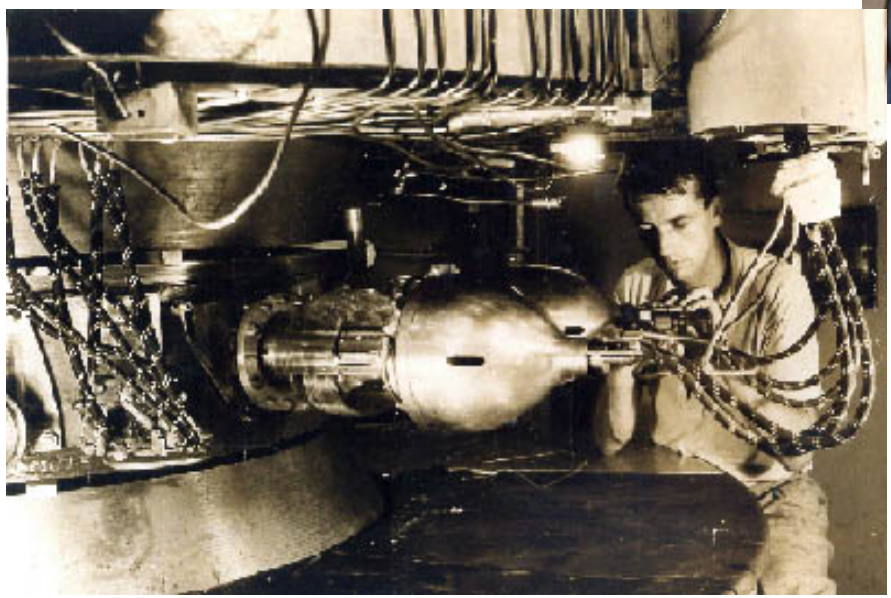
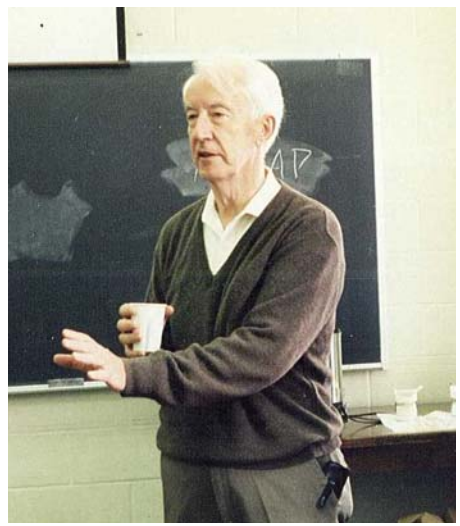
CIRMS 2007





