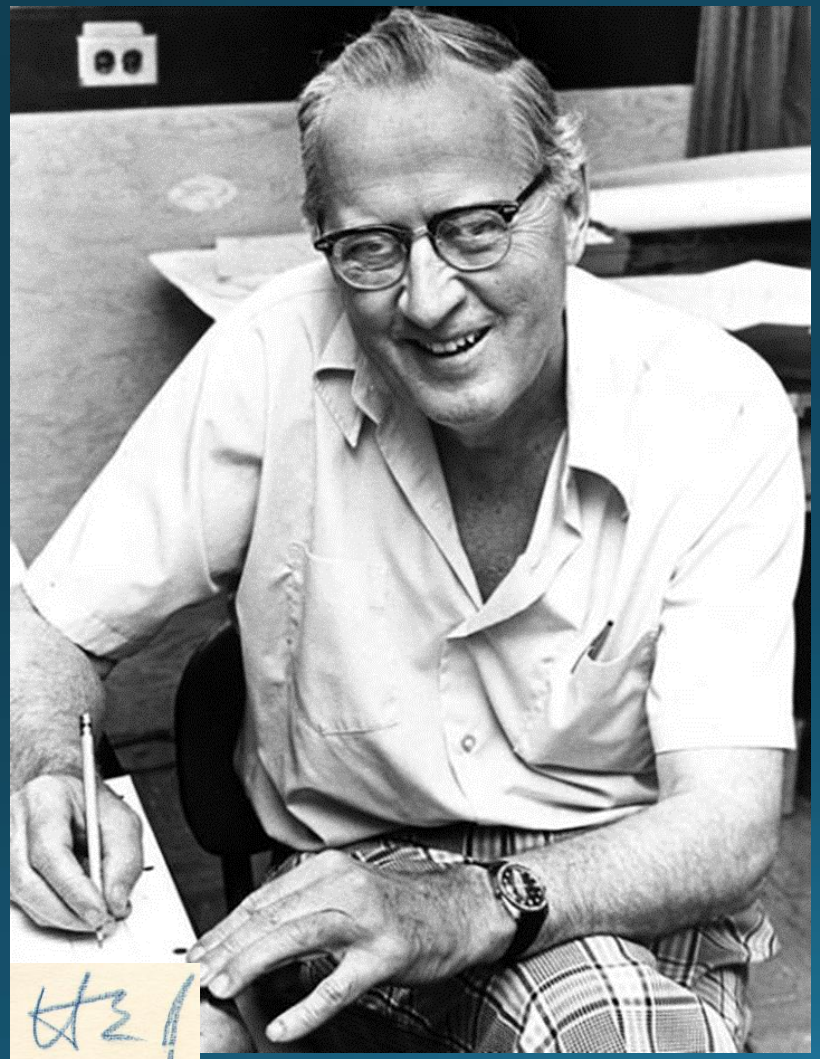
AAPM July 26, 2021

Harold Elford Johns:
Inventor, Researcher, Educator, Leader



Jerry J. Battista
Professor Emeritus
Western University
London, Canada

Western

Biography I

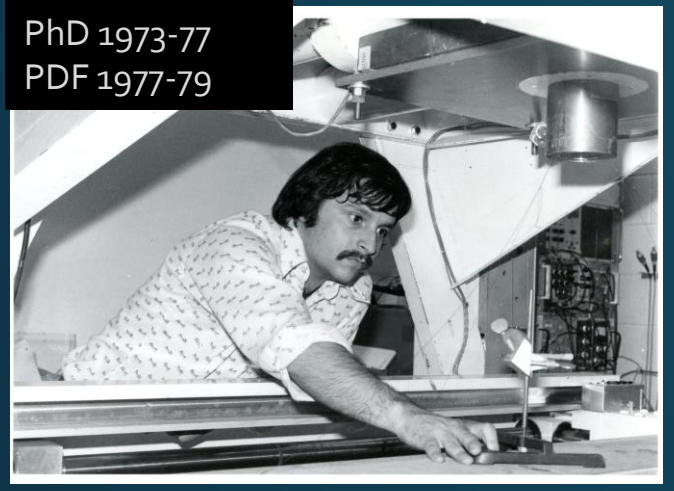
- **Born in Chengdu, Sichuan China** July 1915 to missionary parents from Canada
- McMaster University (B.A. 1936) & University of Toronto (M.A. 1937, Ph.D. 1939)
- University of Alberta Faculty (Physics), 1939-1945
- University of Saskatchewan and Saskatchewan Cancer Commission, 1945-1956
- University of Toronto Faculty (Medical Biophysics, Radiology,Physics), 1956-1980
- Designed first non-commercial Cobalt-60 unit (Saskatoon)
  - Presentation by J. Van Dyk
- Co-authored *The Physics of Radiology*
  (Chinese, Spanish and Russian)

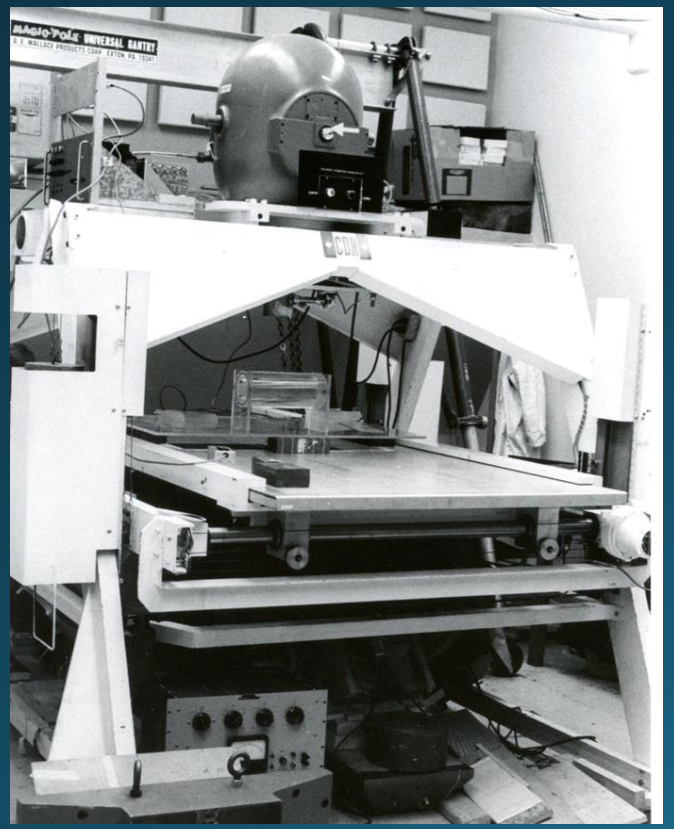
Biography II

- >200 peer-reviewed articles
- Established "CAMP" (1955)
- Fellow of the Royal Society of Canada at age 36 (1951)
- Officer of the Order of Canada (1977)
- Inducted into the Canadian Medical Hall of Fame (1998)
- Honorary degrees from four universities
- Passed away 23 August 1998 in Kingston, Ontario, after a 30-year battle with Parkinson's disease.

