imaging. PET Imaging in 1980s

Concept of Radiology

- Energy source (x-ray, sound, radio, etc)
- Energy interacts with body tissues
- Body emits the altered energy, detected by hardware, processed by electrical circuits and software to produce an image:
  - X-rays (CT and radiography)
  - Radio (MRI)
  - Sound (Ultrasound)
  - Radionuclide photons (Nuclear Medicine, PET)

Computed Tomography (CT)



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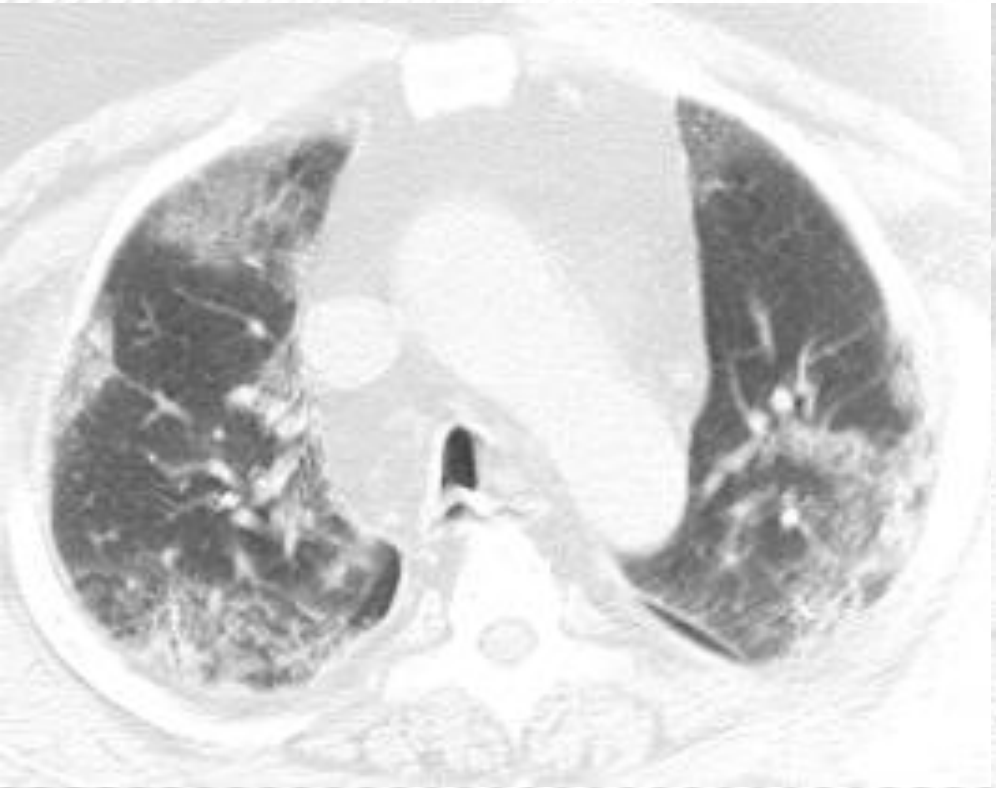
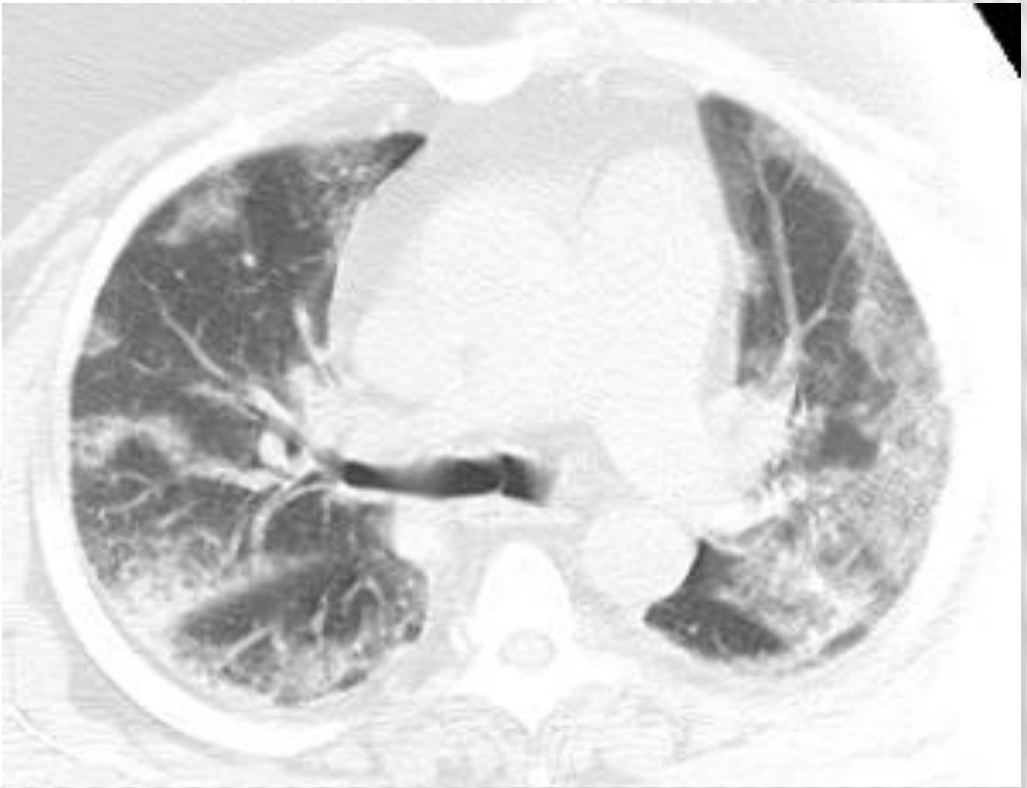
CT as cross sectional imaging





FINDINGS on CT of Lungs:
Peripheral, Peribronchial
Ground Glass, Rounded Patches in
Influenza, 2009

