TARA 2015 Annual General Meeting Minutes

Auditorium: Thursday November 26, 2015
Meeting commenced at 13:30 PM.

TARA Executive Member Attendees:
Jean-Michel Poutissou
Roy Moore
Corrie Kost
Harvey Quan
Dana Giasson
Andy Hurst
Jim Hanlon

TARA Member Attendees:
30 other TARA members

1. Agenda
   - Approval of previous minutes from Friday, December 12, 2014
   - Membership Status
   - Chairs Report
   - TRIUMF status
   - Retiree Benefit Plan Administration Report
   - Election of TARA Executive
   - Activities for 2016

2. Approval of the last TARA Annual General Meeting Minutes
Approved and distributed the meeting minutes of the last TARA AGM held on Friday December 12, 2014.

3. Membership Status
There are now 122 TARA members.

4. Chair’s Report
There were discussions on:
- The TRIUMF 50th Anniversary History Project
- Vogt and Astbury Symposiums
- Articles and Awards
- Science Experiments
5. TRIUMF Status

Jim Hanlon reported on the following:

- Additional $45 million funding averted employee staff changes
- The ARIEL Project is the priority
- There was a management shuffle and the Organization Chart now reflects standard nomenclature as other organizations
- TRIUMF will be engaging the UBC community in the future plans
- Master Plan will be to upgrade facilities, the ARIEL Control Room, Auditorium, Portable Buildings
- Ariel II funding is in progress
- 2015 had no new resources
- Research into Tc-99 continues
- Healthcare companies are interested in the commercial success of the TR-24 Cyclotron and IAMl will provide Project Funding
- AAPS is now a non-profit operation
- There is a Mike Craddock Endowment Fund

Note: Detailed presentation is attached.

6. Retiree Benefit Plan Administration Report

Shirley Tang provided a presentation (attached) on healthcare and dental statistics.

7. Election of TARA Executive

A request was made for 1 or more members to volunteer as TARA executive members. There were no volunteers at this time.

The following members were elected to the 2016 TARA EXECUTIVE:
- Jean Michel Poutissou
- Corrie Kost
- Roy Moore
- Andrew Hurst
- Harvey Quan

TRIUMF Staff Laison: Dana Giasson and Jim Hanlon

8. Activities for 2016

There was discussion on potential future events for members and also the idea of a visit from Justin Trudeau for the 40th anniversary of the opening of TRIUMF on Feb 9/1976.
9. 20th Anniversary Celebration of Proton Therapy Program (in Auditorium)

a) Introduction/History by Ewart Blackmore (see attached)

b) Cancer Radiotherapy with Proton Beams by Cornelia (Connie) Hoehr (see attached)

c) “Views” from the doctors by Tom Pickles and Kate Paton

10. Party for TARA Members and Guests was held in the Hot Spot Café

- held from 17:00 to 18:00
Accelerating Science and Innovation for Canada

TRIUMF Alumni & Retirees Association | November 26, 2015

Jim Hanlon | Chief Administrative Officer
Owned & operated by a consortium of 19 universities

- 12 MEMBERS
- 7 ASSOCIATE MEMBERS
2015 Nobel Prize in Physics

Takaaki Kajita
Arthur B. McDonald

“For the greatest benefit to mankind”
Alfred Nobel

2015 NOBEL PRIZE IN PHYSICS

v News!

2015/11/26

TRIUMF

SNOLAB

Queen's

UNIVERSITY
• Released on April 21, 2015, Economic Action Plan 2015 contained $45M in new funding for TRIUMF, and also reaffirmed the government’s commitment to the laboratory.

• Although CAPTURE did not receive the full $68M requested, the funding we received will preserve TRIUMF’s capacity for the next five years.
TRIUMF’s priorities over the next five years will be focused in the following program areas:

- ARIEL-II
- Nuclear and Particle Physics
- Nuclear Medicine
- Materials Science
- Commercialization

all in the context of Safe and Effective Operations
TRIUMF has engaged UBC Campus Planning to help develop a Site Master Plan that opens TRIUMF to the community, and

1) Captures the present state of the laboratory
2) Identifies facilities that need replacement and/or renovation
3) Rationalizes the flow of people and materials across the site
4) Links TRIUMF’s site to its strategic plan
5) Sites future facilities in support of the plan
6) Allows TRIUMF to respond quickly if funding opportunities arise
7) Identifies opportunities for philanthropy; makes TRIUMF’s story easier to tell
8) Ensures that growth occurs in a way that leaves room for future development
• The Master Plan will address

