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A Newsletter for those interested in proton, light ion and heavy charged particle radiotherapy.

Number 5 January 1990 Editor: Janet Sisterson Ph. D., HCL

This is the fifth issue of a newsletter devoted to matters of interest to all those involved, or planning to become involved in proton, light or heavy ion and heavy charged particle radiation therapy.

Future E-mail and Fax directories:I have e-mail addresses for only about 20 people of the 250 or so who are on my mailing list. I would like more before I include them in an issue of 'Particles'. So, if you think such a compilation would be helpful, send me your e-mail address. I have about the same number of FAX addresses, I could include a list of these at some time if that would be useful.

Information sent to me for inclusion in the newsletter does not need to be extensive but it should be "camera ready" if possible. I am using the following format; flush left; left and right margins of one half inch; single spacing using the 12 point New Century Schoolbook, if you have it, and the Times font, or whatever, if you don't. Graphs and line drawings are welcome.

The deadline for the next newsletter is May 30 1990, so that the sixth issue can come out in June 1990.
Address all correspondence to:-

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FUTURE PTCOG MEETINGS

The times and locations of the next PTCOG meetings are as follows:-

PTCOG XII	Loma Linda CA USA	Monday May 7 1990	workshop on gantry/beam delivery
		May 8 & 9 1990	Main PTCOG meeting
PTCOG XIII	Boston MA USA	week of October 29 1990	
PTCOG XIV	?Fermilab IL USA	Spring 1991	

PTCOG XV	?LBL, Berkeley CA	Fall 1991
PTCOG XVI	?Europe	Spring 1992

A formal announcement and registration form will be sent out about 3 months before each meeting.

PTCOG XII: Please contact Michael Goitein at MGH if you would like to make any suggestions concerning the workshop on gantry/beam delivery design. This is intended to be a working meeting for people who are actively working on these problems.

If you need to make arrangements early for this meeting please contact:

Mrs. Sandra O'Hara
Department of Radiation Oncology
Loma Linda University Medical Center
11234 Anderson Street
Loma Linda CA 92354

phone (714) 824-4644
fax (714) 824-4083

Anyone who has suggestions, or if you wish to join PTCOG, should contact the secretary of PTCOG, Michael Goitein, Department of Radiation Medicine, Massachusetts General Hospital, Boston, MA 02114.

Minutes of PTCOG XI PSI Switzerland September 1989

A very full and successful meeting was held at the Paul Scherrer Institute (previously SIN) at Villigen, Switzerland in conjunction with the European Organization of Research and Treatment of Cancer (EORTC) Heavy Particle Therapy Group, and the European Clinical Neutron Dosimetry Group (ECNEU). There were some 116 registrants. The meeting offered an opportunity for a broad international exchange of views and information, and for some cross-fertilization between neutron and charged particle investigators. A vigorous and increasing level of interest and activity in proton beam therapy was evident at the meeting. It is planned to publish a book of the proceedings.

Two issues surfaced during the meeting: one concerning the radiobiological effectiveness (RBE) of proton beams, the other with clinical protocols. So far as RBE is concerned, it became clear that there is a divergence of opinion and, more importantly, of practice concerning the RBE being used in clinical trials. The MGH/Harvard group use a value of 1.10 (all values relative to cobalt-60 radiation) which they consider, if anything, to be on the low side of the experimental data. The Japanese at KEK in Tsukuba, and the Soviets at ITEP in Moscow both use a value of 1.00 based on their analyses of the data. It is clear that there is a need to review this matter. On the one hand, it will become difficult to interpret the clinical data as they accumulate if an inconsistent set of RBE values are used; on the other hand, there may well be a need to perform international cross-calibrations of proton beams on both a biological and physical basis to resolve the issue.

So far as clinical protocols are concerned, two meetings were held to present outlines of some of the existing and proposed protocols, and to discuss how to proceed in order to best use the talent and interest within PTCOG: to generate co-operation in the design and conduct of clinical trials, to improve proposed protocols, and to generate new protocols.