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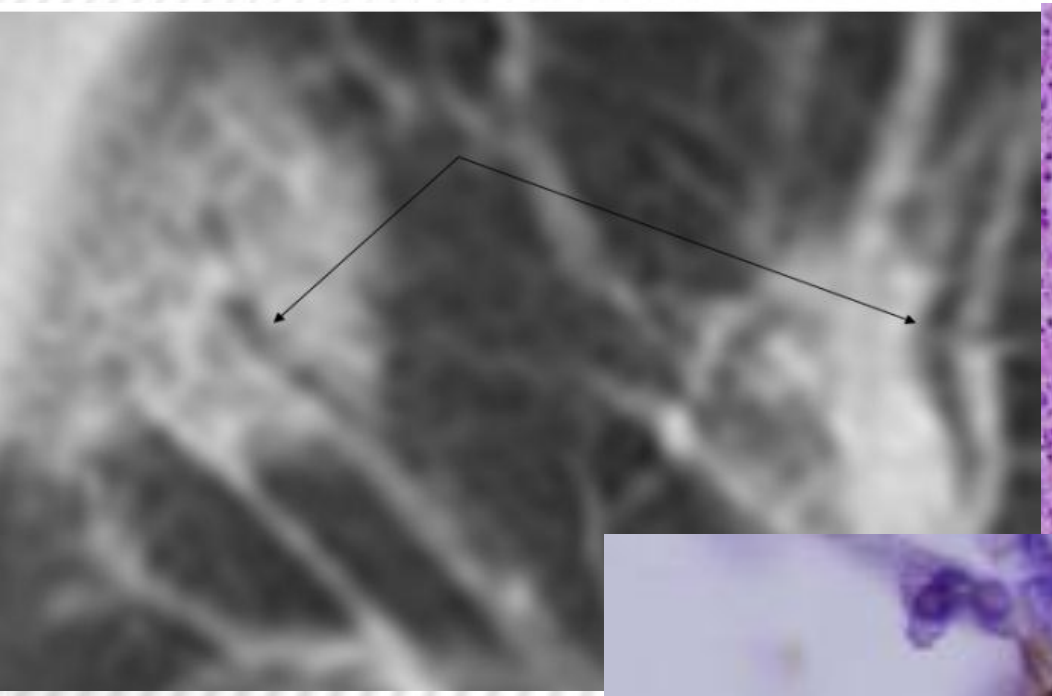
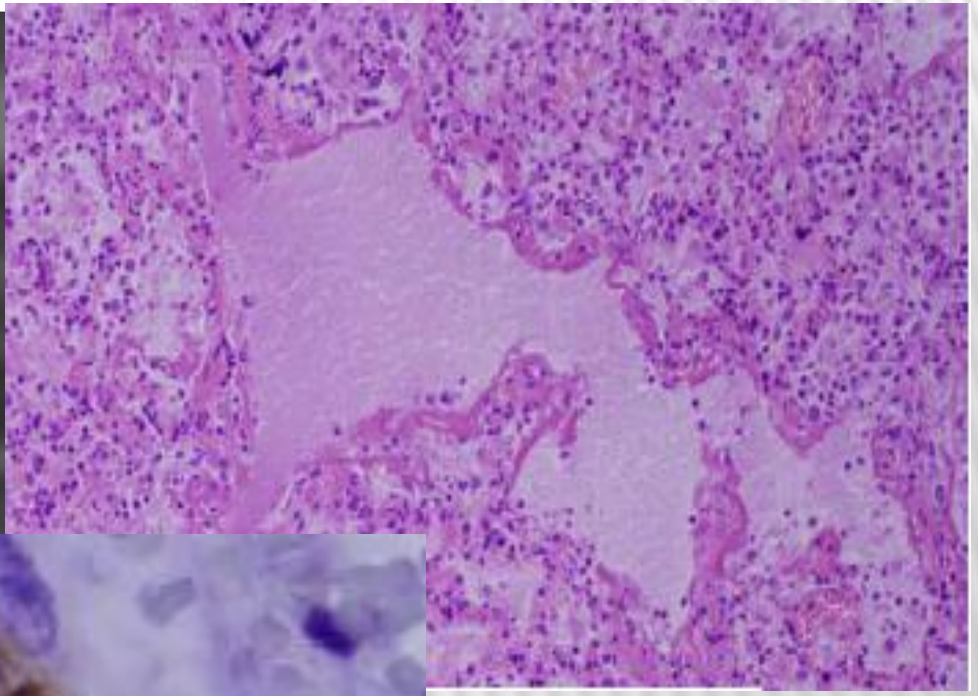
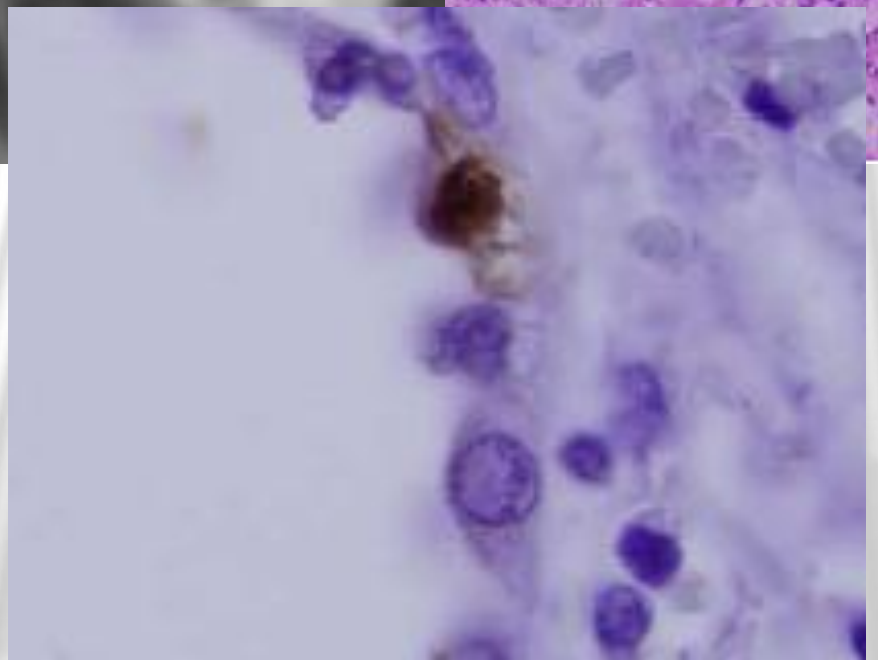
Radiologic-Pathologic Correlation







