Adopting the International System of Units for Radiation Measurements in the United States

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ICRU Mission Statement:

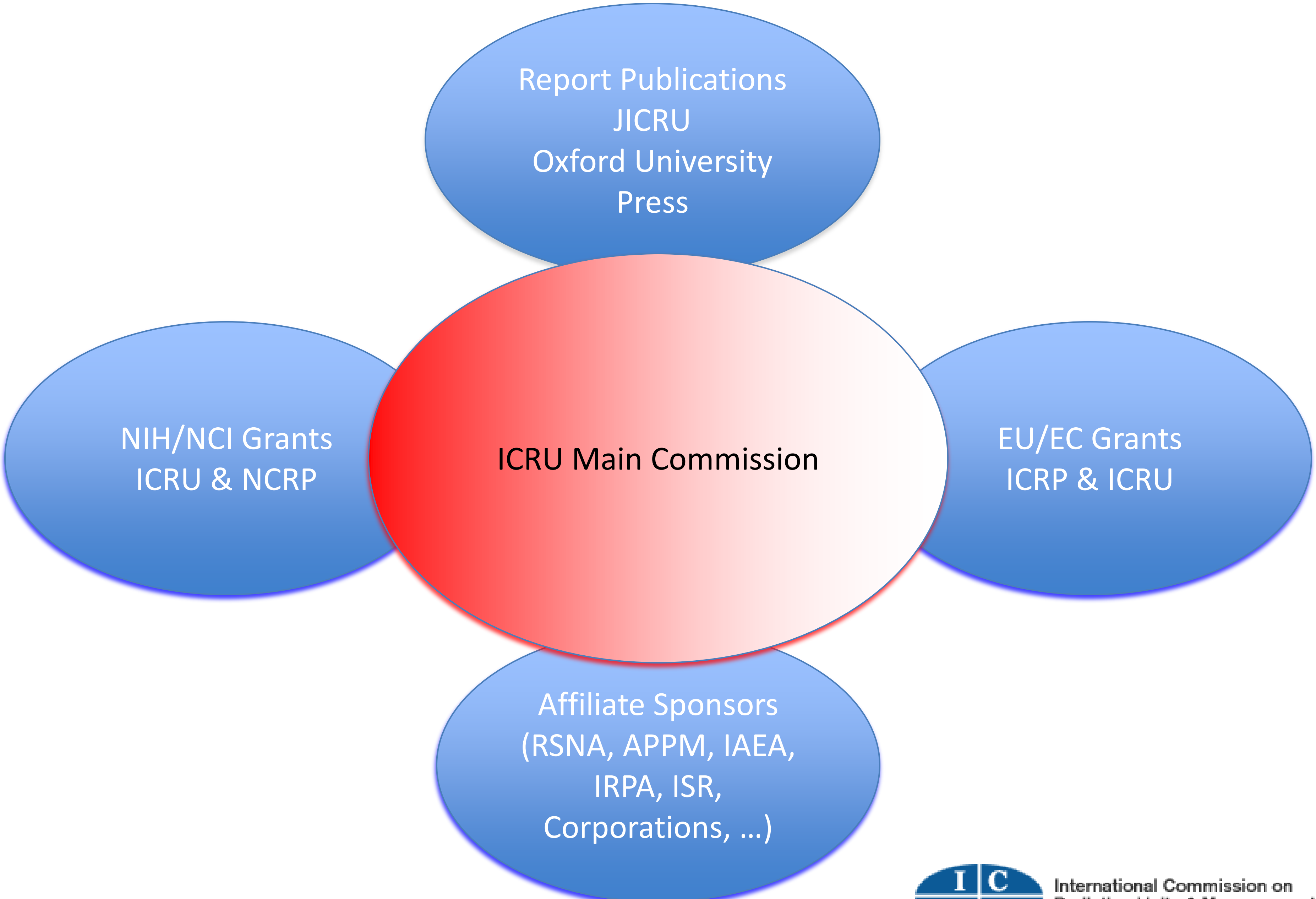
To develop and promulgate internationally accepted recommendations on radiation related quantities and units, terminology, measurement procedures, and reference data for the safe and efficient application of ionizing radiation to medical diagnosis and therapy, radiation science and technology, and radiation protection of individuals and populations.

ICRU International Commission on Radiation Units & Measurements

ICRU History & Leadership:

