MASTER IN ADVANCED RADIOTHERAPY
2017

Universidad de los Andes
Santiago-Chile
University of Los Andes

Arturo Lopez Perez Foundation

Sponsorship

IAEA
International Atomic Energy Agency

In collaboration with

ALATRO
Asociación Ibero Latinoamericana de Terapia Radiante Oncológica

Comisión Chilena de Energía Nuclear
Ministerio de Energía
Gobierno de Chile

SOCIEDAD CHILENA DE RADIOTERAPIA ONCOLÓGICA

Universidad de los Andes
Santiago-Chile

Juntos contra el cáncer

MASTER IN ADVANCED RADIOTHERAPY

I. Introduction

A. Objectives of the Program

The Los Andes University-IAEA Master in Advanced Radiation Oncology will give Latin American Radiation Oncology professionals the necessary training on the use of last-generation radiation-oncology technologies for cancer diagnosis and treatment.

B. Background, program Justification and need analysis

The technological skills and knowledge available for cancer treatment and research have been undergoing fast progresses over the last few years. Last-generation techniques in radiotherapy allow high-precision cancer treatment based on intensity modulation, real-time incorporation of high-resolution digital imaging as treatment guidance, use of stereotactic techniques and protocol designs combining the complementarity and versatility of different techniques and treatments. Until recently there was no Latin American center outfitted with all diagnostic and therapeutic equipment: PET/CT-guided irradiation planning, rotating intensity-modulated radiotherapy (Tomotherapy; V-MAT), intra- and extra-cranial robotic radiosurgery and Intraoperative radiotherapy. Nor was there in this region an academic program for the radiation oncologist's systematic training in these techniques.

Since 2012, the Arturo Lopez Perez Foundation Cancer Center has been implementing its technology which at present benefits from all the above-mentioned therapeutic possibilities in advanced radiotherapy: PET/CT for irradiation planning, linear accelerator Synergy Agility VMAT, HD Tomotherapy equipment, Intraoperative radiotherapy (IORT), High-Dose Rate Brachytherapy, robotic radiosurgery equipment Cyberknife M6. The latter technology makes for a more precise irradiation, making it possible to administer not only safer treatments with lower acute and late toxicities, but also to increase the radiation dose for a higher therapeutic success rate (dose escalation). However, using higher, more precise doses entails more exacting work, requiring the development of professional skills for the personnel involved in all treatment steps, from medical indications to treatment planning and work organization in such services.

The present academic program delivers tools to implement this technology effectively and safely. It guarantees the development of the above-mentioned skills based on its academic courses, national and international teachers and compliance with the quality criteria established by current regulation of postgraduate university courses as well as by Los Andes University School of Medicine and Arturo Lopez Perez Foundation with the support of the International Atomic-Energy Agency (IAEA).

C. **Program Regulations**

The Program will be regulated in compliance with yje current Regulations for Master Programs of Los Andes University School of Medicine

II. **Candidates' profile**

Radiation Oncologists (or Radiotherapists, according to their Country official denomination) from the following Latin American countries members of ARCAL: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Dominican Republic, Uruguay and Venezuela

Last-year Radiotherapy Residents will be allowed to enroll if their government considers it indispensable for the future development of radiotherapy in their Countries. Applications will be accepted only after evaluation and validation by the Academic Committee of the program and by IAEA.

NB: foreign (non-Chilean) participants will be supervised in all their activities by their local supervisors

III. **STUDY PLAN**

A. **General Characteristics**

i. **Starting year:** 2017
ii. **Duration:** 12 months theoretical sessions, practical sessions, thesis/essay preparation)
iii. **Working hours:** Monday to Friday from 8:30 to 17:30
iv. **Vacancies:** TBD by IAEA
v. **Funding:** IAEA will finance students' stay and roundtrip flight as well as teachers' and academic fees
vi. **Patronage**
   - Arturo Lopez Perez Foundation Cancer Center
   - Los Andes University School of Medicine
   - Chilean Society of Radiation Oncology (SOCHIRA)

- International Atomic Energy Agency (IAEA)
- Ibero-Latin-American Society of Radiation Oncology (ALATRO)
- Chilean Commission for Nuclear Energy (CCHEN)
- National Cancer Institute – Chile
- IRAM Cancer Center
- UC Christus Cancer Center
- Viña Cancer Center

vii. **Sponsorship**: International Atomic Energy Agency (IAEA)

B. **Objectives of the study plan: knowledge and skills students will acquire and expected results**

General Objectives:

- To offer an overall perspective of current advances in Radiation Oncology.
- To improve and update the students' theoretical knowledge, skills and professional competence.
- To develop operational and investigational approaches, both general and specific to the different subjects a radiation oncologist must know.
- To complete the specialists' education in Radiation Oncology, so that they can competently perform all the necessary activities required by the latest advances in Radiation Oncology with an integral approach to patient care based on the specific knowledge acquired.