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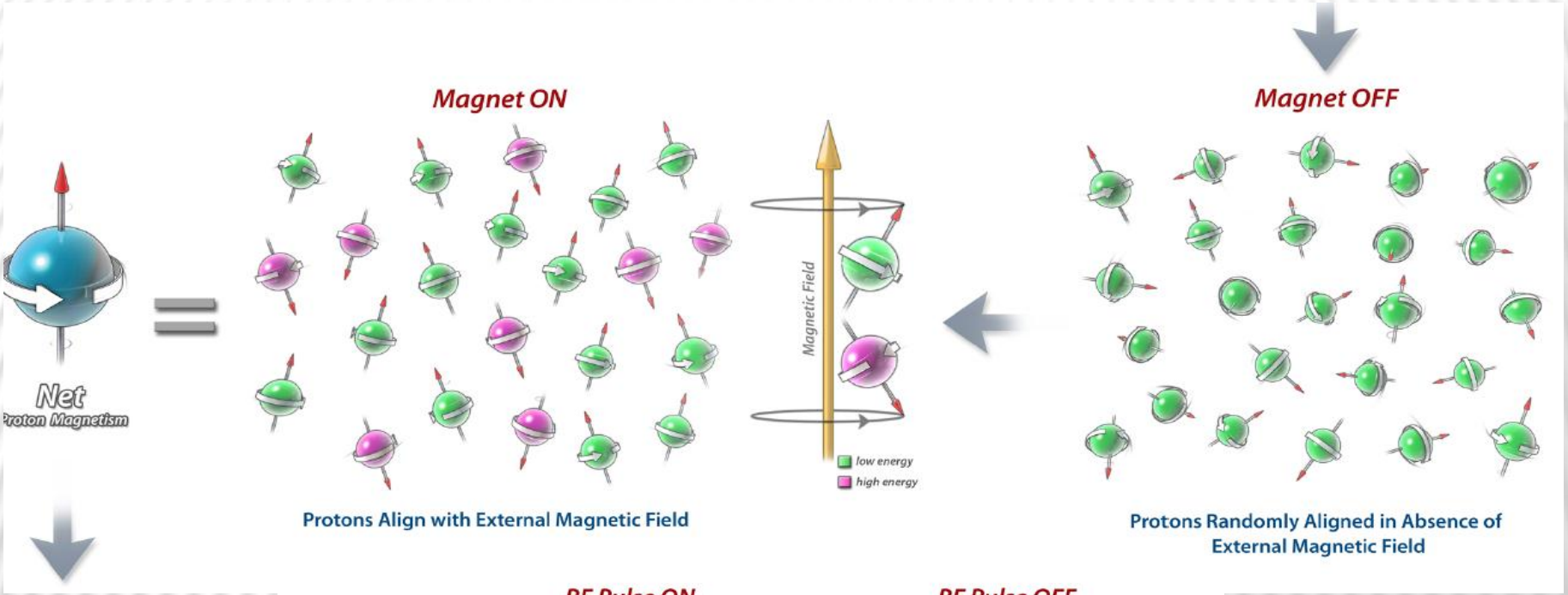
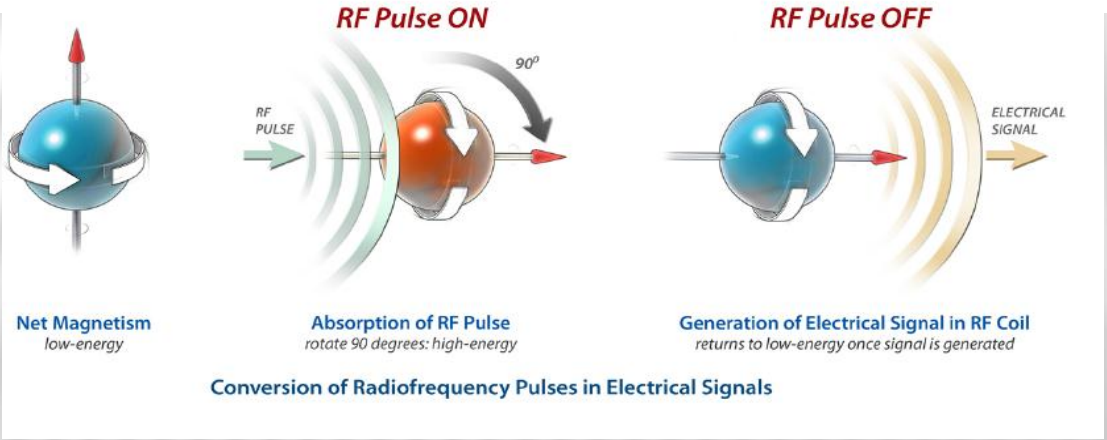
MRI for Molecular Imaging





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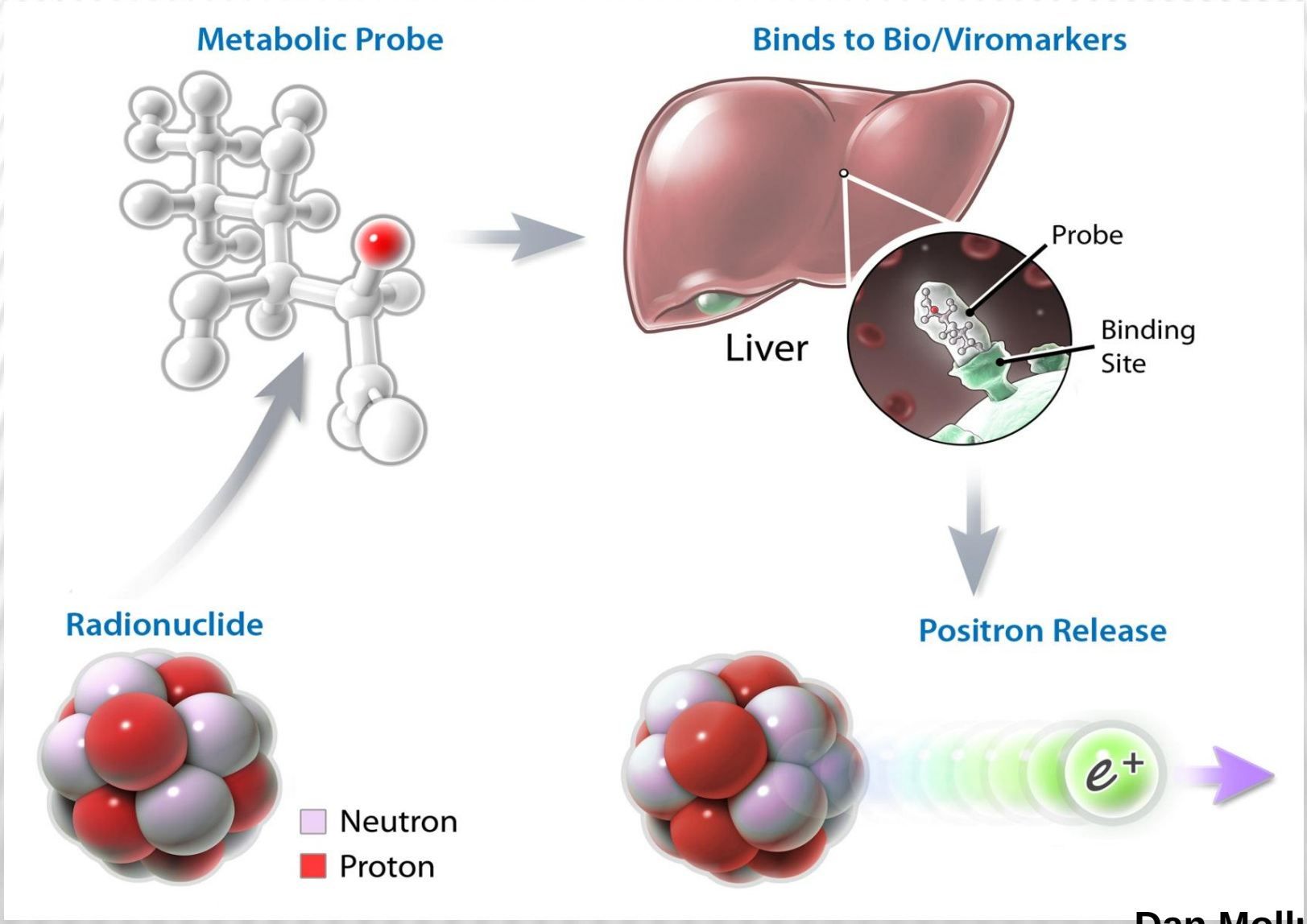
Positron Emission Tomography (PET)