My Personal Connections

PhD 1973-77
PDF 1977-79

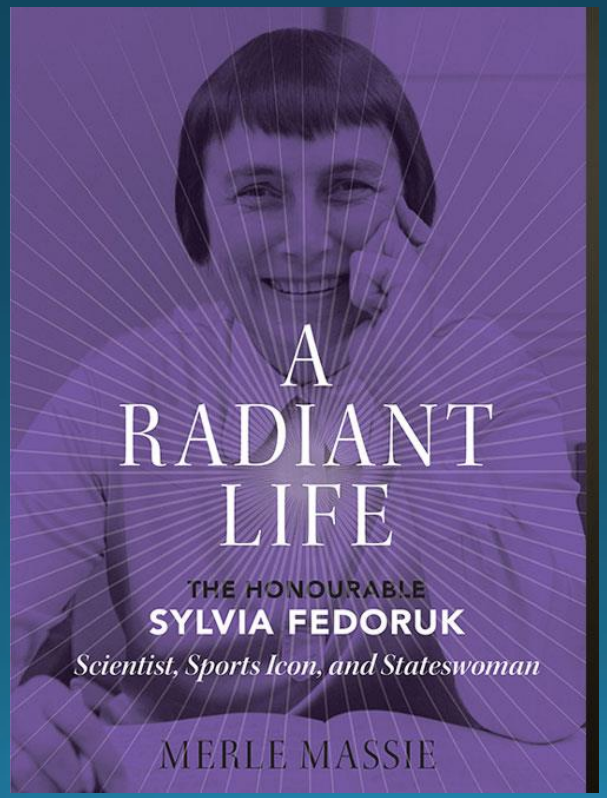




Christmas Show "Hat Trick"

Inventor and Researcher

- Clinical Goals, Applied Research
- Diversified, Adaptive, Impactful
  - Radiation chemistry, DNA uv damage
  - Medical Imaging & Radiation Oncology
- Inclusive



Educator

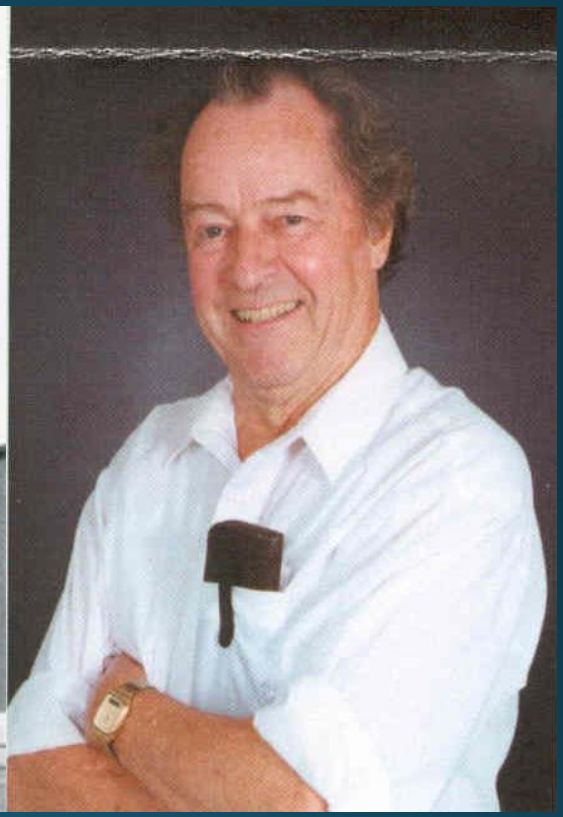
"Physicists can do anything they put their mind to."

- *The Physics of Radiology* – international influence
- 68 Graduate Students and ≈30 Post-Doc Fellows
- Five Generations… of Graduate Students
- No-nonsense, "tough" questions, inspiring
- Publications – thorough, clear, meticulous editing
  - "get to the root of the problem", "come clean"
  - Mix of theory & experimental data
- Social Events – PMH Coffee time, Christmas Show, cottage (Lake Boshkung)

