The Future of Precision in RT

A Tribute to Michael B. Sharpe, Ph.D.
AAPM Memorial Session – July 31, 2017

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1965 - 2016

A Tribute to
Michael B. Sharpe, Ph.D.

Physicist
Innovator
Educator
Mentor
Cyclist
Father
Husband
&
Friend

Michael B. Sharpe, Ph.D.

• Associate Head of Medical Physics, Professional and Academic Affairs at the Princess Margaret Cancer Centre.
• Affiliated Faculty of the Techna Institute.
• Associate Professor in the Departments of Radiation Oncology and Mechanical and Industrial Engineering at the University of Toronto.
• Quality Leader of Cancer Care Ontario’s Radiation Treatment Program.
• Fellow of the American Association of Physicists in Medicine in 2015.
Mike had a deep understanding of dose calculations

Examiner: J.R. Cunningham

Thesis: A Unified Method of Calculating the Dose Rate and Dose Distribution for Therapeutic X-Ray Beams
Prolific, Academic, and Practical
A unique combination

https://scholar.google.com/citations?hl=en&user=W-hwMkAAAAJ

ABC: Active Breathing Control
Modify a Ventilator

Suspension of Respiratory Motion based on Lung Volume

ABC

Fig. 1. The flow-volume display extracted from the ABC computer.
Pioneer in Accelerated Partial Breast Irradiation

Clinical Investigation

Accelerated Partial Breast Irradiation Using 3D Conformal Radiation Therapy (3D-CRT)

Kathy L. Baglan, M.D., Michael B. Snapp, Ph.D., Doris Jovanov, Ph.D.,
Robert C. Farmer, M.D., Julie Fain, M.S., Larry L. Keul, M.D.,
Vincent Remonti, M.D., Alvaro A. Martinez, M.D., F.A.C.R., John Wing, Ph.D., and
Frank A. Vechi, M.D.

Department of Radiation Oncology, William Beaumont Hospital, Royal Oak, MI.


Non-Coplanar Delivery Radiation Beams

Clinical Investigation

Fig. 1. Typical 4-field arrangement for right-sided lesions and 5-field arrangement for left-sided lesions.


First Trial on Partial Breast Irradiation Delivered with External Beams

Clinical Investigation

Ongoing Clinical Experience Utilizing 3D Conformal External Beam Radiotherapy to Deliver Partial Breast Irradiation in Patients with Early Stage Breast Cancer Treated with Breast-Conserving Therapy

Frank A. Vechi, M.D.,† Vincent Remonti, M.D.,† Merrilee Wallace, R.N.,†
Michael Snapp, Ph.D.,† Julie Fain, M.S.,† Laura Tysmore,† Nicola Letts, B.Sc.,†
Larry Keul, M.D., Gregory Emmons, M.S.C.,† and Peter Berg, M.D.,†
Neal S. Ogilvie, M.D.,† and John Wing, Ph.D.,†

Departments of †Radiation Oncology, Surgery, and ‡Anatomic Pathology, William Beaumont Hospital, Royal Oak, Michigan.

1.6% Decrease in Breast Irradiated by > 50% Dose Per %PTV Volume Decrease

Subsequently Breast Dose Conservation Shown to Improve Cosmetic Outcome

Clinical trial that showed that IMRT could be used with tangential breast radiotherapy to improve dose uniformity and lower skin dose

Advancing Cone-beam CT for IGRT

The stability of mechanical calibration for a kV cone beam computed tomography system integrated with linear accelerator

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Jeffrey H. Stenstrom and David A. Jaffray
Princess Margaret Hospital, Cancer Institute, and University of Toronto, Toronto, Ontario M5G 2M9, Canada
(Received 30 July 2005; revised 3 November 2005; accepted for publication 5 November 2005, published 23 December 2005)
Calibration Methods for Cone Beam CT

Some of the earliest work in Robust Optimization for IMRT

Mike’s efforts led to an outstanding and enduring collaboration between the Department of Mechanical and Industrial Engineering at the University of Toronto and the Princess Margaret Cancer Centre.

Tim Chan, Ph.D.

Inverse Optimization and Knowledge-based Treatment Planning

Generalized Inverse Multiobjective Optimization

Predicting objective function weights from patient anatomy in prostate IMRT treatment planning
Tawee Lee, Muneer Mammad, Timothy C. Y. Chan, Tim Craig, and Michael B. Sharpe
Citation: Medical Physics 46, 521705 (2019); doi: 10.1118/1.4838841

Models for predicting objective function weights in prostate cancer IMRT
Justin J. Boutilier, Tawee Lee, Tim Craig, Michael B. Sharpe, and Timothy C. Y. Chan
Citation: Medical Physics 42, 1586 (2015); doi: 10.1118/1.4914140

Sample size requirements for knowledge-based treatment planning
Justin J. Boutilier, Tim Craig, Michael B. Sharpe, and Timothy C. Y. Chan
Citation: Medical Physics 43, 1212 (2016); doi: 10.1118/1.4941363
Automated Design of Treatment Plans

- <4 Minutes for IMRT Breast
- 1000's of cases treated
- Reduced clinical rejection rate by 50% (i.e. to 1.2%)

Teacher and Societal Contributor

Cancer Care Ontario’s Innovation Award in 2007.

University Health Network’s Inventor of the Year Award in 2009.
2004 Joint ASTRO-AAPM Report
“Blessing” IMRT

AAPM TG-65: Report on Dose Calculations

TG-74: The Key to Model-Based Dose Calculation
Organizational Standards for the Delivery of Intensity Modulated Radiation Therapy (IMRT) in Ontario: Recommendations


A Special Project of the Radiation Therapy Program, Cancer Care Ontario and the Program in Evidence-based Care, Cancer Care Ontario

Developed by the Expert Panel on Intensity Modulated Radiation Therapy

Report Date: January 30, 2009

Clinical Oncology 21(3), 192-203 (2009)

Clinical Oncology 21(3), 192-203 (2009)

Peer Review of Treatment Plans

Uses of Peer Review in Radiation Oncology

Rating Scores

Most Important

0 1 2 3 4 5 6 7 8 9 10

- Detection of medication errors
- Improvement of treatment planning policies
- Consistency of plans with existing policy
- Reduce variation in practice
- Reduce treatment incidence
- Education of nurses
- Feedback in multidisciplinary tumor board
- OEC of staff

Michael Brunnberg, Sophie Frossard, Tom McCooey, Eric Gutierrez, Michael Sharpe.

\[ \text{A True Medical Physicist} \]

Clinician Academic Educator

"The Devil is in the details, but so is salvation."

- Albert A. Michie, 1935

Passionate Skeptical Commited
Precision Medicine in RT – A Frontier of Clinical Science that needs Medical Physics

Mike personified the critical role of the Medical Physicist in the Future of Precision Medicine in RT

“...tomorrow, or some future day, what I establish today. I am today what I established yesterday or some previous day.”

James Joyce (1882-1941)