1) Space for future physics facilities
2) Office space for staff and visitors
3) Lab space for life and physical sciences
4) Storage space for radioactive materials
5) Central control room
6) Auditorium, meeting rooms
7) Innovation centre (Joint with UBC?)
8) Cafeteria
9) Visitor centre
10) Places to congregate
• ARIEL brings together all 19 of TRIUMF’s member universities, and represents TRIUMF’s future
• Advancing ARIEL will be TRIUMF’s highest priority project over the next five years
• The ARIEL-II project (UVic) was approved and fully funded by CFI ($13.6M)

• ARIEL-II has received full funding from four of the five provinces (AB, MB, ON, QC) approached to match the CFI request ($8.6M)
  • BC is studying the proposal
• Budget 2015 provided no new resources to expand nuclear medicine
  • The program remains poised to deliver significant benefit to Canada

• Work continues on Tc-99m project
  • Clinical Trials have started in Vancouver, and will soon begin in London, Ontario

• Discussions are underway with provincial health providers and commercial partners to bring this technology to market as quickly as possible
Tc-99m production will be a major pillar of IAMI, the Institute for Advanced Medical Isotopes

- TRIUMF is working with the WD and UBC on a new building to house the TR-24 cyclotron that will underpin IAMI
- TRIUMF is identifying a site for this new facility and is seeking the resources required to fund its construction
Build Capacity in Nuclear Medicine

TR-24 Vault

Life Sciences Laboratory

Future Expansion

2015/11/26 TARA
Engage Community

• Photowalk 2015
Engage Community

- Photowalk 2015
Over the past year, TRIUMF received letters of support from its network of commercial and community partners, including:

- Advanced Cyclotron Systems Inc.
- BC Cancer Agency
- BC Innovation Council
- Cisco Systems
- Canadian Institute of Nuclear Physics
- Centre for Probe Development and Commercialization
- D-Pace
- General Electric Healthcare Technologies
- IKOMED
- Institute of Particle Physics
- iROC Technologies
- Lawson Health Research Institute
- MacDonald, Dettwiler and Associates (MDA)
- Nordion
- Northstar Medical Radioisotopes
- PAVAC
- Science World British Columbia
- UBC PET / Djavad Mowafaghian Center for Brain Health
In 2015, AAPS will be winding down as a CECR. But it will remain as TRIUMF’s commercial arm

- AAPS will be the outward-focused business-facing part of TRIUMF
- It will assume responsibility for all TRIUMF’s commercial efforts

AAPS will be incented to grow those efforts, increasing revenue to itself and to TRIUMF

- AAPS will partner with other CECRs, and with TRIUMF’s member universities, when it is to mutual advantage

TRIUMF’s Innovation and Industrial Partnerships Committee will help guide the transition

The search for the executive team will begin soon
TRIUMF is extremely grateful to Mike Craddock for endowing this fund.
Thank you!

Merci
TRIUMF
Retiree Benefit
# Plan Participation

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<td>43 Retirees</td>
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<td>Extended Health Care - #2937</td>
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<tr>
<td>TOTAL # of Retirees for EHC</td>
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<td>Dental Care</td>
<td>83 Retirees</td>
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## Claim Utilization

### Extended Health Care Utilization

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<td>Drugs</td>
<td>$73,760</td>
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<td>Paramedicals</td>
<td>$14,563</td>
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<td>Vision</td>
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<td>Equip. &amp; Supplies</td>
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<td>Other</td>
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# Paramedical Services

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<td>Acupuncture</td>
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<td>Chiropractor</td>
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<td>Massage Therapist</td>
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<tr>
<td>1</td>
<td>Xarel</td>
<td>Blood &amp; Blood Forming Organs</td>
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<td>2</td>
<td>Apo-Levocarb (25 mg)</td>
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<td>Humira</td>
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<td>Crestor</td>
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<td>5</td>
<td>Butrans</td>
<td>Nervous System (pain mgmt)</td>
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<td>10</td>
<td>One touch strips</td>
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**Top 10 Drug Listing**

Total Amount Paid for Drugs: $73,760
## Dental Care Utilization

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<td>Diagnostic</td>
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<td>Preventive</td>
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<td>Restorative *</td>
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<td>Periodontics</td>
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<td>Dentures &amp; Bridges</td>
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<td>Oral Surgery</td>
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<td><strong>Total</strong></td>
<td><strong>$59,124</strong></td>
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New PBC Premium effective December 1, 2015