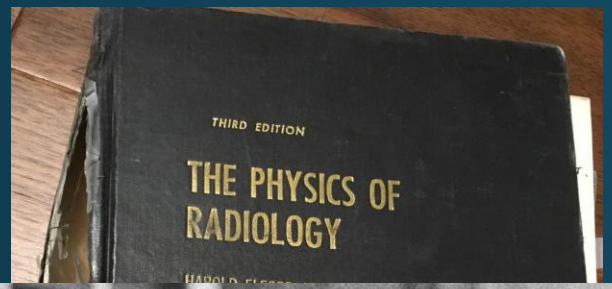
PMH Physics Team

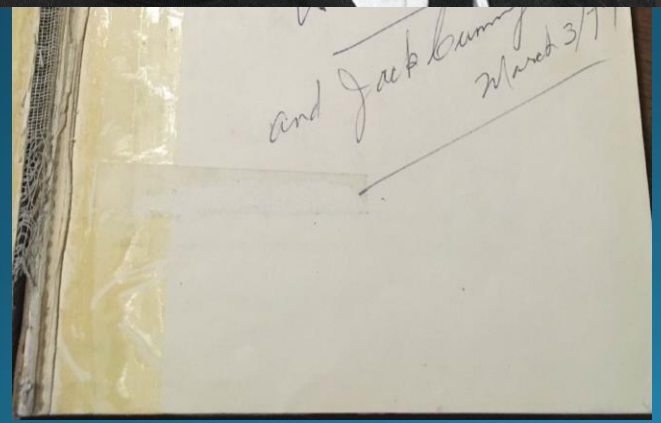
AAPM session July 28

1956-1980



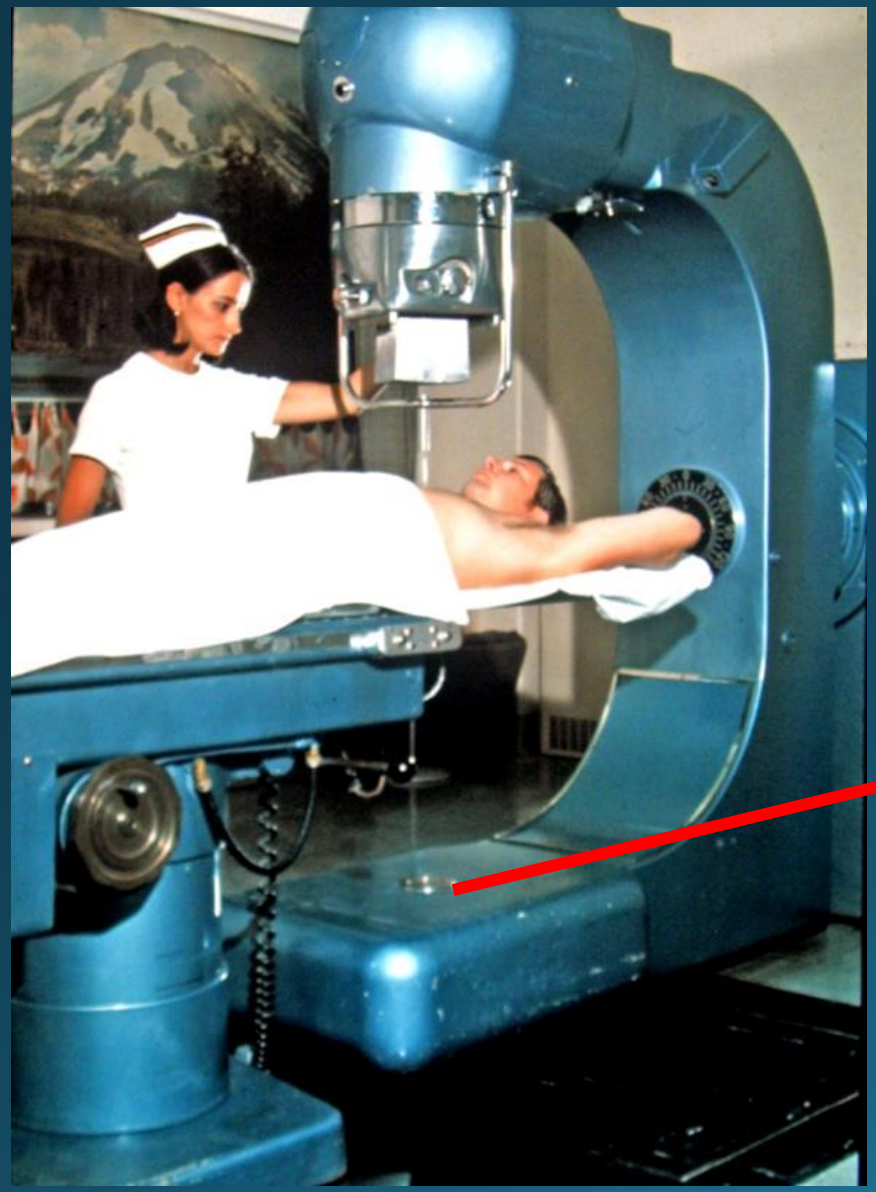
Johns-Cunningham Team at Work

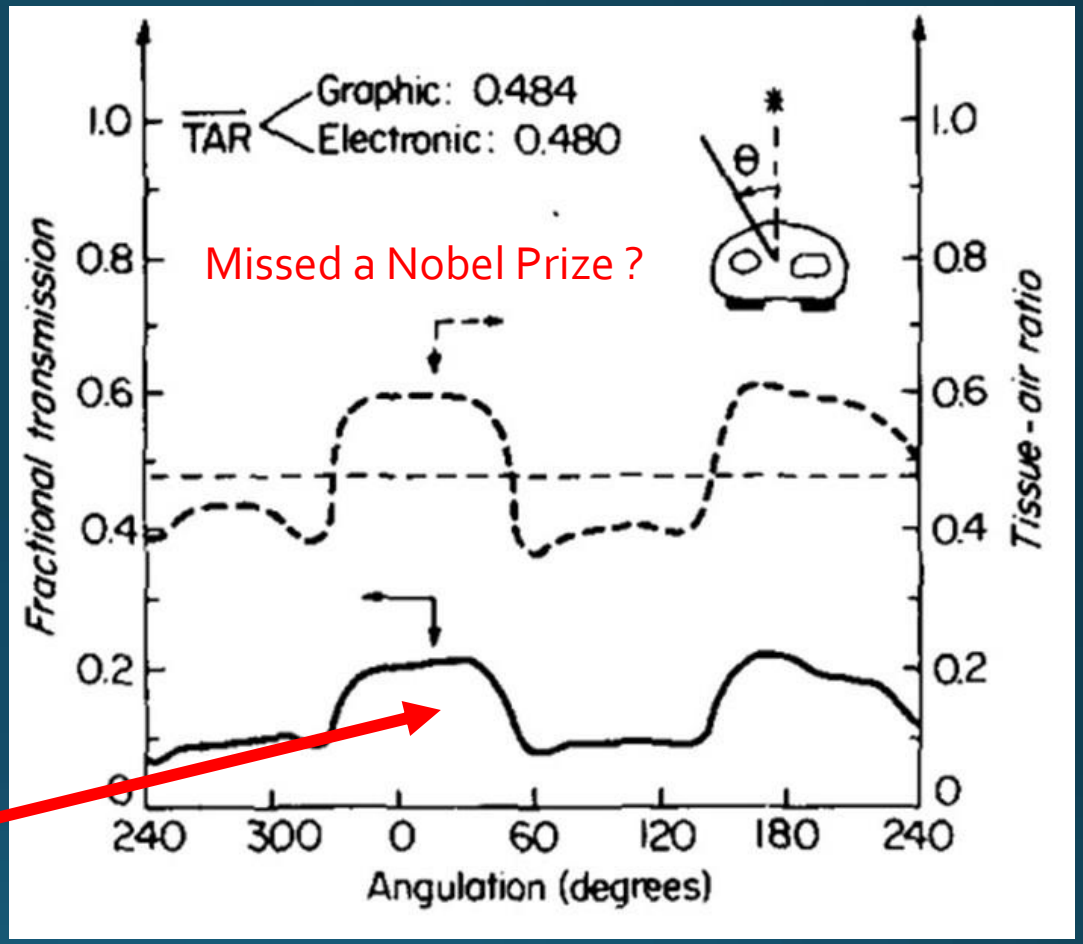




University of Toronto – Medical Biophysics Students

Transit Dosimetry





PHYSICS OF CT SCANNERS: PRINCIPLES AND PROBLEMS

H. E. JOHNS, J. BATTISTA, M. J. BRONSKILL, R. BROOKS,
A. FENSTER and M. YAFFE
Physics Division, Ontario Cancer Institute, 500 Sherbourne Street, Toronto, Ontario, Canada M4S 1K5