Thanks

Robin Hutchinson

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Lura Powell

Curt Reimann

Ray Kammer

Katharine Gebbie

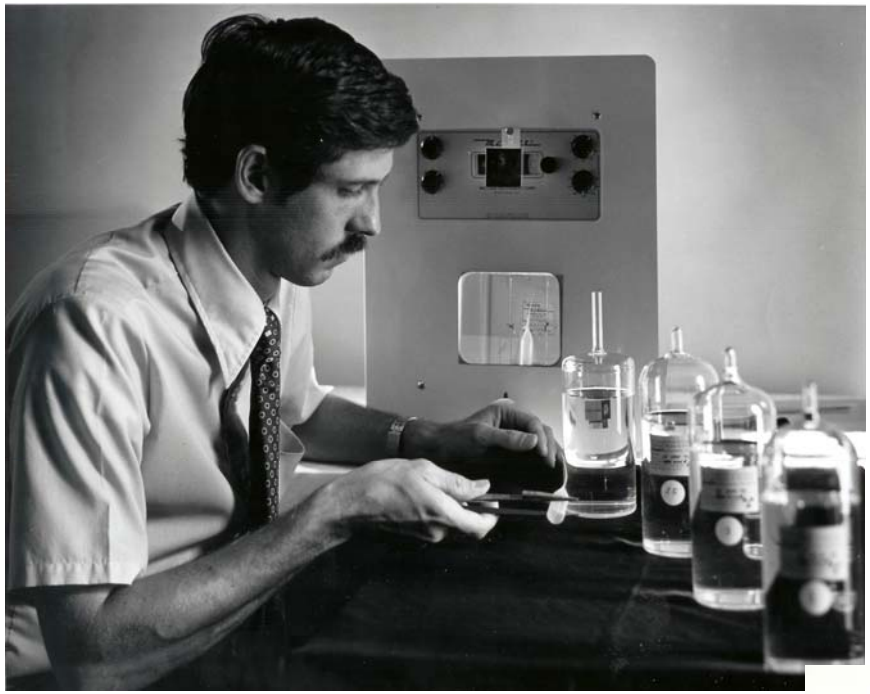
Parney Albright

George Ryan, Jr.

Career Phase I

- Army nuclear power program 1969 – 1971
- Environmental nuclear plant radiochemistry 1972 - 1978
- Liquid scintillation counting 1975 – 1987
- Nuclear medicine 1981 - 1992


DANGER
HIGH
VOLTAGE




P-335-1 22a2 - 47½%

液体闪烁计数在放射性核素计量学中的应用

国际计量局

中国计量出版社

Ⅲ. 高效率液体闪烁计数系统的设计

B.M.Courser and W.B.Mann*

Ⅲ.1. 引 言

为了比较不同设计的液体闪烁计数系统，首先我们必须涉及到本领域中常用的一些优值。在设计中，最常用的优值是η(58 Swa，64 Birl)，它是在闪烁体中吸收1 keV的能量到达第一打拿极的光电子数。为了比较起见，一般7.6×7.6cm碘化钠NaI(Tl)探测器η约为6个光电子/keV，而对于单个光电倍增管液体闪烁系统随着设计的不同，η在0.2—2个光电子/keV之间。本文第二部分中我们将考虑最佳选择η的方法，最后将对放射性核素计量学中使用的液体闪烁系统给出评论。

Ⅲ.2. 比较液体闪烁计数系统的方法

对于很多仪器厂商来说，必不可少的是有一个共同的基础评价不同计数系统的灵敏度。大多数商品计数系统如图1所示的安排由两个光电倍增管一个螺旋帽瓶组成。经常用来比较这些系统的一个指标是双管符合中所谓无猝灭密封标准³H的计数效率ε(³H)。

这些标准（80 ANS）通常含有15 ml去氧液体闪烁体，

* 美国国家标准局放射性室，Washington，D.C.20234，USA。

它由³H-甲苯，PPO和溶在甲苯中的POPOP组成*。

在最近六个商品仪器的比对中，Patterson等（78 Pat）发现³H效率ε(³H)在42%到57%之间。这些值是大概稍为低一些，因为使用的是空气饱和样品。如果使用无猝灭标准，厂商通常声明得到的³H效率ε(³H)在（60—65)%之间。

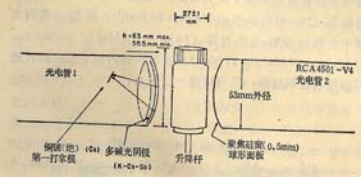


图 Ⅲ-1 典型的商品液体闪烁计数管使用的标准计数瓶和光电倍增管结构图

——瓶的尺寸是国际电工委员会（IEC）标准 581(77 IEC）中给出的。对不同性质的商品瓶（以及所谓"小瓶"）的评价，可在（75 Pen，78 Nea，78 Rin）等文献中得到。

——"小瓶"的外径为14 mm，与基本上和大瓶尺寸相同的玻璃套相配。

——因为升降轴的阴影位置影响光学几何性（78 Rin），闪烁体的最佳体积取决于系统。

——在商品计数系统中也使用其它光电倍增管其中包括EMIQB 9635和Philips 56 DUVP。

利用³H计数效率作为灵敏度的唯一标准是有一些问题的，特别是对于放射性核素计量学对计数系统规定一个优值η更具有信息价值。ε(³H)和η之间的关系表示在图 Ⅲ-2

* 本文中提到的闪烁体的化学公式列在表 Ⅰ-2 中。

NIST Standard Reference Materials (SRMs) for Radionuclides Used in Nuclear Medicine and Biology