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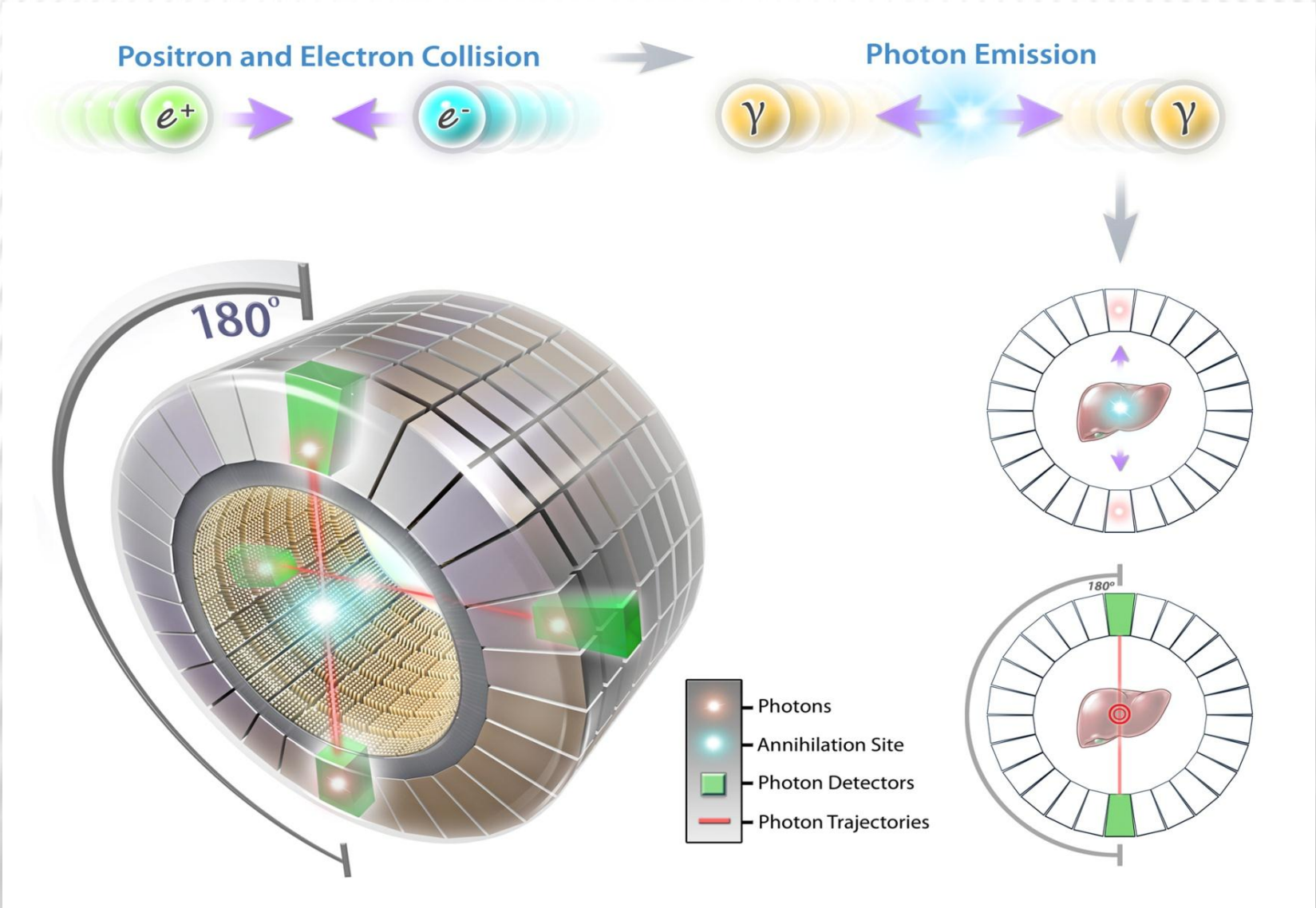

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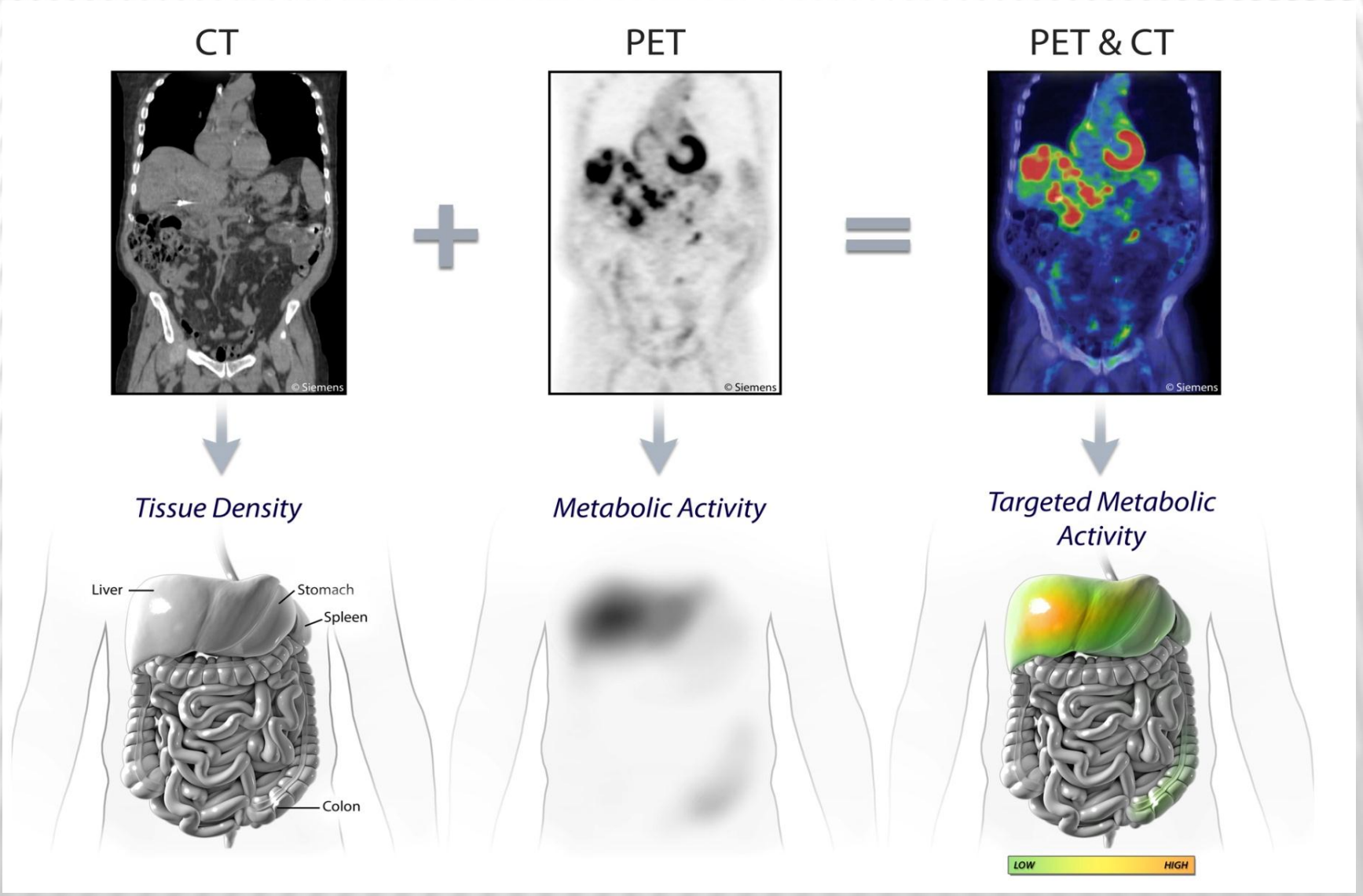
PET/CT for Molecular Imaging