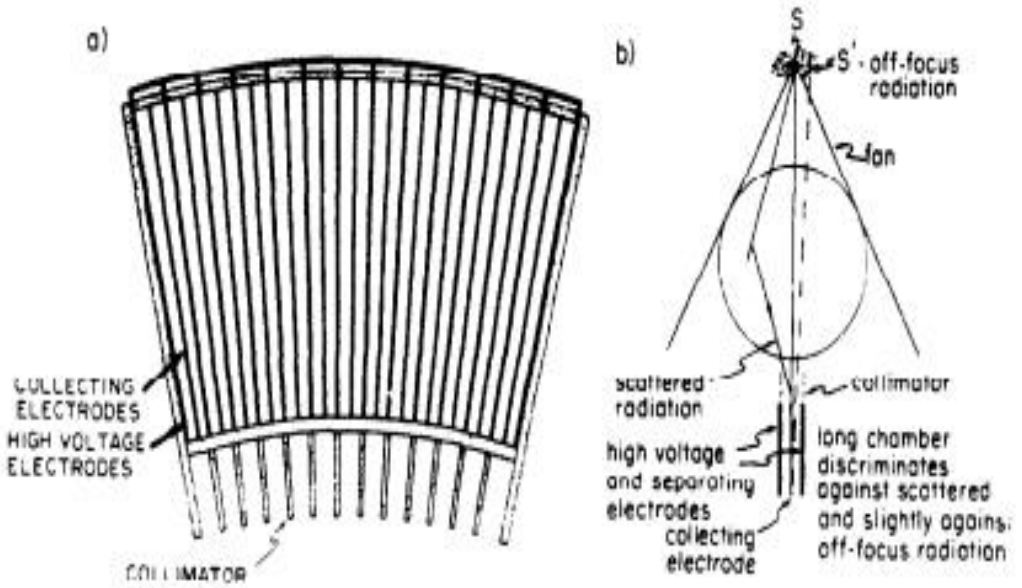
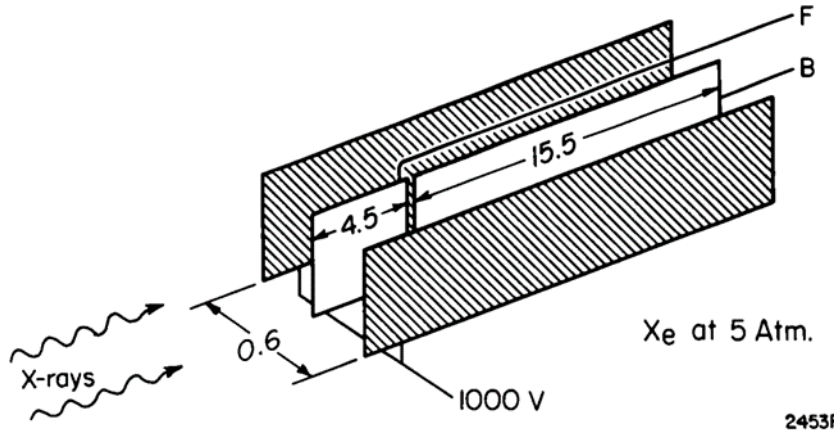


Fig. 2. (a) Schematic representation of radial detector in a fan geometry. (b) Diagram illustrating scattered and off-focus radiation.