It was decided that PTCOG will form a new protocol sub-committee to review and propose protocols. It is likely that there will be a large degree of overlap with the existing clinical sub-committee. However, because the review process will involve the mailing (and, we trust, reading) of voluminous material in at least some instances, the protocol committee should be limited to those (primarily clinicians) with a serious interest in reading and commenting on protocols, and/or in proposing new initiatives. With regard to the latter, a "short form" will be developed by Dr. George Goodman of TRIUMF which will be helpful to those wishing to propose new clinical areas for exploration. A member of PTCOG who would like to be included on the protocol sub-committee should contact Michael Goitein, Department of Radiation Medicine, Massachusetts General Hospital, Boston, MA 02114.

Correction to Particles 4

I apologize to Dr. George Goodman of the Cancer Control Agency of B. C. and TRIUMF for the unfortunate typing error in the third paragraph of his report in Particles 4; it was such a good 'typo' that it completely changed the sense of the sentence. That paragraph should read:-

In his research project Dr. Y Ogawa, Associate Professor of Radiology, Kochi University and visiting TRUIMF clinical research Fellow has been investigating the potential therapeutic gain for pions using two kinds of animal tumor models. The adjuvant use of biological response modifier Schizophyllon (SPG) has been studied in its capacity to delay time to recurrence of tumors. The studies show that pion treatments are of greater benefit in moderately slow growing tumors (SCC VII) with hypoxia and with fractionated treatments whereas KHT sarcoma, a rapidly growing tumor, showed little effect. The immunomodulator SPG produces an enhanced growth **delay** in one tumour model (SCC VII) and with reduction in pulmonary metastases. This suggests new horizons for combination therapy in that pion can control the local tumor resulting in minimal residue allowing the immunomodulator to maximize its effect.

PTCOG News

The following information was received by June 1989.

On October 17 1989 the San Francisco area was struck by a major earthquake (7.1 on the Richter scale). The following report is an edited version taken from the articles that appeared in "Currents" published weekly by the **Lawrence Berkeley Laboratory**

"Preliminary inspection throughout the Laboratory showed no structural damage and minimal nonstructural damage, such as some fallen plaster and spilled computer tapes. A few cans in the cafeteria storage room fell on the floor. There were two minor chemical spills that were cleaned up immediately. The Lab-wide gas and electrical systems functioned as planned. The main gas valve and subordinate valves in various buildings closed off automatically when the quake hit.
October 17 had been a busy day for the radiotherapy program at the Bevatron. The last patient had just been placed in the positioning chair in front of the beamline and immobilized at the head and waist when the quake struck. The patient was never in any danger from the ion beam. According to AFRD's Bill Chu, who was monitoring the treatment room at the time of the quake, there is an automatic beam shutoff system, with multiple backups, that is set into motion by vibrations as slight as three one-thousandths of an inch. The radiotherapy program resumed full operation the next day, and the patient returned to get her treatment."
John Lyman, MS 55-121, Lawrence Berkeley Laboratory, Berkeley CA 94720.

Status report on medical superconducting cyclotrons at **Michigan State University**: At the time of the PTCOG meeting in Zurich, the 100 MeV superconducting cyclotron for Harper Hospital of Detroit was achieving beam currents of 1-2 microamps on target, which was low compared to the specification value of 10 microamps or the expected treatment current of 6 microamps. The lower-than-expected current had been tentatively identified as a transit time difficulty in the first acceleration gap; later this diagnosis was confirmed, a small modification to the source exit slit and a 1 millimeter shift in source position corrected the problem; currents of up to 60 microamps have since been accelerated. Upgrading of several temporary components is presently in process and installation of the cyclotron at the hospital is scheduled for early January. Calibration studies and treatment planning work at the hospital are expected to require six months, after which patient treatments will begin.

In parallel with this work on the neutron therapy cyclotron, studies of superconducting synchrocyclotrons for proton therapy have continued. Computer studies of the extraction system have been completed and publications are in process. Accelerator physics studies have since shifted to the cyclotron central region and include computer studies of the central region electrode configuration and an experimental test of a 3 millimeter diameter ion source; the later test nicely confirmed the feasibility of using such small sources in a superconducting medical cyclotron. A new facility layout has also been developed in which dual beams are extracted on opposite sides of the synchrocyclotron to feed independently rotatable treatment gantries in two treatment rooms also on opposite sides of the cyclotron. This system preserves the beam optics advantage of keeping all bending magnets in the same plane while providing the dual treatment room benefit. In the coming months, development work will shift to design
and construction of a full-scale prototype of the rf system to confirm the design of the frequency modulation system.
Henry Blosser, National Superconducting Cyclotron Laboratory, Michigan State University, East Lansing MI 48824-1321.