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<td>1.6%</td>
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</tr>
<tr>
<td>Monthly Prem.</td>
<td>$332.88</td>
<td>$338.89</td>
<td>1.8%</td>
<td>$332.88</td>
<td>$338.89</td>
<td>1.8%</td>
<td>$310.65</td>
<td>$315.74</td>
<td>1.6%</td>
<td></td>
</tr>
<tr>
<td>Change In Monthly Premium</td>
<td>$6.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
MSP Premiums Effective Jan 1, 2016

• Single: $ 75
• Family of Two: $136
• Family of Three or More: $150
The Early Days of Proton Therapy
Steps along the way and who contributed

Celebrating 20 years of Treatment

Ewart Blackmore
1979: Plans for BL2C (65-120 MeV) – John Vincent
1980-82: Design, installation of BL2C components - layout
1982: First test beams on BL2C with fixed stripping foils - EWB
1983-86: Studies on isotope production with cesium (Xe-127) and NaI targets (I-123) - JV & Dave Pearce
1987: First beam into BL1B experimental area – neutrons for RBE measurements in collaboration with BCCA – Gabe Lam
1988: Protons into BL1B area & Bragg peak measurements on BL2C and BL1B (200 MeV) – JV and EWB
1990: BL2C extraction system installed – Dan Gray, Dave Morris
BL2C Proposal 1979

John Vincent

Cyclotron

BL2A

BL2B

BL2C

2C1 to PT

PT Area

Isotope Prod’n

Fig. 109. Proposed layout of beam line 2C inside the vault.
First Bragg Peak Measurements 1988

John Vincent
Ewart Blackmore
1979: First patient treated with negative pions on M8 channel
1994: Last pion patient treated
1997: *Results of randomized trial using pions (2 papers)* based on ~350 patients. Tom Pickles et al

Summary: Experiment in radiotherapy, pion flux issues, 15 fraction issues for scheduling and patient accrual.
- but very important for improving cyclotron reliability/intensity
5 year results with pions no better than conventional therapy

**Protons much easier to produce than pions!**
1988: First meeting of Proton Group Planning Committee
G. Goodman, J. Rootman(Eyes), F. Durity(AVMs)

1988-92: Regular meetings at Cancer Agency: EWB. JV attending

1992: Business plan BCCA to province for tumours of the eye
(uveal melanoma) and neuroradiosurgery (AVMs) – see layout

1992: Woodward’s Foundation grants $500K for eye therapy
using BL2C.

1993: Revised business plan for Eye Therapy only.

Medical: Drs T.Pickles, R.Ma, G.Goodman, K.Paton, L.Skarsgard,
     E.El-Khatib, G.Lam, I.Liu

TRIUMF: E.Blackmore, J.Vincent, U.Oelfke, K.Gardey

Early Plans for Proton Therapy

Fig. 122. Layout of proton therapy facility in present BL1B area.
The capital cost estimates for 1991 for this program include construction of a facility at TRIUMF to allow treatment of patients including an eye chair, radiography facilities and satellite viewing stations. The capital costs are broken down as follows.

<table>
<thead>
<tr>
<th>PROPOSED CAPITAL COSTS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Beam delivery equipment</td>
<td>$50,000</td>
</tr>
<tr>
<td>Alignment equipment</td>
<td>100,000</td>
</tr>
<tr>
<td>Eye chair</td>
<td>115,000</td>
</tr>
<tr>
<td>Controls and instrumentation</td>
<td>50,000</td>
</tr>
<tr>
<td>Building/area modification</td>
<td>100,000</td>
</tr>
<tr>
<td>Treatment planning</td>
<td>25,000</td>
</tr>
<tr>
<td>Contingency</td>
<td>60,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>500,000</strong></td>
</tr>
</tbody>
</table>

**Assumptions**
- Land, building maintenance, hydro, etc. will be by assumed by TRIUMF.
- Building of the beam-handling components would be done by existing staff as outside contracting could increase cost by a factor of 3.
- Estimate for materials or purchased parts only. Assumes TRIUMF will provide design office, electronic and machine shop free of charge. Complete outside contracting could increase cost by a factor of 3.