Split Xenon Detector for Tomochemistry in Computed Tomography

A. FENSTER

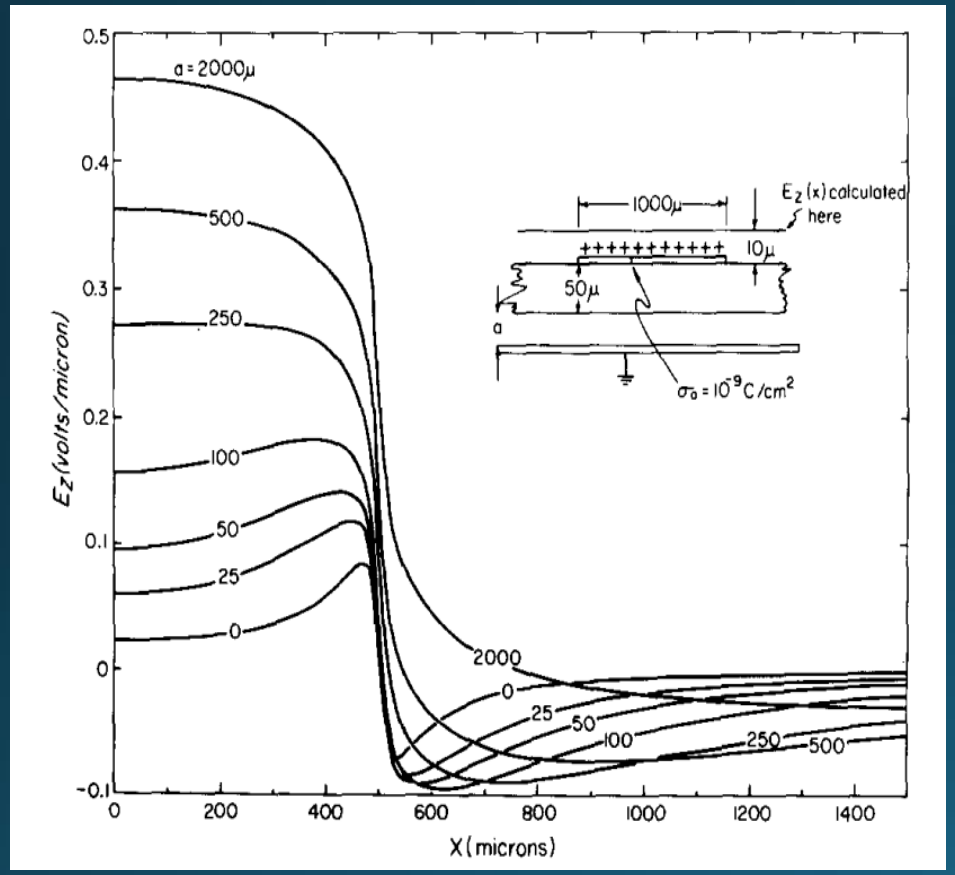


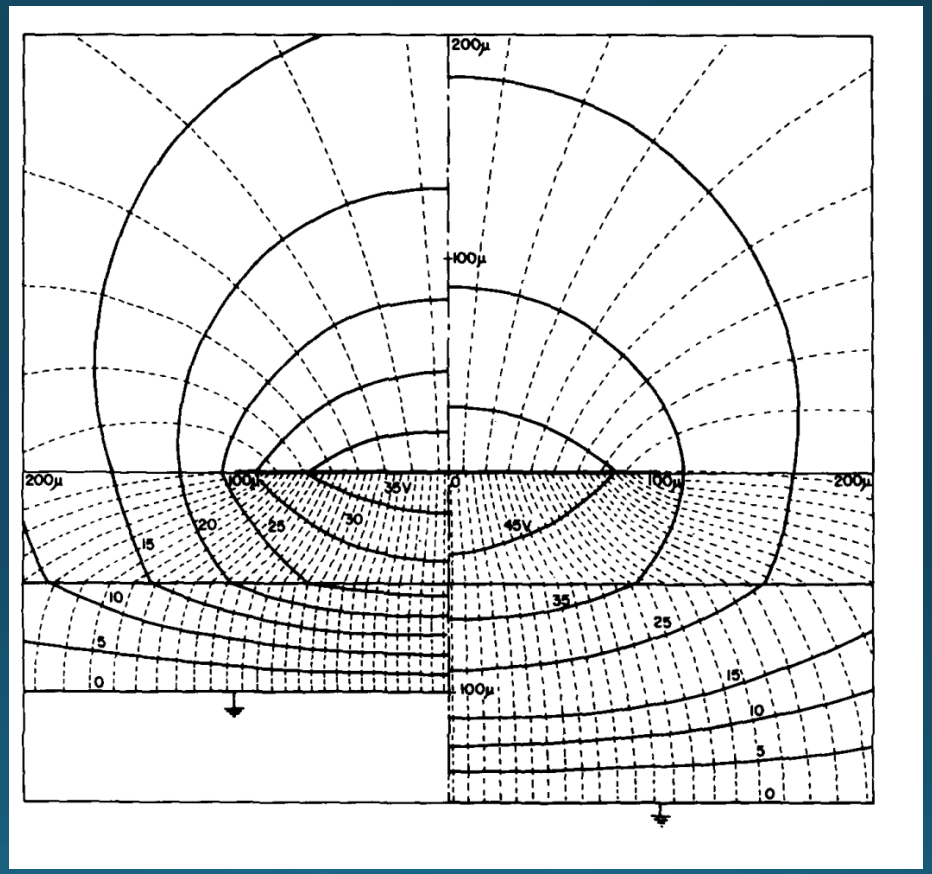
Electrostatic fields in ionography*

Don Plewes and H. E. Johns

Department of Medical Biophysics, University of Toronto and The Division of Physics, Ontario Cancer Institute, Toronto, Ontario, Canada M4X 1K9

(Received 17 August 1974)





VOL. 121, No. 4

DESIGN OF X-RAY TARGETS FOR HIGH ENERGY LINEAR ACCELERATORS IN RADIOTHERAPY*

By E. B. PODGORŠAK, PH.D., J. A. RAWLINSON, M.Sc.,
M. I. GLAVINOVIĆ, B.Sc., *and* H. E. JOHNS, PH.D.
TORONTO, ONTARIO, CANADA

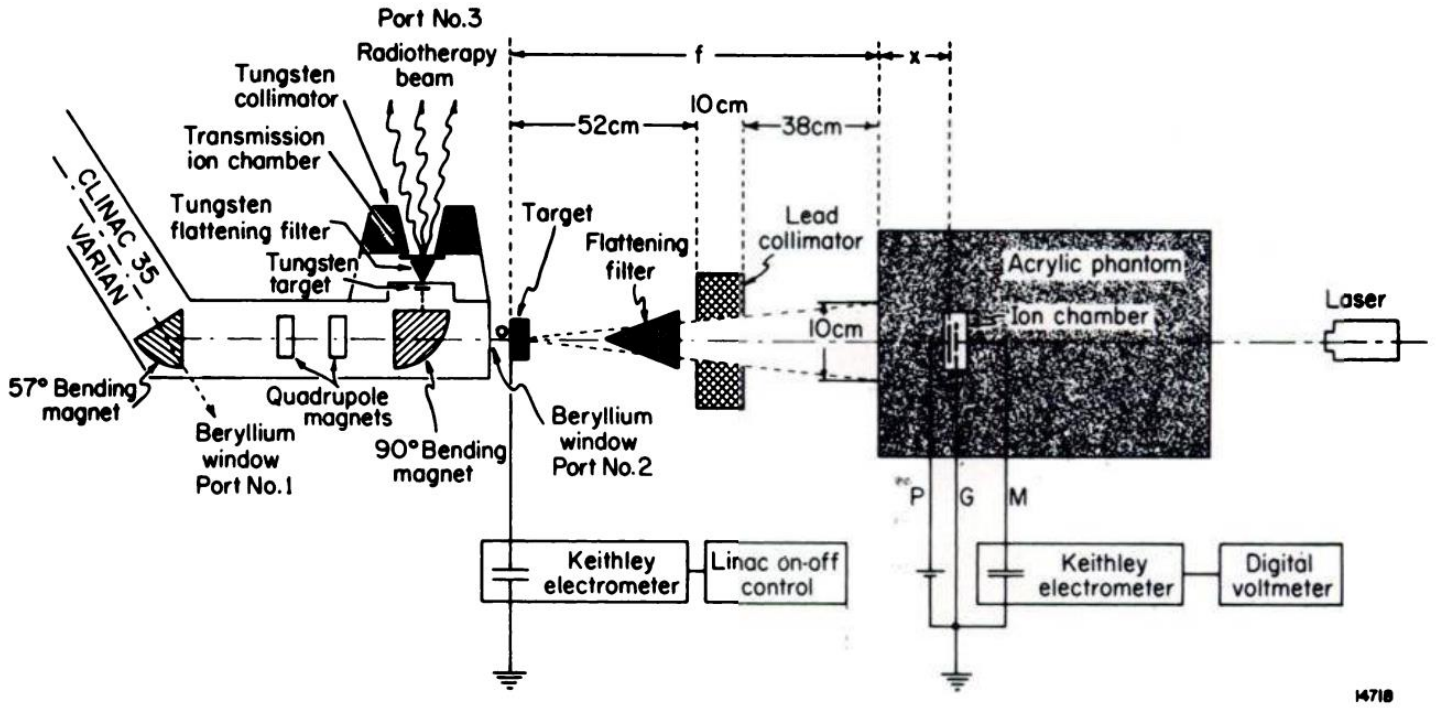


FIG. 1. Schematic diagram of the complete experimental apparatus.

Hemitron

Figure 2. The Hemitron with a patient in treatment position and a radiation therapist at the machine controls. Note the collimators located just in front of, and slightly below, the radiation therapist's face. These contain lead inside a stainless-steel housing and are used to define the field size. This cobalt-60 unit became affectionately known by staff members as "Jaws."