As of early December 1989, the PBTS project group of the **Loma Linda University Medical Center** is very busy since most of the components are now coming together at Loma Linda. Construction of the buildings is progressing well so Loma Linda now has "beneficial occupancy" of the accelerator and beam transport rooms. The accelerator beam transport group has moved into their cavernous office space beside the accelerator.

The accelerator components have been successfully transported from FNAL (Chicago) to Loma Linda. The accelerator dipoles are installed and alignment is now in process. The electronic racks for the accelerator are largely installed and power is now applied so that debugging has started. The first computers have been installed in the control room with successful token ring operation being achieved recently.

The major components for the beam transport system are arriving at present and there are now enough magnets on site for the initial operation. Many smaller components such as multiwire ion chambers, vacuum flanges and bellows are still in fabrication.

The three gantries are installed and the next major activity will be to outfit the first one with its magnets, counterbalances, cables and plumbing. The components for the eye beam line are in fabrication with most of them due to arrive by January 1990. Design of the nozzles for the gantry and horizontal beam line is almost complete.

The pod for patient immobilization is undergoing operational tests with x-ray treatments of patients and the patient treatment software for proton therapy is undergoing testing in parallel. Detailed radiological physics protocols and test programs are being prepared for various tests and calibrations.

The first patient couch arrived at Loma Linda recently from Switzerland. The second couch is due shortly as is the patient chair from PSI.

A recent review of the status of the safety system showed that a large amount of work still needed to be done so it is receiving a much higher priority throughout the Project.

Overall, it is a very exciting and hectic time in the Project's life.

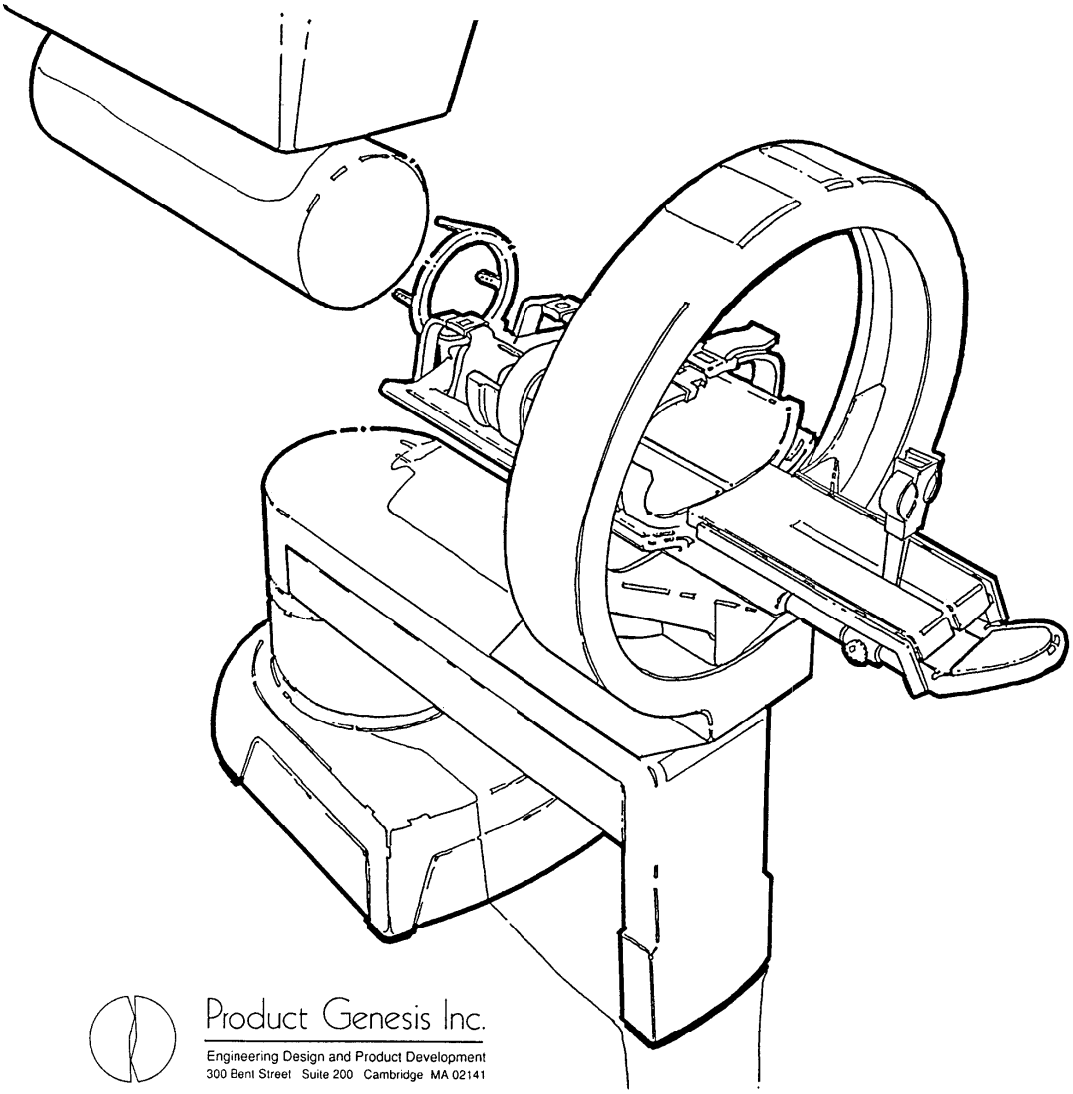
Roy Little, Loma Linda University Medical Center, P. O. Box 2000, 11234 Anderson Street, Loma Linda CA 92354.

