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 IAMI 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 40^{th} 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



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Accelerating Science and Innovation for Canada

TRIUMF Alumni & Retirees Association | November 26, 2015

Jim Hanlon | Chief Administrative Officer

Accelerating Science for Canada Un accélérateur de la démarche scientifique canadienne

Owned and operated as a joint venture by a consortium of Canadian universities via a contribution through the National Research Council Canada Propriété d'un consortium d'universités canadiennes, géré en co-entreprise à partir d'une contribution administrée par le Conseil national de recherches Canada





Membership





2015 Nobel Prize







v News!





2015/11/26

TARA



Budget 2015

- 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





Five-Year Plan 2015 – 2020

- 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





Organization





Site Master Plan (1)

- 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



Site Master Plan (2)

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 (1)



- 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 TARA 9



ARIEL (2)

- 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



Photowalk 2015



Build Capacity in Nuclear Medicine

- 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







Build Capacity in Nuclear Medicine



- 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





Engage Community

• Photowalk 2015





Engage Community

• Photowalk 2015





Engage Community

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





RIUMF

Increase Commercial Activity – AAPS

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





Advanced Applied Physics Solutions

RIUMF

Michael Craddock Fund for Students in Accelerator Science

TRIUMF is extremely grateful to Mike Craddock for endowing this fund.





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Thank you! Merci

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TRIUMF Retiree Benefit

Plan Participation

Benefit Line	Current (2015)	
Extended Health Care - #2936	43 Retirees	
Extended Health Care - #2937	68 Retirees	
TOTAL # of Retirees for EHC	111 Retirees	
Dental Care	83 Retirees	

Claim Utilization

Extended Health Care Utilization

	Sep 14 - Aug 15		
	\$ paid	% of total	
Drugs	\$73,760	74%	
Paramedicals	\$14,563	15%	
Vision	\$1,424	1%	
Equip. & Supplies	\$6,823	7%	
Other	\$3,179	3%	
Out-of-Canada	\$0	0%	
Total	\$99,749	100%	

Paramedical Services

	Sep 14 - Aug 15	
	\$ paid	% of total
Acupuncture	\$2,510	17%
Chiropractor	\$2,402	16%
Massage Therapist	\$1,942	13%
Naturopath	\$218	1%
Podiatrist/Chiropodist	\$2,830	19%
Physiotherapist	\$4,311	30%
Psychologist	\$350	2%
Miscellaneous	\$0	0%
Total	\$14,563	100%

Top 10 Drug Listing

Rank	Drug Name	Common Indicator	Total Claims Paid
1	Xarel	Blood & Blood Forming Organs	\$1,788
2	Apo-Levocarb (25 mg)	Central Nervous System	\$1,325
3	Humira	Asthma	\$1,237
4	Crestor	Cardiovascular	\$1,208
5	Butrans	Nervous System (pain mgmt)	\$1,026
6	Renagel	Various	\$993
7	Norvasc	Cardiovascular	\$978
8	Cymbalta	Nervous System	\$977
9	Nexium	Alimentary Tract	\$966
10	One touch strips	Diabetes	\$959
		Top 10 Drug Listing	\$11,458
		Total Amount Paid for Drugs	\$73,760

Dental Care Utilization

Dental Care Utilization

	Sept 14 - Aug 15	
	\$ Paid	% of Total
Diagnostic	\$7,829	13.2%
Preventive	\$15,863	26.8%
Restorative *	\$19,627	33.2%
Endodontics	\$5,810	9.8%
Periodontics	\$6,528	11.0%
Dentures & Bridges	\$1,791	3.0%
Oral Surgery	\$1,677	2.8%
Total	\$59,124	100.0%

New PBC Premium effective December 1, 2015

Policy #2936 - Single			
	Current	Renewal	% Chg
EHC	\$63.35	\$67.91	7.2%
Dental	\$50.85	\$48.82	-4.0%
Monthly Prem.	\$114.20	\$116.73	2.2%
Change In Monthly	Premium		\$2.53

Policy #2936 - Couple			
	Current	Renewal	% Chg
EHC	\$122.86	\$130.97	6.6%
Dental	\$104.28	\$100.11	-4.0%
Monthly Prem.	\$227.14	\$231.08	1.7%
Change In Monthl	y Premium		\$3.94

Policy #2936 - Family			
	Current	Renewal	% Chg
EHC	\$164.68	\$175.61	6.6%
Dental	\$145.97	\$140.13	-4.0%
Monthly Prem.	\$310.65	\$315.74	1.6%
Change In Monthl	y Premium		\$5.09