Specific Objectives:

- To acquire specialized knowledge of the technical development in Radiation Oncology, complementing the knowledge received while studying for one's medical and specialization degrees.
- To develop the criteria and skills needed for medical indications where there is a specific benefit from advanced radiotherapy techniques, both for localized and metastatic disease.
- To acquire concepts in and correctly perform an advanced-radiotherapy treatment, developing the specific skills described below.
- To develop the quality control required by an advanced-radiotherapy department and its relation with treatment safety
- To identify and perform the main elements of follow-up and control of results: acute and late toxicity, oncologic results (local and regional control; survival), quality of life, cost-effectiveness.
- To explain how to organize an advanced-radiotherapy department
- To prove one's ability in performin all activities in a multidisciplinary and intercultural environment where team work is guided by professionalism and co-responsibility criteria

Specific competences:

The Program graduates will have strong theoretical and practical competences in advanced radiotherapy, will know how to be part of a work team and how to operate within healthcare systems and will be capable of self-improvement and of responsibly using their knowledge in performing their daily duties.

Clinical management skills	1. To know the principles which allow the correct running of a clinical registry. 2. To know the elemental composition of a health system and its role in the definition of cancer-care provision. 3. To know and manage the organization of a multidisciplinary Tumor Board. 4. To know current health regulations regarding national health programs and Health Explicit Guarantees. 5. To establish multidisciplinary care processes with other hospital staff. 6. To communicate effectively with medical and non-medical authorities that participate in health decisions to achieve the objectives of cancer care programs
Clinical skills	1. To perform the correct clinical evaluation of pathology, molecular biology and imaging reports to offer a treatment compliant with clinical evidence and guidelines, as well as, when they are not available, to be able to suggest the appropriate study protocol. 2. To suggest a treatment justifying the choice in the multidisciplinary discussion of a Tumor Board. 3. To perform correctly a radiation treatment: image fusion for radiotherapy planning with MRI and/or PET/CT as appropriate, contouring and dose prescription/fractionation of the targets to be irradiated, contouring and tolerance dose for risk organs, indication of the advanced-radiotherapy technique most adequate to each case, dosimetry calculation and interpretation/evaluation, positioning evaluation for image-based treatments (IGRT). 4. To evaluate treatment results, diagnosing and managing complications. 5. To plan and perform the follow up of treated patients.
Management of evidence-based medical practice	1. Critical analysis of scientific literature. 2. Its application in the treatment of the most prevalent diseases. 3. Knowledge of ongoing research protocols.
Application of bioethical principles in medical practice	1. To apply bioethical principles, values and analysis in clinical practice. 2. To safeguard privacy in clinical practice. 3. To relate with people from all walks of life without discrimination. 4. To respect the rights of the patient, of the health team and of the community.
Self-study	1. To encourage continuing medical education.
Competences to	1. To comply with current laws and regulations in one's clinical activity.

work effectively within health systems	2. To efficiently use resources in health care. 3. To participate effectively in the healthcare team. 4. To connect with the community in order to promote healthcare. 5. To know and apply the population's epidemiological profile. 6. To respect bio-safety regulations

Expected results

After completing the Master, students will know advanced radiotherapy and all details necessary to implement the modernization of their centers. They will also have acquired the necessary knowledge of therapeutic quality and safety for the safe implementation of new technologies in their centers of origin. Lastly, students will have acquired the necessary methodological tools to start a clinical research program in their centers of origin.

C. **Curriculum Studiorum:**

Study plan:

The educational study plan lasts a year. It comprises theoretical and practical education, with tutored patient-care sessions, self-study sessions on recommended references and online courses for revision.

During this year the resident carries out the theoretical activities of the program (detailed in appendix II) as well as a 4-day-per-week practical tutored course of 12 months using the advanced-radiotherapy technological platform of the FALP Cancer Center.

Program Chronogram

See appendix I

Program of each course

See appendix II

Characteristics of the Thesis, essay or equivalent

(see the Course: Preparation of a thesis, essay or equivalent)

Requirements for graduation

In order to graduate each student must complete and pass each course.