Stereotaxic Alignment for Radiosurgery (STAR): The Neurosurgical Service at **Massachusetts General Hospital** in collaboration with the Departments of Radiation Medicine, Biomedical Engineering, and the **Harvard Cyclotron Laboratory**, is constructing a new stereotaxic alignment system for proton beam therapy which can be used for either single dose or fractionated therapy to lesions of the craniocervical axis. Product Genesis, Inc., a product development firm from Cambridge MA specialized in electromechanical systems design, is responsible for full system engineering, including all mechanical and control system design and implementation.

To prepare for the procedure, stereotaxic target coordinates are defined from CT, MRI, and angiographic images. Once the patient's stereotaxic head ring has been fitted to the positioning system, the patient is supported in a reclined position and then moved within the x,y,z coordinate system to translate the target volume to the system isocenter. After this adjustment has been made, the patient is freely rotated about the horizontal and vertical axes for portal selection. Each rotational axis passes through the stereotaxic target, allowing one to select any desired beam path to the target. Three dimensional treatment planning is used to determine optimum beam angles and to design individually shaped collimators and compensators for each field.

The ability to shape lateral and distal edges of the dose distribution for each field, combined with excellent lateral and axial dose sharpness, result in high dose volumes which conform almost exactly to the target volume. The radiation dosage within the high dose volume is generally uniform to within ± 5% of the prescribed value. Beams of arbitrary shape up to 10 cm can be designed.

As of the end of November 1989, the design of the positioning system is complete. Installation and testing at the Harvard Cyclotron Laboratory are scheduled for the first quarter, 1990. The versatile design features of this system allows for the incorporation of anticipated advances in stereotaxis and three dimensional treatment planning technology as these materialize in the future.



Paul Chapman, Department of Neurosurgery, Massachusetts General Hospital, Boston MA 02114 and Brian Vogel, Product Genesis Inc., 300 Bent Street, Suite 200, Cambridge MA 02141.

From April 1983 to August 1989 at **Tsukuba, Japan**, a total of 158 patients with various sites of tumors has been treated. This is the number treated during the past 5 years. The whole period of the 2nd year was not used for treatment because of interruption due to construction of the high-energy accelerator (TRISTAN). The results of treatment for 110 patients who were treated with curative intent and followed up for more than 6 months were reported at PTCOG at PSI. The aim is to establish the efficacy of proton therapy for deep-seated tumors including the lung, esophagus, stomach, liver, cervix, and urogenital organs. So far our judgement is that proton therapy is very promising for these sites.