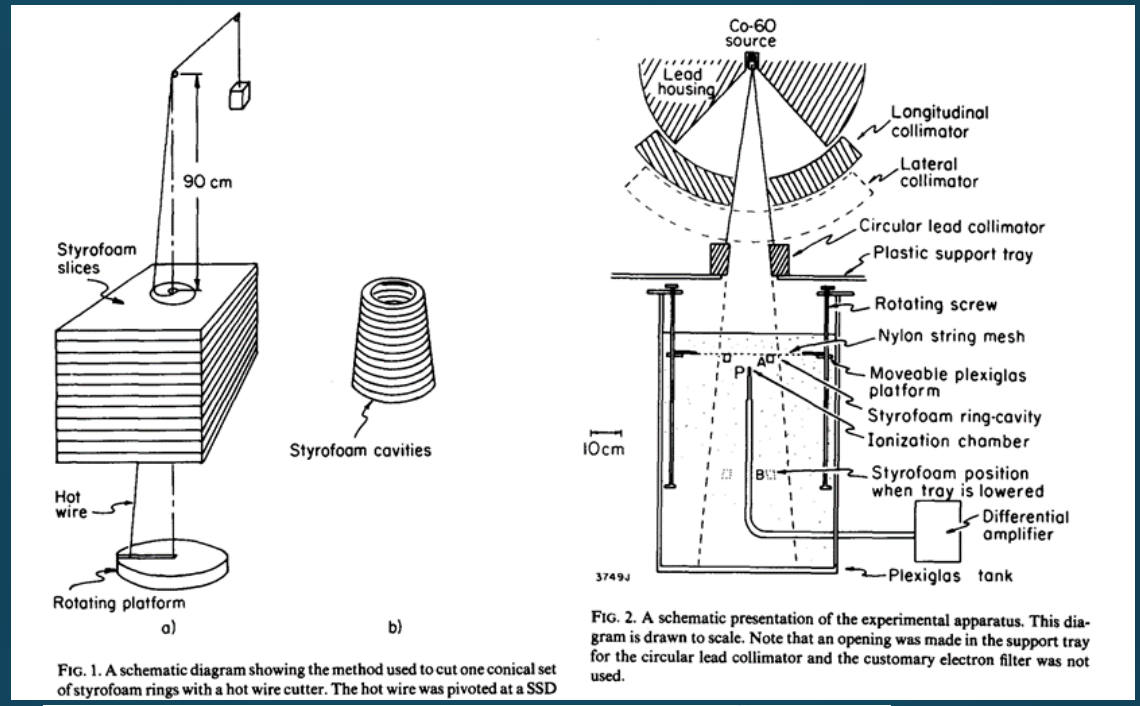
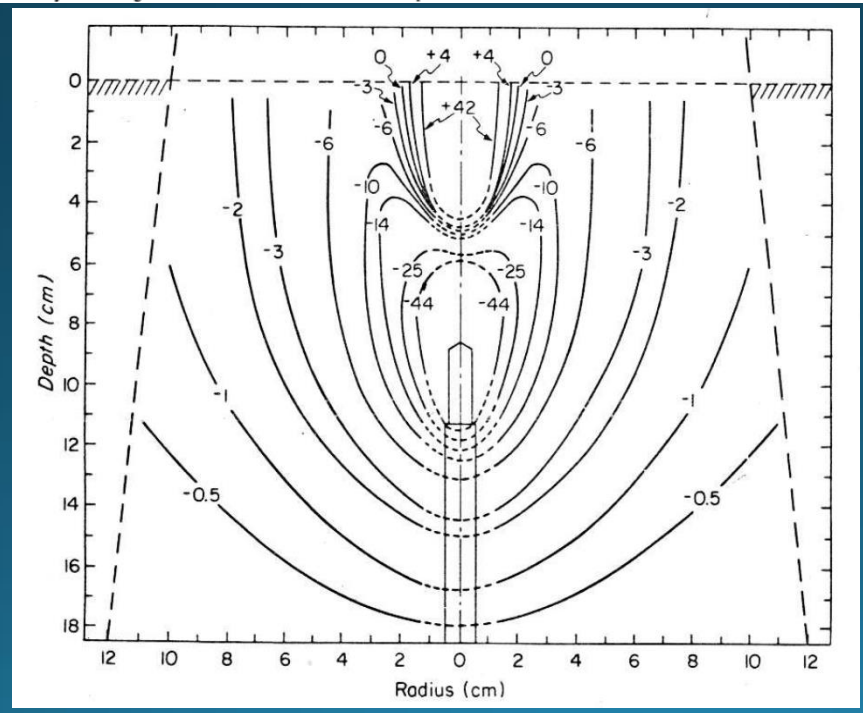
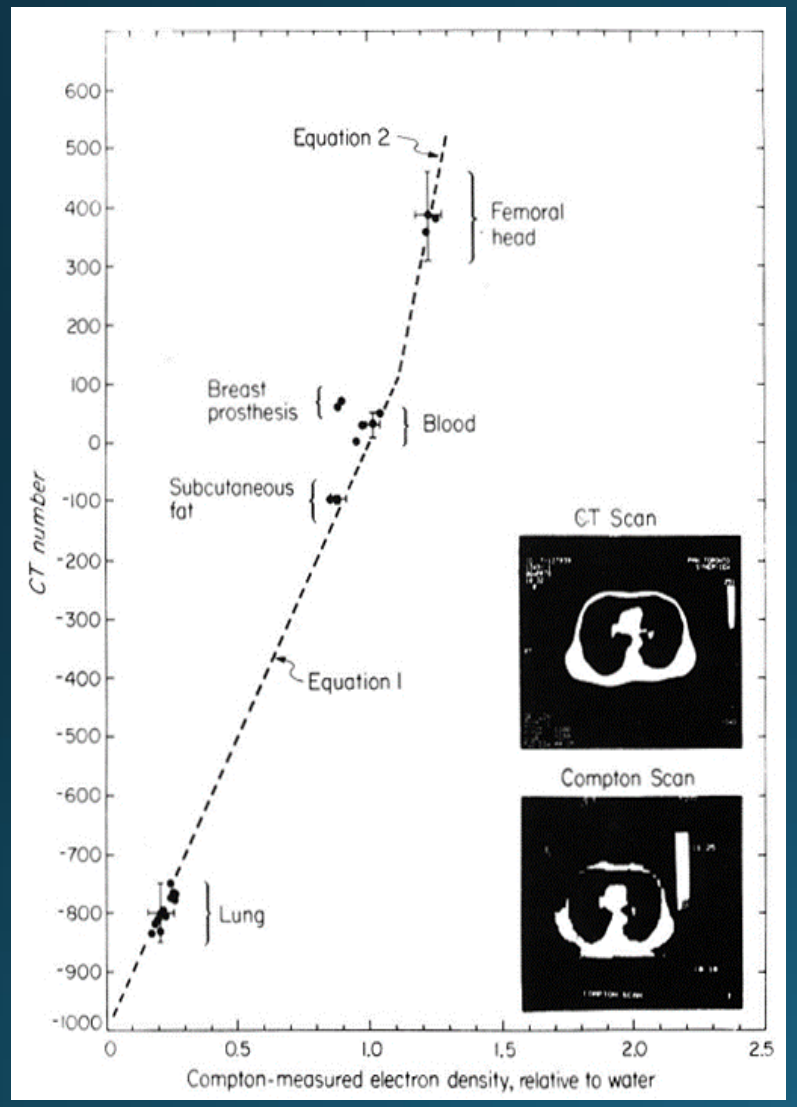


FIG. 1. A schematic diagram showing the method used to cut one conical set of styrofoam rings with a hot wire cutter. The hot wire was pivoted at a SSD

FIG. 2. A schematic presentation of the experimental apparatus. This diagram is drawn to scale. Note that an opening was made in the support tray for the circular lead collimator and the customary electron filter was not used.