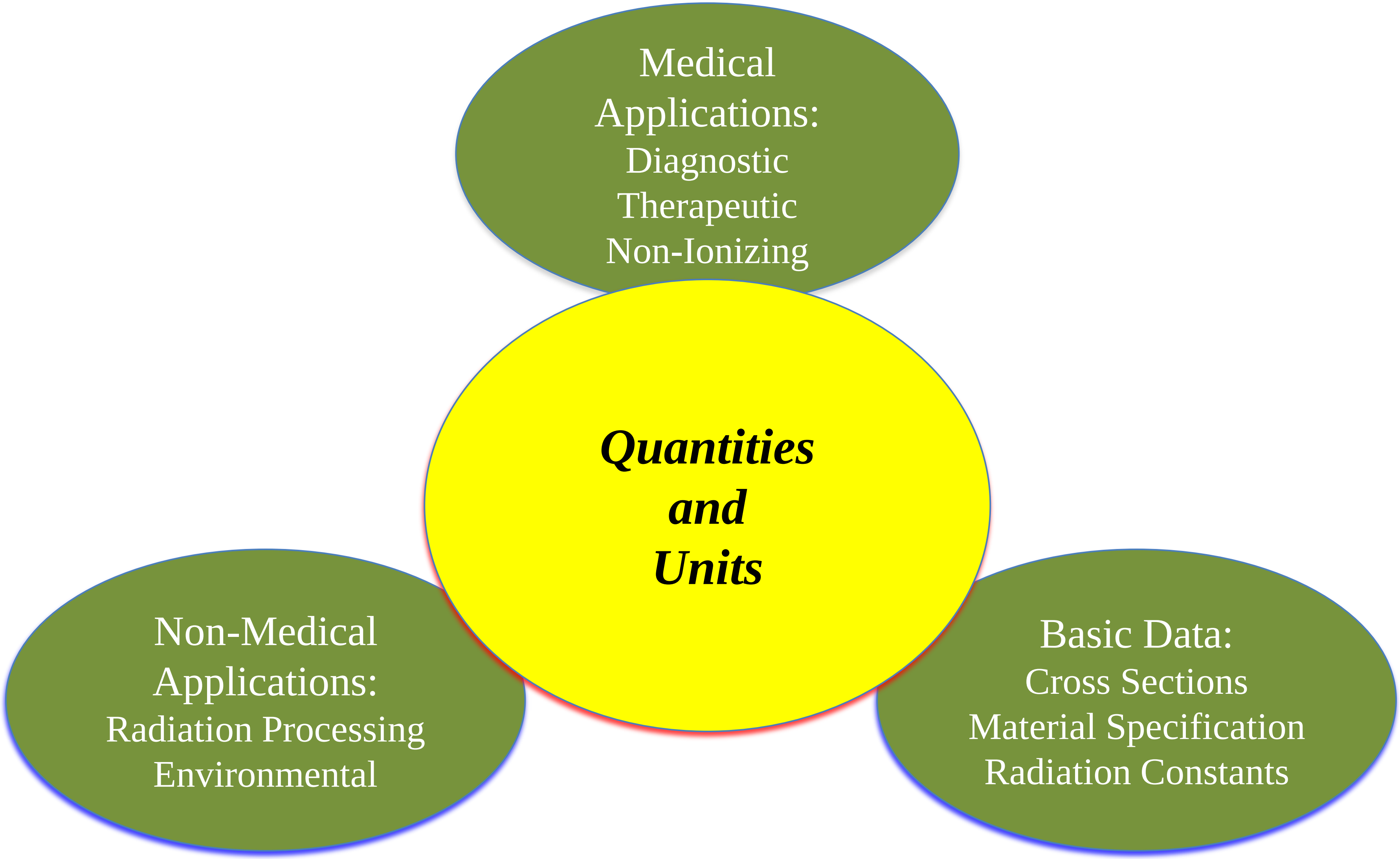
- First International Congress of Radiology 1925: International X-ray Unit Committee
- Stockholm 1928 Officially Recognized
- Propose and Develop Unit for Medical Radiation Applications
- Laurie Taylor 1953 - 1969
- H.O. Wyckoff 1969 - 1987
- A. Allisy 1987 - 1994
- A.W. Wambersie 1994 - 2006
- P.M. DeLuca, Jr. 2006 - 2009
- Hans Menzel 2009 - Present

Major Program Activities:



International Commission on
Radiation Units & Measurements

Organization of Activities:



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Medical Imaging Science:

- Modulation Transfer Function of Screen-Film Systems (Report 41) 1986
- Phantoms and Computational Models in Therapy, Diagnosis and Protection (Report 48) 1993
- Medical Imaging - Assessment of Image Quality (Report 54) 1995
- Tissue Substitutes, Phantoms, and Computational Modeling in Medical Ultrasound (Report 61) 1998
- Absorbed Dose Specification in Nuclear Medicine (Report 67) 2002
- Image Quality in Chest Radiography (Report 70) 2003
- Patient Dosimetry of X Rays used in Medical Imaging (Report 74) 2005
- Receiver Operating Characteristic (ROC) Analysis in Medical Imaging (Report 79) 2008
- Radiation Dosimetry and Image Quality Assessment in Computed Tomography (Report 87) 2012

Medical Radiation Oncology – Dosimetry:

- Measurement of Absorbed Dose in a Phantom Irradiated by a Single Beam of X or Gamma Rays (Report 23) 1973
- Determination of Absorbed Dose in a Patient Irradiated by Beams of X or Gamma Rays in Radiotherapy Procedures (Report 24) 1976
- Clinical Neutron Dosimetry – Part I: Determination of Absorbed Dose in a Patient Treated by External Beams of Fast Neutrons (Report 45) 1989
- Clinical Proton Dosimetry – Part I: Beam Production, Beam Delivery and Measurement of Absorbed Dose (Report 59) 1998
- Dosimetry of High Energy Photon Beams Based on Standards of Absorbed Dose to Water (Report 64) 2001
- Dosimetry of Beta Rays and Low-Energy Photons for Brachytherapy with Sealed Sources (Report 72) 2004
- Prescribing, Recording, and Reporting Intensity-Modulated Photon-Beam Therapy (IMRT) (Report 83) 2010