At Tsukuba University, located about 60 km from Tokyo, a dedicated proton therapy facility is being designed. In our plan, the new facility will be built next to the radiotherapy department of the University Hospital. The main accelerator under consideration is a synchrotron with an orbital circumference of 35 cm. As an injector we are thinking of using a commercially available accelerator, an electrostatic accelerator or linac. The maximum beam energy is 230 MeV and the design goal of the intensity is 20 nA. We hope to construct two treatment rooms which will be equipped with fixed beam lines, one room

with two vertical (upper and lower opposing) beams and a horizontal beam, and the other one with two vertical beams.
Hirohiko Tsujii and Sadayoshi Fukumoto, Particle Radiation Medical Science Center, University of Tsukuba,Tsukuba-shi, Tennoudai 1-1-1, Ibaraki, 305 Japan

Charged Particle Bibliography

Loma Linda University Medical Center (LLUMC) has been compiling a database of published and unpublished materials relating to basic and applied charged-particle research, and to therapy. The compilation will be available to PTCOG members. This communication summarizes the present status of the database, and the use PTCOG members can expect to make of it in the future.

The database currently contains over 1300 citations relating to charged-particle therapy, mostly proton therapy. The citations were compiled from MEDLINE searches and from lists of articles, reports and conference proceedings, supplied by some PTCOG members. Literature searches are now being done to update the citations. LLUMC has committed personnel and equipment to develop the collection of citations, and plans to commit additional resources to develop an archive of full-text materials, to make the database a useful tool for researchers and clinicians. Database users eventually will be able to access not only citations and abstracts, but also the complete texts and illustrations from important sources relating to charged-particle therapy.

LLUMC intends that the database be interactive and dynamic, an ever-growing thing. PTCOG members will be encouraged to submit information to the database, such as journal articles, book chapters, conference reports and internal reports. The objective is to share information, so that researchers can be aware of the state of the art in charged-particle therapy.

Working in close cooperation with the Department of Radiation Sciences, the Medical Library & Information Center at LLUMC will maintain the database, updating it periodically with information supplied by PTCOG members and from regular literature searches. In addition, LLUMC will begin collecting the complete texts (including diagrams, illustrations and other figures) of important sources, with the objective of becoming a repository of such sources. LLUMC regards this objective as part of its commitment to assist the research effort in proton beam therapy.

LLUMC plans to make the database available to PTCOG users in early 1990. The initial database will consist of citations only, with abstracts as permissions for their use are secured. A list of all citations will be available to all PTCOG users, either in hard-copy form or on a floppy disk. In addition, users will be provided with information about interacting with the database on-line. Current plans are to make the database accessible via ASKSAM, a bibliographic searching tool; on-line users will need to secure inexpensive software to use this tool. After the full-text component of the database reaches a size that makes its use feasible, LLUMC will make it available as well. Because the full-text database will require large amounts of storage capacity, plans now are to store the full-text archive using optical disk technology.

BITNET users can contact "MDLPKI@LLUVM" for more information.
William Preston, Loma Linda University Medical Center, P. O. Box 2000, 11234 Anderson Street, Loma Linda CA 92354.

Obituaries

Miguel Awschalom (1927—89), one of the founders of Fermilab, died at his home in Batavia, Illinois, on August 11,1989.

Born December 20, 1927 in Buenos Aires, Argentina, he received his bachelor's degree from Rutgers University, and a Ph. D. in 1955 from University of Rochester.

Early in 1968, Awschalom came to the then National Accelerator Laboratory (now Fermilab) making significant contributions in many areas. After the construction of the original Fermilab, he, Robert Wilson, and Donald Young spearheaded the concept of the Fermilab Neutron Therapy Facility. Awschalom headed the construction of the facility and was the chief physicist from 1975 to 1985, This facility has treated approximately 2000 cancer patients and has provided the standard by which all subsequent neutron therapy beams have been designed. Awschalom played a leading role in this development, as well as in the development of the first protocol for neutron dosimetry.