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Future of Radiology

- Advanced computer processing of imaging
- Fusion of modalities
- Radiotracer development in molecular imaging techniques
- Lowering radiation dose

- We must deal with disparity and access to radiology care…

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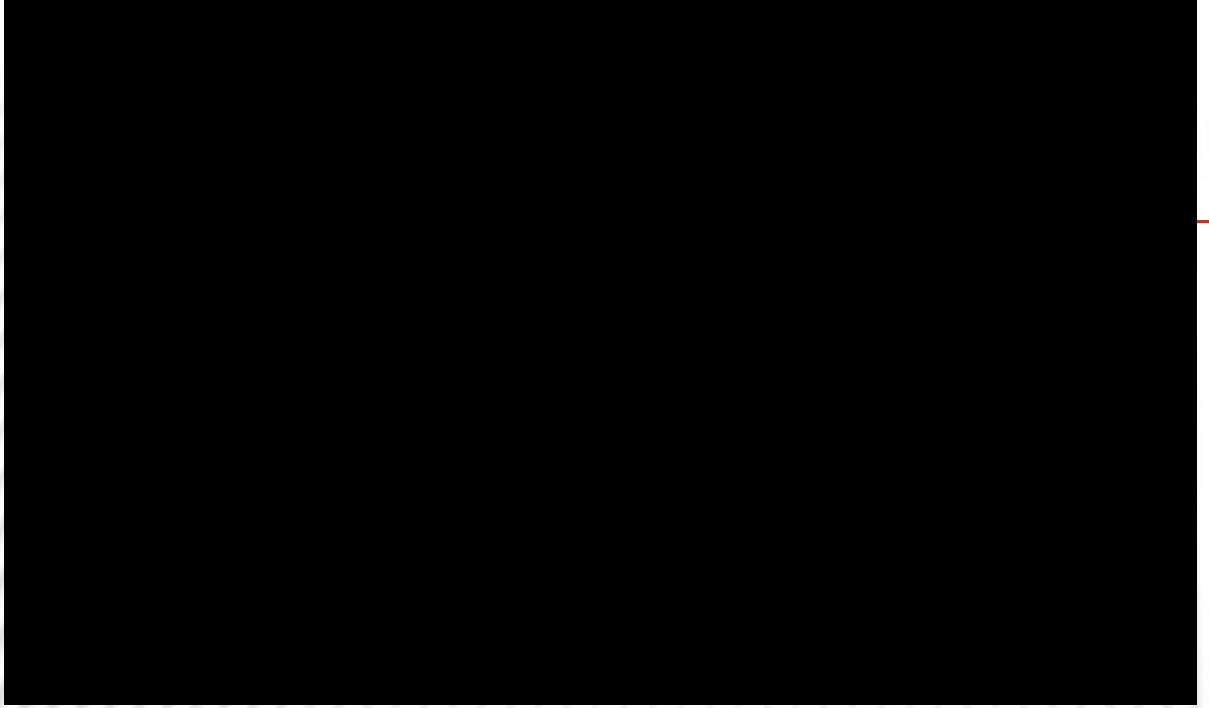