Policy #2937 - Single			
	Current	Renewal	% Chg
EHC	\$73.09	\$78.05	6.8%
Dental	\$50.85	\$48.82	-4.0%
Monthly Prem.	\$123.94	\$126.87	2.4%
Change In Monthl	y Premium		\$2.93

Policy #2937 - Couple			
	Current	Renewal	% Chg
EHC	\$145.08	\$154.11	6.2%
Dental	\$104.28	\$100.11	-4.0%
Monthly Prem.	\$249.36	\$254.22	1.9%
Change In Monthl	y Premium		\$4.86

Policy #2937 - Family			
	Current	Renewal	% Chg
EHC	\$186.91	\$198.76	6.3%
Dental	\$145.97	\$140.13	-4.0%
Monthly Prem.	\$332.88	\$338.89	1.8%
Change In Monthl	y Premium		\$6.01

MSP Premiums Effective Jan 1, 2016

- Single: \$75
- Family of Two: \$136
- Family of Three or More: \$150



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The Early Days of Proton Therapy

Steps along the way and who contributed

Celebrating 20 years of Treatment

Ewart Blackmore

Accelerating Science for Canada Un accélérateur de la démarche scientifique canadienne

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First Steps TRIUMF 1979-1990

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 Nal 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





First Bragg Peak Measurements 1988



RTRIUMF

Collaboration with BC Cancer Agency

1979: First patient treated with negative pions on M8 channel

- 1981: Patient couch installed, cyclotron reliability/intensity issues for 15 fraction treatments.
- 1990: Pion therapy at TRIUMF. Treatment results for astrocytoma grades 3 and 4: a pilot study. <u>Goodman GB</u>¹, <u>Skarsgard LD</u>, <u>Thompson GB</u>, <u>Harrison R</u>, <u>Lam GK</u>, <u>Lugate C</u>.
- 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!

RIUMF

Collaboration towards Proton Therapy

- 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
- Monthly meetings at Cancer Agency 1993-1995.


Early Plans for Proton Therapy



Proposal to Woodward's Foundation for Eye Therapy

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.

PROPOSED CAPITAL COSTS	
Beam delivery equipment	\$50,000
Alignment equipment	100,000
Eye chair	115,000
Controls and instrumentation	50,000
Building/area modification	100,000
Treatment planning	25,000
Contingency	60,000
	500,000

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.

TABLE 5

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



Design Phase 1993-1994

During the last years of the KAON PDS



RTRIUMF

Design Phase 1993-1994

PROTON THERAPY CONTROL SYSTEM





TRIUMF PT Team

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

RIUMF

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)
- May 30, 1995: AECB grants Proton Therapy Operating Licence.



BC Cancer Agency/Ophthalmology Team

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	
Chr	is Alexander	

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

DATE	·
Monday, July 31	Clip insertion
Tuesday, August 8	Simulation 8:00 a.m. at TRIUMF
Thursday, August 10	Planning 8:30 a.m. at TRIUMF
Thursday, August 17	Final measurements, if needed
Friday, August 18	
Saturday, August19	
Sunday, August 20	Final Simulation
Monday, August 21	First fraction
Tuesday, August 22	Second fraction
Thursday, August 24	Third fraction
Friday, August 25	Fourth fraction



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Cancer Radiotherapy with proton beams

Dr. Cornelia Hoehr | Research Scientist | TRIUMF







RIUMF

Nuclear Medicine @ TRIUMF



2



Cancer









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





DNA break



 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



LET – Linear Energy Transfer



7



Relative Biological Effectiveness



Definition of <u>R</u>elative <u>B</u>iological <u>E</u>ffectiveness: RBE= 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

IAEA technical report series No. 461 (2008)



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 <0.1eV)
- 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





Bethe – Bloch equation



Hans Bethe, 1930 and 1932

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

Zur Theorie des Durchgangs schneller Korpuskularstrahlen durch Materie, Annalen der Physik. vol. 397, pp. 325-400, 1930

Robert Wilson – father of proton therapy



Radiological Use of Fast Protons, Radiology vol. 47, pp. 487-91, 1946



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



X rays

Protons



Proton Therapy at TRIUMF



19



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



Treatment Planning



Beamline





Beamline





Modulator and Collimator



Modulators: 5 mm to 27 mm in 1 mm increments (depth control) Brass collimators (lateral control)



Beam Profile



Beamline





Patient Set-up




Patient Set-up

Second set-up Treatment plan First set-up ÷γ . m a ÷γ

Treatment: four days in a row, around 90 seconds each



Patient Set-up

Second set-up First set-up Treatment plan ÷γ 01

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



Collaboration









Dr. Ewart Blackmore



Around the World