Radionuclide	SRM ID	Last Issued	Radionuclide	SRM ID	Last Issued
Chromium-51	4400N	July 1992	Xenon-133	4415Y	March 2001
Iodine-131	401AA	January 2001	Gallium-67	4416V	April 2001
Tin-113-indium-113m	4402C	October 1980	Indium-111	4417U	August 2001
Strontium-85	4403B	April 1977	Mercury-203	4418A	November 1976
Thallium-201	4404S	June 2001	Ytterbium-169	4419C	October 1986
Gold-198	4405B	August 1978	Lead-203	4420B	November 1984
Phosphorus-32	4406O	October 1997	Gold-195	4421A	December 1979
Iodine-125	4407Z	October 2001	Chlorine-36	4422A	April 1980
Cobalt-57	4408F	July 1995	Strontium-90	4423A	November 1985
Selenium-75	4409D	August 1981	Sulfur-35	4424A	October 1988
Technetium-99m	410AA	September 2001	Samarium-153	4425G	July 2001
Iron-59	4411B	January 1979	Strontium-89	4426A	April 1995
Molybdenum-99	4412Z	February 2001	Yttrium-90	4427E	December 2001
Mercury-197	4413A	May 1976	Gadolinium-153	4428A	October 1998
Iodine-123	4414C	June 1980			

Radiopharmaceutical Therapy

NIST radioactivity standards for radiolabelled, tumor-specific monoclonal antibodies

^{90}Y Zevalin

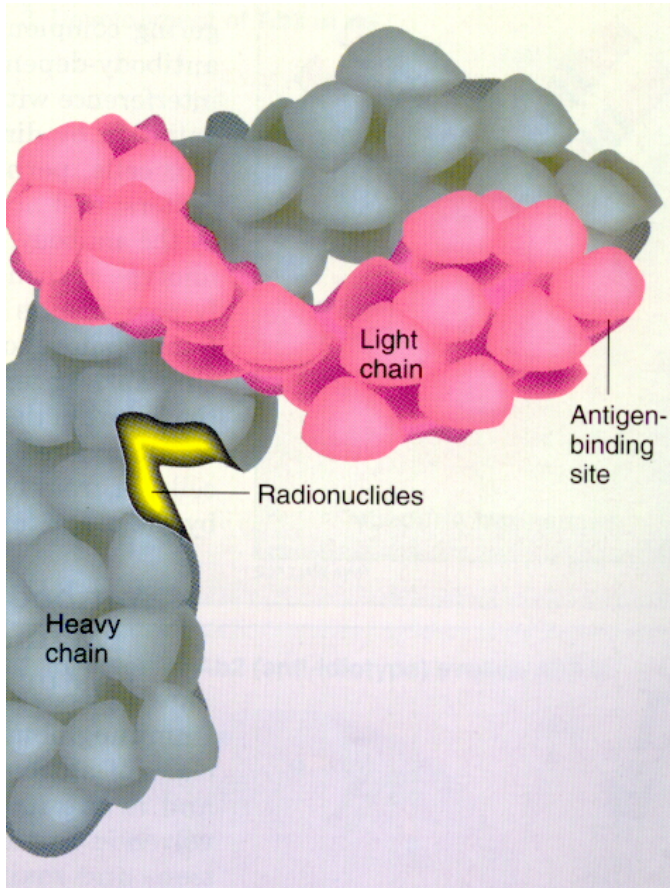
^{131}I Bexxar

^{166}Ho

^{177}Lu

^{188}Re

^{211}At




CONGRES I.C.R.M. GRENOBLE 06-1985

Career Phase 2

- Malcolm Baldrige National Quality Award 1987 – 1988
- Radiation Physics/Medical Physics 1988 – 1996
- Brachytherapy standards 1997 - 2000