**Purchases Outside**
- Eye chair - Benchmark
- X-ray equipment - Toshiba
- Room modifications

**Rest done by TRIUMF**

EWB visited Harvard, PSI, Clatterbridge (UK) to learn about Eye Therapy techniques & equipment.
During the last years of the KAON PDS
Design Phase 1993-1994

PROTON THERAPY CONTROL SYSTEM

SAFETY
AREA ACCESS
PROTON THERAPY TRIP

PATIENT MODE
DISABLE

FAST SHUTTER
PLC.
DOSE
MODULATOR
RATES
ASYMMETRY

DOSE TRIP
WATCHDOGS

CAMAC CRATE
ADCS
SCALERS
TRIMAC

PROTON THERAPY VAX

NIM CRATE #1
ORTEC 439
AMP/V-F
BIAS SUPPLY

BACK-UP PRINTER

NIM CRATE #2
ORTEC 439
BIAS SUPPLY
(BACKUP)

BACK-UP COUNTER

ROOM MONITOR
EYE MONITOR
VISUAL SCALERS
CALIBRATION EQUIP.

AUDIO/VIDEO
CONTROL
CHAIR
RANGE SHIFTER
EMERGENCY
X WINDOWS
TERMINAL

BACK-UP
DOSE SET
FAST SHUTTER
IN/OUT
KEY BOARD

CONTROL CONSOLE

November 26, 2015
Proton Therapy 20th
Overall coordination – EWB

**Mechanical design & ass’y:** F. Cifarelli, E. Knight + Machine Shop

**Fast Shutter, profile monitor:** D. Gray, B. Rawnsley

**ISIS pepperpot:** R. Ruegg

**Ion chambers:** W. Faszer, P. Vincent, C. Lim

**Modulators & Range Shifter:** EWB, U. Oelfke, K. Gardey

**Controls hardware, software, cameras, console:** B. Evans, P. Bennett, R. Moore, J. Nelson, D. Morris, B. Roberts

**Operator Interface software:** M. Mouat, T. Kadantseva, E. Klassen

**Room modifications:** H. Mertes

**Safety hardware & overview:** J. Drozdoff, L. Moritz, I. Thorson

**Control room operations & BL2C coordination:** A. Hurst, M. Stenning, J. Vincent, D. Pearce.

**Summer students:** R. Van Varsveld
Main Challenge – Getting AECB Approval

- System commissioned and ready for patient treatment by December 1994
- Dosimetry checked, beam profiles checked
- RBE measurement using V79 cells & mouse feet
- Treatment planning software EYEPLAN and patient alignment checked.
- TRIUMF TSAC approved Safety Analysis Report but AECB wanted more reviews.
- February 1995: External Expert Review Dr. L. Verhey
- April 1995: Structured Peer Review (control system)
Eye Care Centre/UBC: Dr. Katherine Paton, Dr. Jack Rootman

Oncologists: Dr. Tom Pickles, Dr. Roy Ma

Medical Physics: Dick Kornelson, Gabe Lam, Ellen El Khatib, Cheryl Duzenli, William Kwa, Richard Lee, Conrad.Yuen

Physics Ass’t: Ivan Liu, Vince Strgar

Radiotherapy Technologists: Chris Alexander, Pat Ho, Sarah Conibear

TRIUMF: Ewart Blackmore, Conny Hoehr (since ~2009)

Typically 5-9 present at TRIUMF for each treatment
First Patient August 21-25 1995

The first patient, Mr. Lorne Scott, immediately after proton treatment to his right eye at TRIUMF in August 1995.

PRESENT:

Dr. T. Pickles
Dr. E. Blackmore
Dr. R. Ma
Dr. K. Paton
Dr. U. Oelfke
Dr. C. Duzenli
Chris Alexander

Dr. J. Vincent
Dr. L. Skarsgard
Dr. G. Lam
Mr. K. Gardey
Mr. I. Lui
Bob Harrison

DATE
Monday, July 31
Tuesday, August 8
Thursday, August 10
Thursday, August 17
Friday, August 18
Saturday, August 19
Sunday, August 20
Monday, August 21
Tuesday, August 22
Thursday, August 24
Friday, August 25

Clip insertion
Simulation 8:00 a.m. at TRIUMF
Planning 8:30 a.m. at TRIUMF
Final measurements, if needed
Final Simulation
First fraction
Second fraction
Third fraction
Fourth fraction
Thank you!

Merci
Cancer Radiotherapy with proton beams

Dr. Cornelia Hoehr | Research Scientist | TRIUMF
Nuclear Medicine @ TRIUMF

TRIUMF - nuclear physics lab.
Expertise in:
- Accelerator technology
- Accelerator operation
- Detectors
- Targets for isotope production
- Interaction of particles

Applicable to nuclear medicine
If you were to develop cancer:

**Surgery**  — to remove the tumor

**Chemotherapy**  — to kill the tumor with drugs (fast-dividing cells)

**Radiotherapy**  — to kill the tumor with radiation
  * External beam therapy  — photons, neutrons, protons
  * Internal therapy  — brachytherapy (radioactive isotopes)

**Success:**  Tumor control vs. complications
Destroy/remove tumor without damaging healthy or normal tissue nearby
Ionizing Radiation

- Charged particles interact strongly and ionize directly.
- Neutral particles interact less, ionize indirectly and penetrate farther.