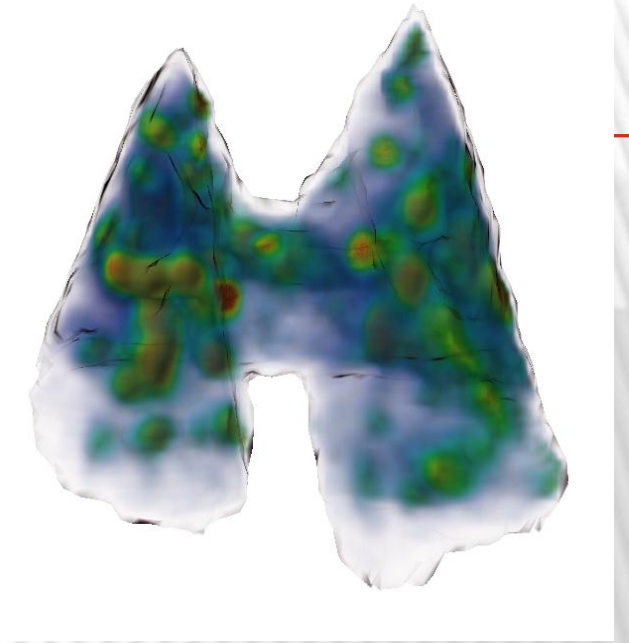

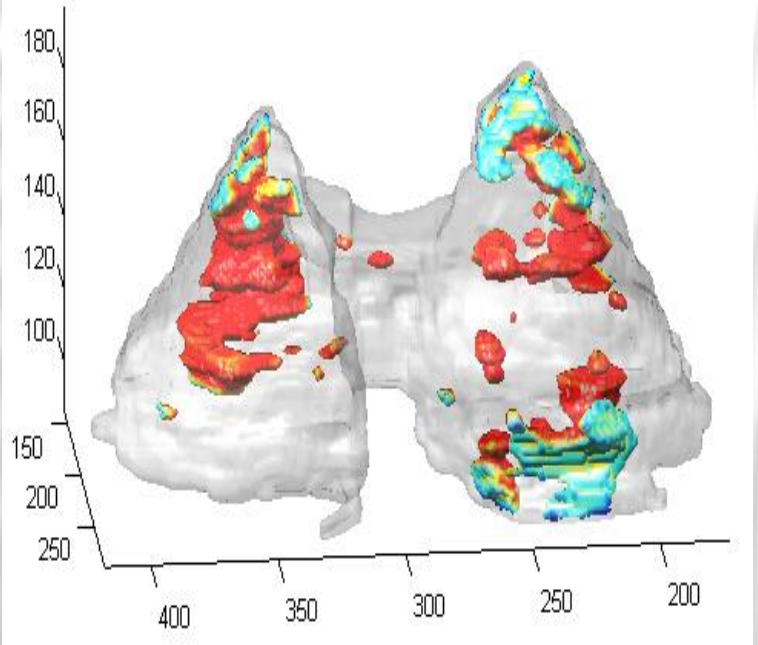
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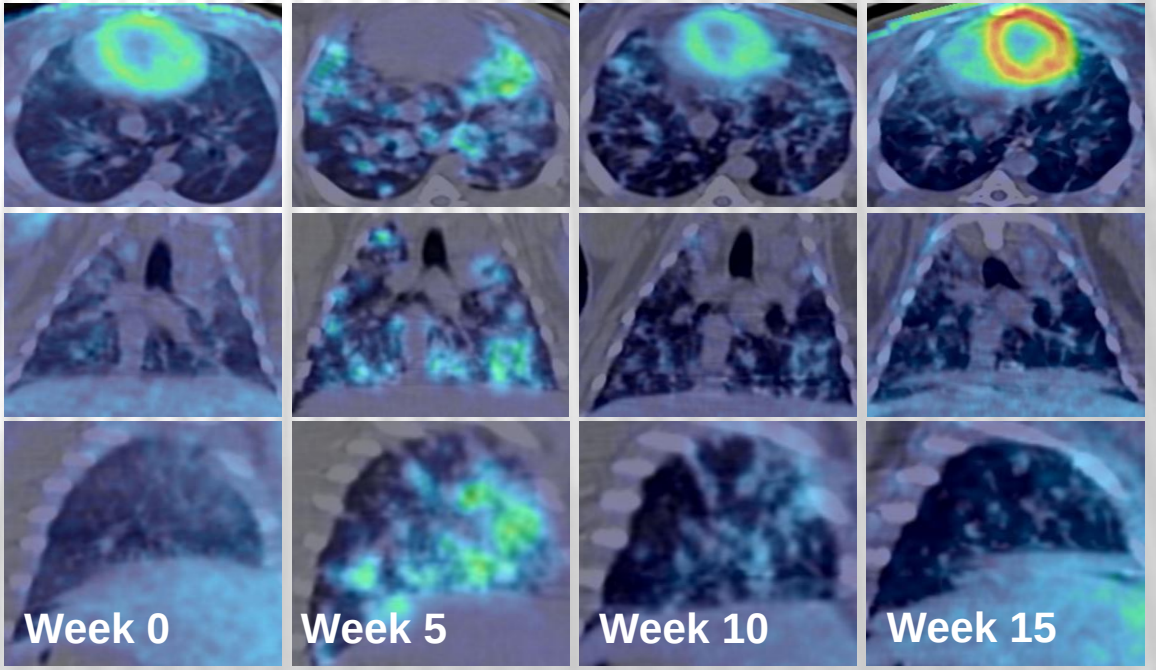
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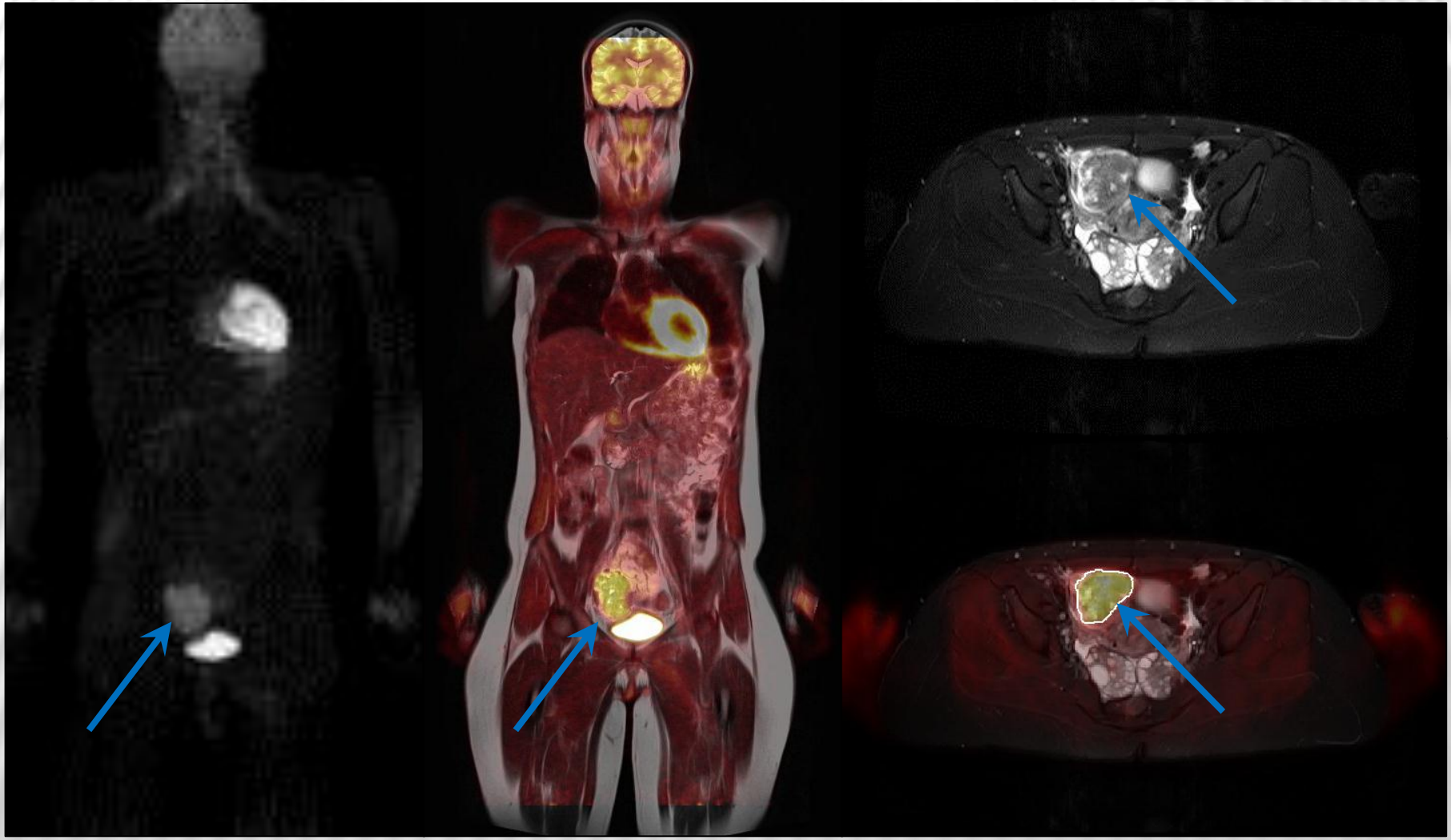
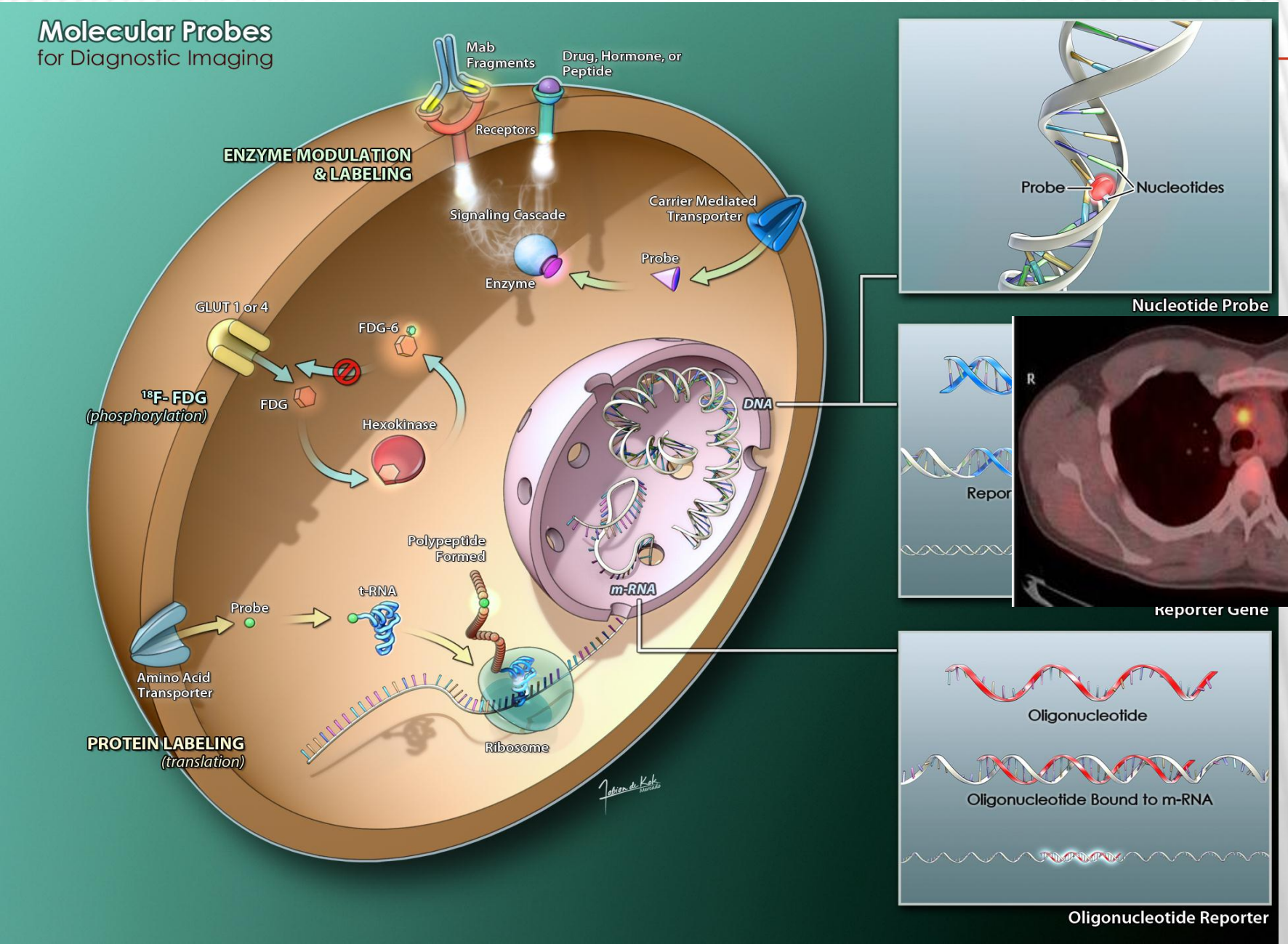
FUSION: THE EXAMPLE OF MRI-PET