In the minds of Awschalom, Wilson and Young, the Neutron Therapy Facility had started out to be a proton therapy facility. Awschalom did not lose interest in protons. He stimulated a national workshop at Fermilab of people interested in proton therapy. Out of that workshop grew the Loma Linda Proton Therapy Facility project. Awschalom had much more knowledge and experience in medical physics than the other Fermilab participants and he helped to guide the design, inventing and developing a number of devices that are part of the final facility. He worked with great intensity on the Loma Linda Project until his long-standing illness overwhelmed him in 1988.

Awschalom was a forthright person who argued and strove with intensity toward excellence in everything he did. His dedication to therapy and to good physics was evident in all his accomplishments. At the same time, he was a devoted husband and father, very pleased with his son's endeavors in medicine and physics. He has left his mark with them, with the successful Neutron Therapy Facility, and with his important contributions to the Loma Linda project.

Edited from the memorial written by *Francis Cole and Arlene Lennox, Fermilab, Lionel Cohen, Fermilab and Michael Reese Hospital, Franca Kuchnir and Ivan Rosenberg, University of Chicago, Paul de Luca, University of Wisconsin.*

WORLD WIDE CHARGED PARTICLE PATIENT TOTALS

As of January 1 1990

WHO	WHERE	WHAT	DATE FIRST RX	DATE LAST RX	RECENT PATIENT TOTAL	DATE OF TOTAL
Berkeley 184	CA. U.S.A.	p	1955	— 1957	30	inc. in Berkeley Bev total
Berkeley 184	CA. U.S.A.	He	1957	— 1987	899	inc. in Berkeley Bev total
Berkeley Bev.	CA. U.S.A.	heavy	1975		2351	10/20/89 total all beams.
Uppsala	Sweden	p	1957	— 1976	73	1976 original series
Harvard	MA. U.S.A.	p	1961		4841	Dec-89
Moscow	U.S.S.R.	p	1965		1993	Mar-89
Dubna	U.S.S.R.	p	1967	— 1977	80	1977 expected to reopen
Los Alamos	NM. U.S.A.	π-	1974	— 1982	230	final total 1982
Leningrad	U.S.S.R.	p	1975		508	Dec-87
Chiba	Japan	p	1979		65	Oct-89
TRIUMF	Canada	π-	1979		190	May-89
PSI (SIN)	Switzerland	π-	1980		439	Jun-89
Tsukuba	Japan	p	1983		158	Aug-89
PSI (SIN)	Switzerland	p	1984		719	Oct-89
Uppsala	Sweden	p	1988		7	Dec-89
Clatterbridge	England	p	1989		28	12/15/89
					859	pion beams
					2321	ion beams
					8502	proton beams
				TOTAL	11682	all particle beams

PROPOSED NEW FACILITIES
PROTON & ION BEAM THERAPY

INSTITUTION	PLACE	TYPE	DATE 1ST RX?	COMMENTS
Loma Linda	CA U.S.A.	p	1990	250 MeV accelerator; 4 treatment rooms; 3 gantries.
Orsay	France	p	1990?	adapt an existing cyclotron no longer being used for physics.
N.A.C.	South Africa	p	1990	200 MeV. 2 treatment rooms; 2 horiz. beam; 1 vert. or gantry.
Nice	France	p	1990	MEDICYC; neutron & proton radiotherapy facility
G.S.I	W. Germany	ion	1992?	Heidelberg/Darmstadt. He & higher ions. 3-dim. raster scan
Chiba	Japan	ion	1994	HIMAC design complete; funds are available to construct.
A.P.D.C.	IL U.S.A	p	1994	250 MeV accelerator; private facility.
Harvard	MA U.S.A.	p	1995?	new accelerator & facility to be built at MGH
TRIUMF	Canada	p	?	adapt existing proton beam lines to therapy use.
EULIMA	Europe	ion	?	European cooperative venture; location not yet decided.
Louvain-la-Neuve	Belgium	p	?	variable to 90 MeV proton beam; add to neutron facility
Tsukuba	Japan	p	?	230 MeV accelerator; 2 treat. rooms; 2 vert+1 h beam; 2 vert.