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Critical Data for Medical Radiation Oncology:

- Average Energy Required to Produce an Ion Pair (Report 31) 1979
- Stopping Powers for Electrons and Positrons (Report 37) 1984
- Stopping Powers and Ranges of Protons and Alpha Particles (with Data Disk) (Report 49) 1993
- Stopping of Ions Heavier than Helium (Report 73) 2005
- Elastic Scattering of Electrons and Positrons (Report 77) 2007
- Prescribing, Recording, and Reporting Proton-Beam Therapy (Report 78) 2007
- Key Data for Ionizing-Radiation Dosimetry: Measurement Standards and Applications *in process**S Seltzer*

Reporting Aspects for Medical Radiation Oncology:

- Prescribing, Recording, and Reporting Photon-Beam Therapy (Report 50) 1993
- Prescribing, Recording, and Reporting Photon-Beam Therapy – Supplement (Report 62) 1999
- Prescribing, Recording, and Reporting Electron Beam Therapy (Report 71) 2004
- Prescribing, Recording, and Reporting Proton-Beam Therapy (Report 78) 2007
- Dose and Volume Specification for Reporting Intracavitary Therapy in Gynecology** (Report 38 – Report 89) 1985
  ** In Revision ** ** P DeLuca/ R Poetter *

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Work About
to be Published:

Medical Radiation
Oncology Area:

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Prescribing, Recording, and Reporting Brachytherapy for Cancer of the Cervix

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MEASUREMENTS

Reports with Radiation Protection Focus:

- **Determination of Dose Equivalents Resulting from External Radiation Sources, Part 1, (Report 39) 1985**
- **Determination of Dose Equivalents Resulting from External Radiation Sources, Part 2, (Report 43) 1988**
- ***Quantities and Units in Radiation Protection Dosimetry (Report 51) 1993***
- **Photon, Electron, Proton and Neutron Interaction Data for Body Tissues (w/ Data Disk) (Report 46) 1992**
- **Conversion Coefficients for Use in Radiological Protection against External Radiation (Report 57) 1998**
- **Gamma-Ray Spectrometry in the Environment (Report 53) 1994**
- ***Quantities, Units, and Terms in Radioecology (Report 65) 2001***
- **Sampling for Radionuclides in the Environment (Report 75) 2006**
- **Dosimetry of External Beta Rays for Radiation Protection (Report 56) 1997**
- ***Determination of Operational Dose-Equivalent Quantities for Neutrons (Report 66) 2001***
- **Retrospective Assessment of Exposure to Ionizing Radiation (Report 68) 2002**
- **Direct Determination of the Body Content of Radionuclides (Report 69) 2003**

Glossary

absorbed dose (D**):** The energy imparted to matter by ionizing radiation per unit mass of irradiated material at the point of interest. The SI unit is J kg–1 with the special name gray (Gy). The special unit previously used was rad. 1 Gy = 100 rad.

activity: Rate of transformation (or disintegration or decay) of radioactive material. The SI unit of activity is the reciprocal second (s–1) (meaning one transformation per second), and its special name is the becquerel (Bq). In previous units often used by state and federal agencies, activity is given in curies (Ci); 1 Ci = $3.7 \cdot 10^{10}$ Bq.

air kerma (kerma) (kinetic energy released per unit of mass) (K**):** The quotient of the sum of the initial kinetic energies of all the charged particles liberated by uncharged particles in matter divided by the mass of the matter into which the particles are released and is given the special name gray (Gy). 1 Gy = 1 J kg–1. In the event that the matter is air, kerma is often referred to as air kerma.

dose equivalent (H**):** The product of the absorbed dose (D) at a point and the quality factor (Q) at that point for the radiation type (i.e., H = DQ). The unit of H is J kg –1 with the special name sievert (Sv).

dose rate (radiation dose rate): Dose delivered per unit time. Dose rate can refer to any dose quantity (e.g., absorbed dose, dose equivalent).

effective dose: The sum over specified tissues of the products of the equivalent dose in a tissue or organ and the tissue weighting factor for that tissue or organ. The tissue weighting factor represents the fraction of the total radiation detriment to the whole body attributed to that tissue when the whole body is irradiated uniformly. The SI unit for effective dose is joule per kilogram (J kg–1), with the special name sievert (Sv). The special unit previously used was rem. 1 Sv = 100 rem.

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Unit of contention

The United States' refusal to use SI units for radiation measurement is confusing and dangerous. It's time to catch up with the rest of the world.

"……. As fear spread and the public and media clamoured for information, the last thing anybody needed was a load of complicated conversions. It was hard enough for most to sort out the difference between milli-sieverts and micro-sieverts, never mind then having to convert those to rems. Yet US officials insisted on generating hazard maps using rems. And that meant that people, including those in the danger zone, could not tell at a glimpse what was really happening."