Pixel-Based Dose Computation



Inhomogeneous Phantom.

① Combine CT numbers into $2\times2\times2\ cm^3$ pixels as in ⓔ or perhaps ⓕ for the principal plane as in Ⓐ

ⓔ 2×2×2 pixels → transform coordinates. ∴ CT → ρe

ⓕ

Surface.

ℓ'

pixel $2\times2\times2 = \Delta V$

Q

d_1 d_0 f' d_2 r_2

① Let the radiological thickness above the pixel be ℓ' which may be > or < than $(d_0 - d_1)$

② Let f' be the radiological thickness of the distance QP which may be greater or less than $\sqrt{r_2^2 + d_1^2} = \rho$

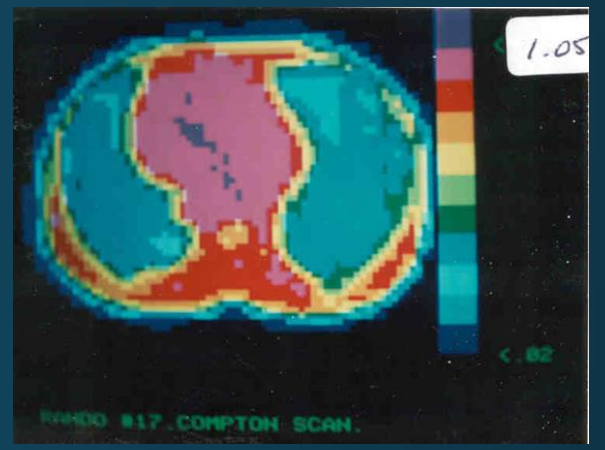
③ Let μ_s be the attenuation coef for radiation scattered at angle.

④ Let $S(d_0, d_1, d_2, r_2)$ be the scatter value from page 9 or 10

⑤ The scatter dose to P from the pixel at Q for 10^4 rads in air to P is

$$S = T(d_0,0) \cdot S(d_0, d_1, d_2, r_2) \cdot \frac{T(\ell', 0)}{T(d_0 - d_1, 0)} \cdot \frac{e^{-\mu_s f'}}{e^{-\mu_s \cdot \rho}} \cdot \frac{\mu_{\Delta V}}{\mu_{water}} \cdot \rho e$$

⑥ Since the distance ρ is usually small for the important



Administrative Skills

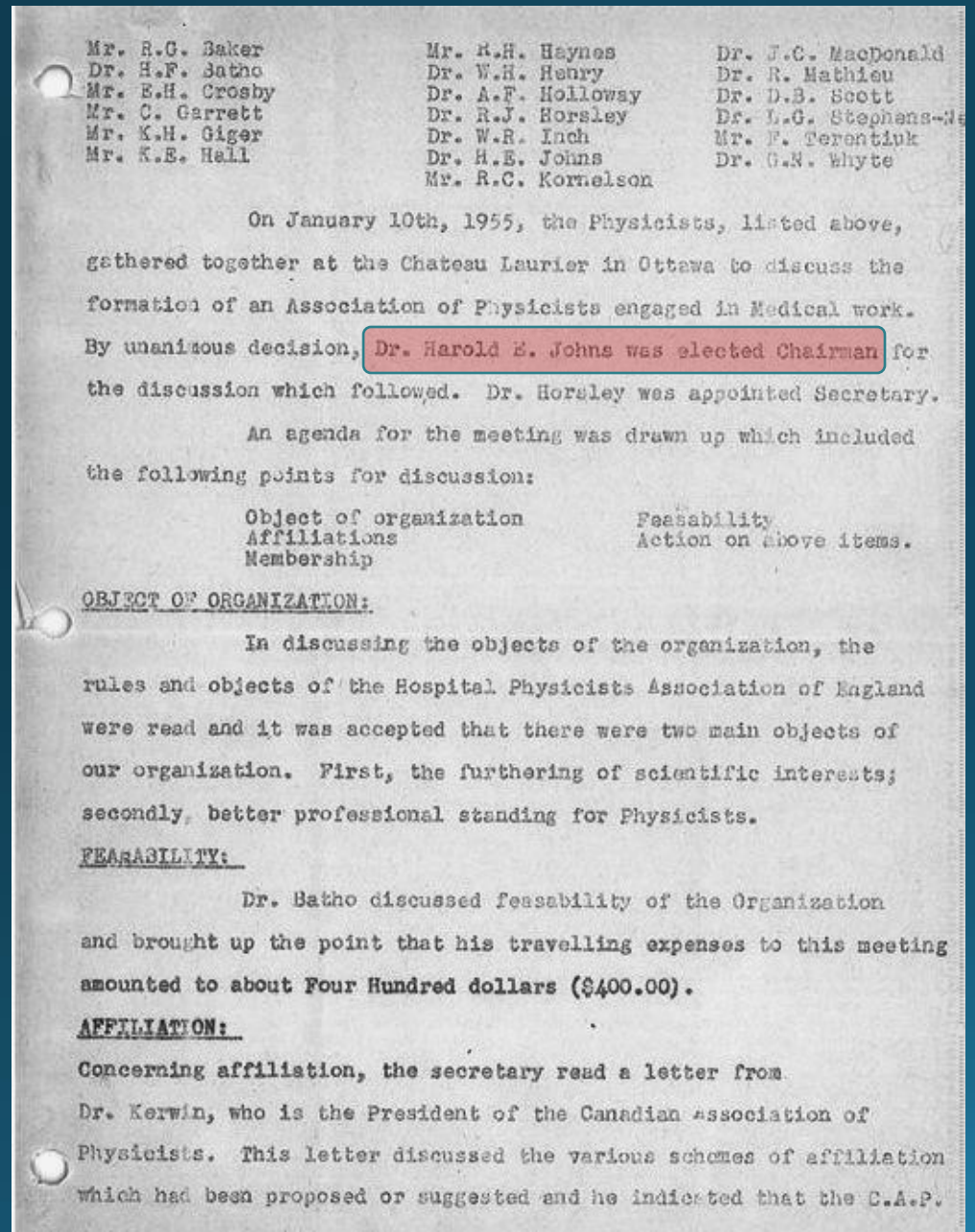
- Confident Leader, Convincing
- Influential with governments
- Public Relations – Demos
- Radiation Protection