Radiotracers of the Future



Lowering Radiation Dose

- Improved hardware
- Software for recording and monitoring dose
- Maintain quality
- Directed imaging to alter dose so that images are made for focused clinical purposes
- Careful monitoring of adverse affects

BUT…there is great global disparity in access to radiology health services…

MEASURING SHORTAGE

*MEDICAL DEVICE DENSITY MEASUREMENT

- Most countries in Africa have less than or equal to 1 CT scanner per 1 million inhabitants; Denmark has 24 CT scanners per 1 million inhabitants
- MRI: nearly all countries in Africa <1 MRI per 1 million; Denmark with 14 MRI scanners per 1 million.
- 1 doctor per 8500 vs 1 per 350 in US; >20:1 differential

Source: 2010 WHO Global Health Observatory, available at http://www.who.int/gho/health_technologies/medical_devices/medical_equipment/en/index.html **and** 2012 https://www.cia.gov/library/publications/the-world-factbook/geos/us.html

THE NEED FOR GLOBAL RADIOLOGY

Most medical decisions and public health programs are now influenced by medical imaging and radiology tests in developed countries, leaving most of the world behind

RADIOLOGY IS A FOCAL POINT

FOR ADDRESSING HEALTH DISPARITIES

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THE RADIOLOGY DIVIDE

- "In…Sub-Saharan Africa… up to 70% of equipment lies idle due to mismanagement of the technology acquisition process, lack of user training, and lack of effective technical support." –WHO Guidelines for Health Equipment Donation (2000)

MISSION of RAD-AID

- Increase access to medical technology and radiology in developing regions of the world
- Optimize the role of radiology in global public health initiatives and clinical health care
- Build sustainable health care solutions for long term viability of radiology services for targeted health service needs.

RAD-AID STRATEGY

1. Interdisciplinary
   - Integrated analytical approaches (econ, tech, education, clinical, pub health)
   - Multiple imaging modalities
2. Long Term Sustainability with Data Driven Approaches
3. Economies of Scale
   - Multiple nations with on-site clinical partners to leverage numerous global efforts at once
4. Horizontal Structure to promote innovation, research, and public service across wide base of emerging leaders

Sustainability: *RADIOLOGY-READINESS*™

- Optimize the use of radiology in developing countries having limited resources
- Systematic analytical framework for integrating radiologic, clinical, technical, economic, and emerging market development.
- Optimize the yield of donated resources through sustained education, training, clinical collaboration and technology support.
- Integrate economic, policy and public health factors to develop local and regional economies supporting health care with job creation and improved health outcomes

BUILDING RESOURCES

SCIENTIFIC AMERICAN

SEARCH

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PET Project: Radiologists Push Imaging Technologies in Developing Countries

RAD-AID, Project Hope and Philips Healthcare team up to assess the ability of communities in western China and northern India to use CT scans, MRIs and other imaging equipment to improve health care

By Larry Greenemeier | August 2, 2010 | 0

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SSRD (DR. SHAMER SINGH MEMORIAL RADIODIAGNOSTIC CENTER)