Particles:
- $\alpha$ (alpha)
- $\beta$ (beta)
- $\gamma$ (gamma)
- $n$ (neutron)
• DNA (Deoxyribonucleic acid): genetic instructions for development and functioning
• Cell needs information from DNA for survival

• Single helix break easy to repair
• Double helix break more difficult to repair
• Cell can not survive

• Radiotherapy: as many double helix breaks in cancer cells as possible with as few double breaks as possible in healthy cells
Linear Energy Transfer (LET): Energy transferred (ionization, secondary electrons) per unit distance.

High LET – ions, neutrons, protons, direct damage

Low LET – photons, electrons, protons, indirect damage via free radical formation
Relative Biological Effectiveness

Definition of Relative Biological Effectiveness:

\[ \text{RBE} = \frac{D_x}{D_i} \]

Data for CHO-K1 cell line irradiated by photons (blue curve) and carbon ions (red curve).
Choice of Treatment

- Radiosensitivity of cancer cell
- Repair ability of healthy tissue
- Size of tumor
- Fractions

External: Photon treatment

- Cost-efficient, easy set-up, very common
- Many techniques to minimize dose to healthy tissue (multiple beams, wedges, intensity modulation…)
- Dose does not stop after tumor
- Low LET
Internal: Brachytherapy

From the Greek word *brachys*, meaning "short-distance", most isotopes used are gamma emitters.

Advantages
- Very localized
- Can have shorter treatment times
- Moves with tumor
- Can be permanent or temporary

Disadvantage
- High dose to medical personnel
- Dose not homogeneous (in some cases 40% of dose can be deposited in 15% of tumor)
- Tumor-size dependent
External: Electron-beam treatment

- Mostly used for tumors close to skin
- Low LET
External/internal: Neutron treatment

- Boron neutron-capture therapy (BNCT)

- BNCT (thermal <0.1 eV)
- Only experimental (treatment for hours)
- Tracer development still in beginning
External: Ion-beam therapy

Advantage
• Less dose to surrounding tissue (Bragg peak)
• Very homogeneous tumor dose
• High control over position of Bragg peak (low to high LET)

Disadvantage
• Need higher-energy accelerator
• 250MeV for 30cm in human tissue
• Expensive
The equation is as follows:

$$- \frac{d T}{d x} = \frac{4 \pi e^4 z^3}{m v^3} Z \ln \frac{2 m v^2}{E},$$

Zur Theorie des Durchgangs schneller Korpuskularstrahlen durch Materie,
Annalen der Physik. vol. 397, pp. 325-400, 1930
Robert Wilson – father of proton therapy

External: Ion-beam therapy

Advantage
- Less dose to surrounding tissue (Bragg peak)
- Very homogeneous tumor dose
- High control over position of Bragg peak (low to high LET)

Disadvantage
- Need higher energy accelerator
- 250MeV for 30cm in human tissue
- Expensive
X Rays vs. Protons

- Highest dose - red
- Lowest dose - yellow

X rays

Protons
Ocular Melanoma

Frequency: 5 - 6 cases/year per million population

Treatment protocols:  Radioactive plaque therapy  
Charged-particle radiotherapy  
Enucleation

Uveal Melanoma before proton beam treatment  
Uveal Melanoma after proton beam treatment
Modulators: 5 mm to 27 mm in 1 mm increments (depth control)
Brass collimators (lateral control)
Mono-energetic proton – Bragg peak at the end of its range

Modulate energy – Spread Out Bragg Peak (SOBP)

Maximum dose to tumor – minimize dose to nearby sensitive structures
Beamline
Patient Set-up

Treatment Chair
6 motorized motions
X, Y, Z, K, θ, Φ
**Patient Set-up**

**First set-up**

**Second set-up**

**Treatment plan**

**Treatment:** four days in a row, around 90 seconds each
Patient Set-up

Statistics: 183 patients, average 9/year, ages 14-80, median 57
Tumor control >95%, survival rate (>5 years) 80%
Collaboration

Eye Care Centre

BC Cancer Agency

TRIUMF

Dr. Ewart Blackmore
Around the World

Proton and heavy ion therapy centers

Currently 59 centers in operation, 36 under construction, 15 in planning