Malcolm Baldrige National Quality Award

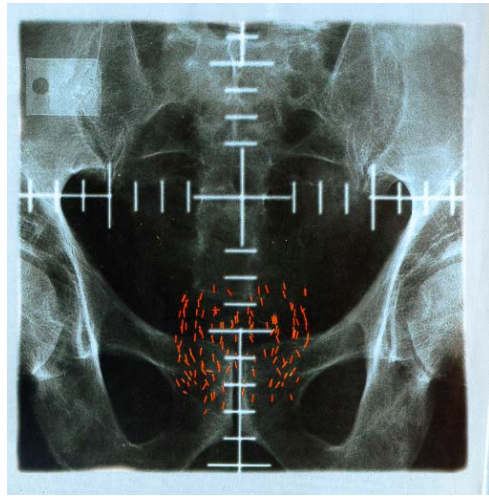
The Baldrige Criteria: From Interest to Action

Standards for Prostate Seed Therapy

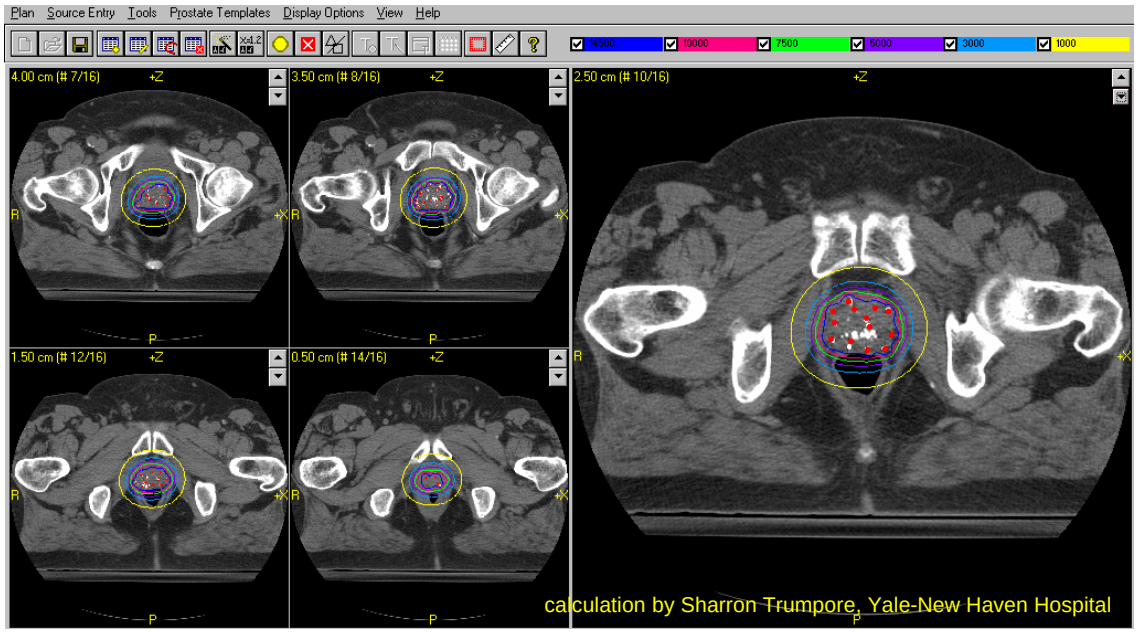
Two radionuclides:
- **^{103}Pd ($t_{1/2}$ = 17 days)**
- **^{125}I ($t_{1/2}$ = 59 days)**

198,000 New prostate cancer patients per year in U.S.

80-120 Seeds per patient



Effective therapy ....



…. requires traceability to a NIST primary standard for seed strength

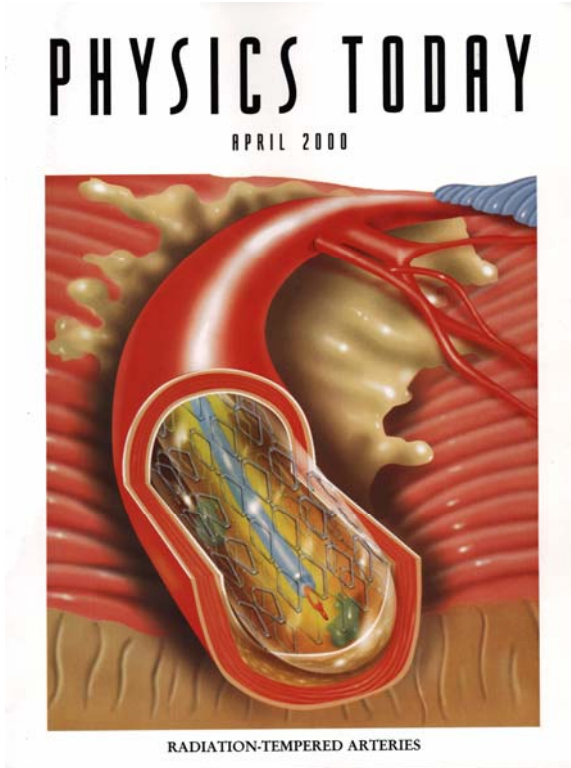
Intravascular Radiation to Prevent Restenosis