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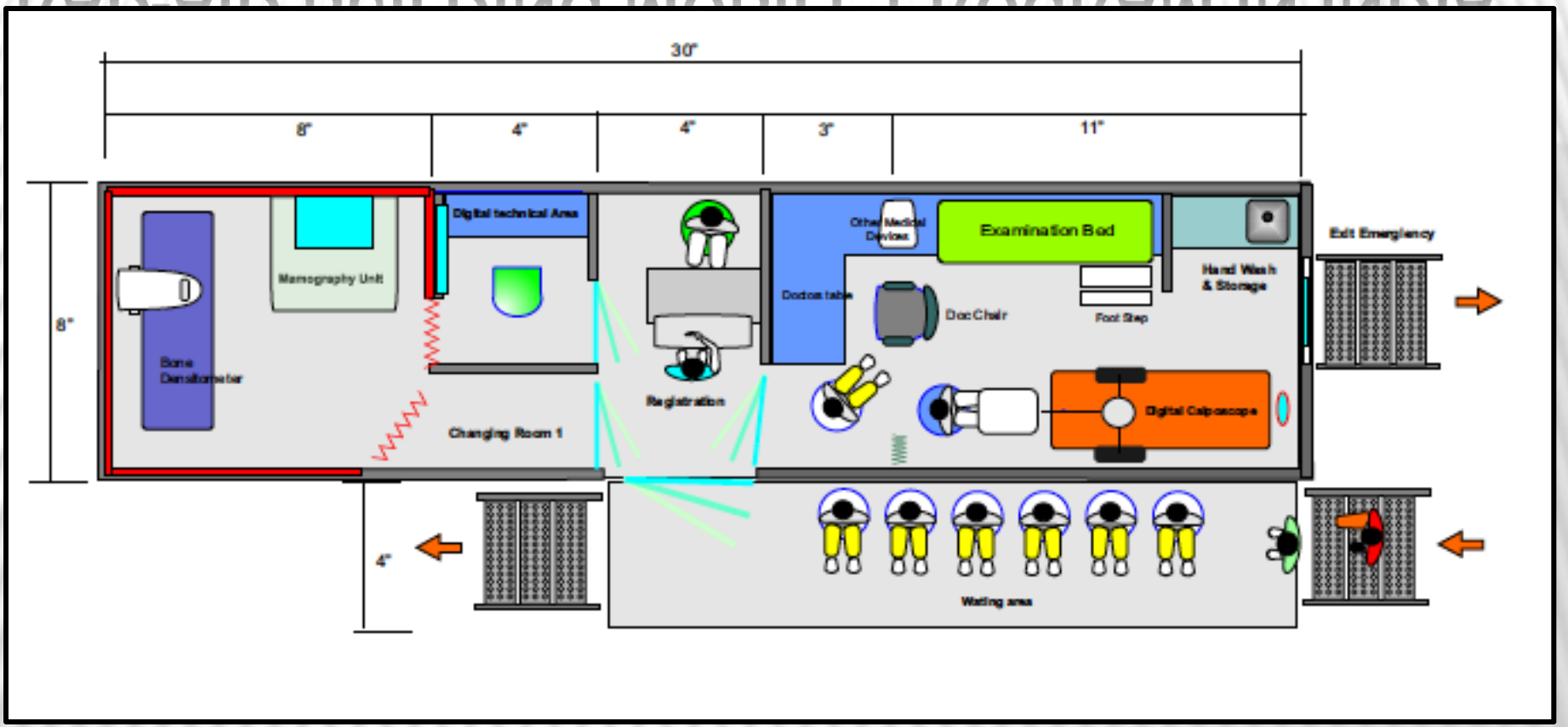
RAD-AID BUILDING MOBILE PROGRAM IN INDIA



- Public Service, Community Outreach
- Public Health for Multiple Diseases
- Radiology Research

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RAD-AID BUILDING MOBILE PROGRAM IN INDIA

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DRIVING FORWARD: GHANA

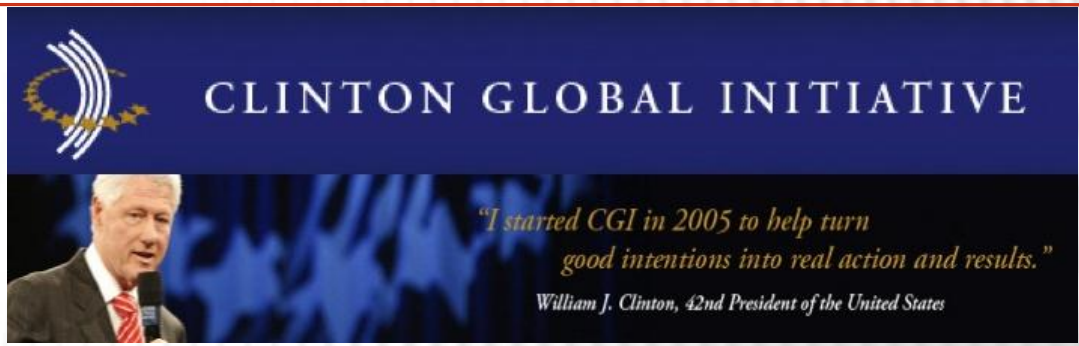
RAD-AID PARTNERSHIP WITH WHO

- World Health Organization, Radiological Health Division
- Pan American Health Organization (PAHO)
- Data Collecti
- Quality
- Safety
- Access

AWARD

Clinton Global Initiative Award: *Champions of Action session*

- Clinical Model Innovation
- Public Private Partnership



Former President of Costa Rica, 1994-1998, Jose Maria Figueres Olsen, CGI, September 2012.

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YEARLY RAD-AID CONFERENCE

- Yearly forum on international radiology project development
- JACR White Paper summarizing conference
- 2009-2013 – doubled in size of conference.

White Paper Report of the 2010 RAD-AID Conference on International Radiology for Developing Countries: Identifying Sustainable Strategies for Imaging Services in the Developing World

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The 2010 RAD-AID Conference on International Radiology for Developing Countries was a multidisciplinary meeting to discuss data, experiences, and models pertaining to radiology in the developing world, where widespread shortages of imaging services reduce health care quality. The theme of this year's conference was sustainability, with a focus on establishing and maintaining imaging services in resource-limited regions. Conference presenters and participants identified 4 important components of sustainability: (1) sustainable financing models for radiology development, (2) integration of radiology and public health, (3) sustainable clinical models and technology solutions for resource-limited regions, and (4) education and training of both developing and developed world health care personnel.

Key Words: Radiology, developing countries, public health, residency education, international global imaging, economic development, radiology readiness, sustainability, technology

White Paper Report of the 2011 RAD-AID Conference on International Radiology for Developing Countries: Integrating Multidisciplinary Strategies for Imaging Services in the Developing World

Kathryn L. Everton, MD[a,b], Jonathan Mazal, MS, RRA, RT(R)(MR)[b], Daniel J. Mollura, MD[b], for the RAD-AID Conference Writing Group

The 2011 RAD-AID Conference on International Radiology for Developing Countries discussed data, experiences, and models pertaining to radiology in the developing world, where widespread shortages of imaging services significantly reduce health care quality and increase health care disparities. This white paper from the 2011 RAD-AID conference represents consensus advocacy of multidisciplinary strategies to improve the planning, accessibility, and quality of imaging services in the developing world. Conference presenters and participants discussed numerous solutions to imaging and health care disparities, including (1) economic development for radiologic service planning, (2) public health mechanisms to address disease and prevention at the population and community levels, (3) comparative clinical models to implement various clinical and workflow strategies adapted to unique developing world community contexts, (4) education to improve training and optimize service quality, and (5) technology innovation to bring new technical capabilities to limited-resource regions.

Key Words: Radiology, developing countries, public health, residency education, international global imaging, economic development, radiology readiness, sustainability, technologists, radiology outreach, radiologic nursing

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INTRODUCTION

widened over time because of a relative lack of progress in

CONCLUSION

- Radiology has transformed medicine in the last century via innovation
- Enormous potential for future innovation in radiology to further enhance health care
- We must address global radiology disparity
  - Education and training
  - Equipment access and utilization
- Substantial role for radiology in global public health via prevention and early treatment of large scale diseases