In recalling his 1946 experiences, Johns reported (Johns1976): "On my return to Saskatoon, Dr Blair asked me what I had learned and what we should do in Saskatchewan. I said we should get a betatron and design a cobalt unit. By 10 o'clock that morning we had an appointment with the premier of the province, **Tommy Douglas**, whose enthusiasm matched ours and whose permission gave us the full backing of the Saskatchewan Government" (*DVC note: Not for one or the other but for both!*)

Harold Johns demonstrates the operation of a Cobalt-60 treatment unit to Princess Margaret

"Watch out for the little fellow with an idea."

Father of Medical Physics



Mr. R.G. Baker
Dr. H.F. Batho
Mr. E.H. Crosby
Mr. C. Garrett
Mr. K.H. Giger
Mr. K.E. Hall
Mr. R.H. Haynes
Dr. W.H. Henry
Dr. A.F. Holloway
Dr. R.J. Horsley
Dr. W.R. Inch
Dr. H.E. Johns
Mr. R.C. Kornelson
Dr. J.C. MacDonald
Dr. R. Mathieu
Dr. D.B. Scott
Dr. L.G. Stephens-[illegible]
Mr. P. Terentiuk
Dr. G.N. Whyte

On January 10th, 1955, the Physicists, listed above, gathered together at the Chateau Laurier in Ottawa to discuss the formation of an Association of Physicists engaged in Medical work. By unanimous decision, Dr. Harold E. Johns was elected Chairman for the discussion which followed. Dr. Horsley was appointed Secretary.

An agenda for the meeting was drawn up which included the following points for discussion:

Object of organization
Affiliations
Membership
Feasability
Action on above items.

OBJECT OF ORGANIZATION:

In discussing the objects of the organization, the rules and objects of the Hospital Physicists Association of England were read and it was accepted that there were two main objects of our organization. First, the furthering of scientific interests; secondly, better professional standing for Physicists.

FEASABILITY:

Dr. Batho discussed feasability of the Organization and brought up the point that his travelling expenses to this meeting amounted to about Four Hundred dollars ($400.00).

AFFILIATION:

Concerning affiliation, the secretary read a letter from Dr. Kerwin, who is the President of the Canadian Association of Physicists. This letter discussed the various schemes of affiliation which had been proposed or suggested and he indicated that the C.A.P.

cap

COMP
Canadian Organization of Medical Physicists

OCPM
Organisation canadienne des physiciens médicaux

CCPM

Kornelson

Fedoruk *

Epp

Bates

Cormack *

Cradduck *

Cunningham *

Darby

Freeman

Horsley

Hunt *

Whitmore *

Till

Mauchel

Morrison

Bernier

Reid

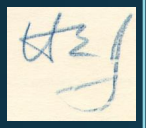
Skarsgard

Bruce

Griffith

Scrimger

Derbowka



HEJ – First Generation

Circa 1989 U Western Ontario

HEJ – Fourth Generation

HEJ – 5th Generation

PhD 1987

Cindy Thomason

PhD 1990

Sam Beddar

PhD 1991

Doug Simpkin

MS 1992

Jason Sohn

PhD 1993

Tim Holmes

PhD 1994

Nikos Papanikolaou

PhD 1995

Mark Holmes

PhD 1997

Ben Nelms

PhD 1997

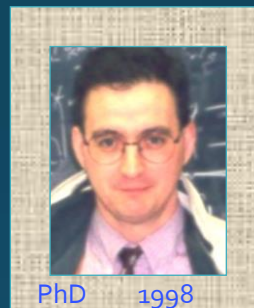
James Yang

PhD 1997

Todd McNutt

PhD 1998

Michelle Svatos

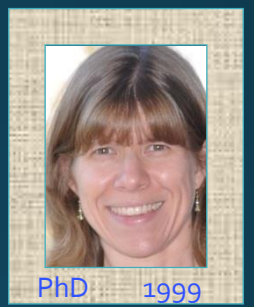


PhD 1998

John Balog

PhD 1999

Ken Ruchala



PhD 1999

Stacy Aldridge

PhD 1999

Dave Shepard

PhD 2000

Jeff Kapatoes

PhD 2001

Weiguo Lu

PhD 2002

Chuan Wu

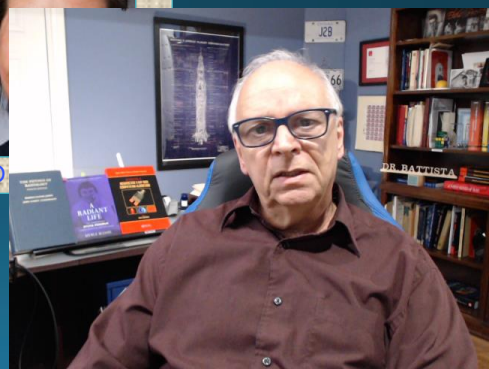
PhD 2002

Jeni Smilowitz

PhD 2003

Ralf Hinderer

PhD



HEJ – 5th Generation

PhD 2003

Marv Glass

PhD 2004

Tiezhi Zhang

PhD 2004

Ke Sheng

MS 2005

Josh James

MS 2006

Michael Kissick

PhD 2006

Richard Shaw

PhD 2006

Sarah Boswell

PhD 2006

Stew Becker

MS 2007

Pat Matola

PhD 2007

Alonso Gutierrez

PhD 2007

Jihad Al-Sadah

PhD 2007

Ryan Flynn

PhD 2009

Dave Westerly

PhD 2010

Miao Zhang

PhD 2011

Pat Hill

PhD 2011

Brian Hundertmark

PhD 2011

Dongxu Wang

PhD 2012

Naser Darwish

PhD 2012

Dustin Jacqmin

PhD 2012

Evan Sengbusch

PhD 2014

Jeremy Bredtfeld

Conclusions

- Saskatchewan – Birthplace of Canada's medical physics
- Radiation Sciences - Canadian success story
  - University-Government-Industry Collaboration
  - Translational Research - Science to Medicine
  - Research, Education, Training Opportunities
  - Generations of research still going strong
- Harold Johns played the leading role

Paul Johns & Ian Cunningham

Western

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