FDA Approved in 2000

- **Cordis ^{192}Ir seed train**
- **Novoste ^{90}Sr seed train**

Submitted to FDA

- **Guidant ^{32}P wire**
- **Radiance ^{32}P hot-wall balloon**



March 13, 2001
THE DOCTOR'S WORLD; The New Treatment Cheney Did Not Get
LAWRENCE K. ALTMAN, M.D.
The New York Times

"Dr. Jonathan S. Reiner, Vice Pres. Dick Cheney's cardiologist, finds himself at center of debate among some in medical field over his decision to clear blocked coronary artery and then not to use new radiation technique to help prevent another blockage…."

Career Phase 3

- Validation of USPS mail irradiation 2001 -2002
- Standards for radiological/nuclear detectors 2002 – 2005
- Standards for Homeland Security 2003 - 2007


UNITED STA

Sessions on
RDD & Nuclear:
Standards and Measurements for 1st Responders

Federal
State
Local emergency planners

Standards organizations
Manufacturers
Testing laboratories

http://www.cirms.org

Process to Develop User Guidance on Existing Technologies

Assessment of Existing Radiation Pagers

Guidelines

Performance Specifications

Test Protocols

Product Comparison

	Product A	Product B	Product C
Criterion 1	◑	○	○
Criterion 2	◑	◑	●
Criterion 3	●	○	●
Criterion 4	●	●	●
Criterion 5	○	●	●

Transition Planning Office
DHS

Radiation Detection Equipment for Detect/Prevent (Top Line) and Respond/Recover (Bottom Line)

Radiation Portal Monitors

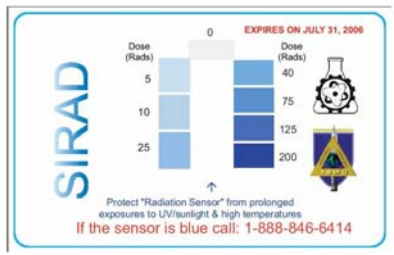
Radiation Pagers

Radioisotope Identifiers

Survey Meters

Electronic Personnel Dosimeters

Radiochromic Passive Dosimeters



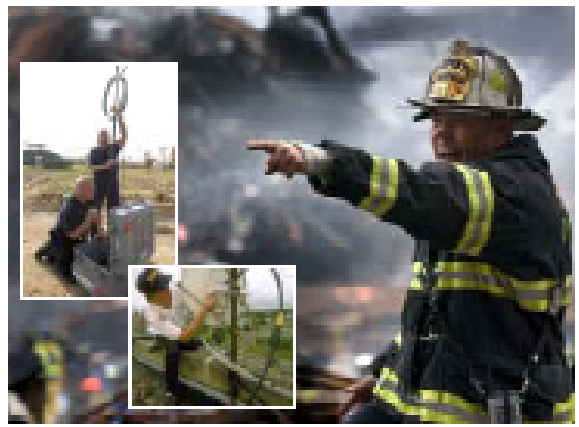
Homeland Security

FROM SCIENCE...SECURITY

Explosives

Chemical/Biological

Command, Control, & Interoperability



Borders/Maritime

Human Factors

Infrastructure/Geophysical

FROM TECHNOLOGY...TRUST


EntryScan


Analogic Corp.


NATIONAL INSTITUTE


MONTGOMERY COUNTY
FIRE & RESCUE
US&R

Thanks!

NIST Ionizing Radiation Division

DHS Office of Standards

CIRMS Participants 1992 -2007