The final grade, rated on a 1-to-7 scale, will be determined according to the following criteria: the arithmetical mean of the grades from all courses will weight 70 %, the thesis/essay grade will wight 15% the grade of the final test will weight 15%)

Passing grades are 5,0 or higher

D. **Academic Staff**

Program Coordinator**:**

- Hugo Marsiglia

Academic Committee**:**

- Marsiglia Hugo (President)
- Baruzzi Nordiana (FALP)
- Bruna Maribel (FALP)
- Calvo Felipe (Complutensis University of Madrid)
- Fariña Ariel (FALP)
- Marin Luis (FALP)
- Torszok Karla (FALP)
- Yañez Loreto (FALP)
- Zamorano Juana (Los Andes University)
- Zubizarreta Eduardo (IAEA)

Local Teachers/ Tutors**:**

- Badínez Leonardo - FALP
- Becerra Sergio - National Cancer Institute
- Bettoli Piero - FALP
- Bruna Maribel - FALP
- Bustamante Eva - FALP
- Ciudad Ana María - FALP
- Córdova Andrés - SOCHIRA
- Chahuan Badir - FALP
- Fariña Ariel - FALP
- Fritis Marcela - FALP
- González Manuel - Viña Cancer Institute
- González Pablo - Viña Cancer Institute
- Isa Nicolás - IRAM
- Marín Luis - FALP
- Merino Tomás - Chile Catholic University
- Rosso Roberto - FALP
- Russo Moisés - FALP
- Solé Sebastian - IRAM
- Solé Claudio - IRAM
- Yáñez Loreto - FALP

- Lucic Felipe - FALP
- Santillana Paulina - FALP

- Troncoso Alexis - FALP

- Broque Hervé - FALP
- Bulgraen Dos Santos Guilherme - FALP
- Marangoni Filippo - FALP
- Reggio Franklin - FALP
- Ribeiro Marcelo - FALP
- Ruiz Alvaro - FALP
- Torzsok Karla - FALP

- Silva Fernando - FALP

International teachers

- Alvés Maria José (Director Radiotherapy Department State Public Hospital / German Hospital Oswaldo Cruz - Sao Paulo, Brazil)
- Amendola Beatriz (Radiotherapy Department, Innovative Cancer Center - Miami, USA)
- Aviles Lijia (Radiotherapy Department, Bolivia Cancer Center- La Paz, Bolivia)
- Azinovic Ignacio (Chief Medical Officer Madrid Cancer Institute - Madrid, Spain)
- Batchelor Tracy (Director of Neuro-oncology, Massachusetts General Hospital - Harvard University; Boston USA)
- Bautista Yisel (Directora Radiotherapy Department Mexico General Hospital Dr. Eduardo Linceaga – Mexico City, Mexico)
- Bourhis Jean (Radiotherapy Professor Lausanne University, Chief Medical Officer CHUV - Lausanne, Switzerland)
- Britton Keith (Radiotherapy Department CIRRO National Hospital – Panama City, Panama)
- Caceros Victor (Director Radiotherapy Department International Cancer Center - Colonia Escalón, San Salvador)
- Calvo Felipe (Professor of Radiotherapy Complutensis University of Madrid / Director Department of Oncology University Hospital Gregorio Marañon - Madrid, Spain)
- Castro Peña Pablo (Chief Medical Officer Radiotherapy Institute Marie Curie Foundation - Córdoba, Argentina)
- Cendales Ricardo (Cancer Control Center - Bogota, Colombia)
- Chajón Enrique (Radiotherapy Department Centre Eugene Marquis - Rennes, France)
- Cordero Lisbeth (Radiotherapy Department Mexico Hospital - San José, Costa Rica)
- Cotes Marta (Radiotherapy Department National Cancer Hospital - Bogota, Colombia)
- de la Torre Marcela (Radiotherapy Professor Buenos Aires University / Director Radiotherapy Department José San Martín Hospital - Buenos Aires, Argentina)
- Delgado José Miguel (Radio-Physics Department 12th October Hospital - Madrid, Spain)
- Domenge Christian (Vice President and CEO French-Brazilian Society of Oncology - Rio de Janeiro, Brazil)
- dos Santos Marcos (Head Oncology and Radiotherapy Department Brasilia University Hospital - Brasilia, Brazil)
- Dzhusgashvili Maia (Radiotherapy Department Madrid Cancer Institute - Madrid, Spain)
- Ferrer Carlos (President Elect SEOR / Oncology Professor Cardenal Herrera University / Chief Medical Officer Cancer Center Provincial Hospital Consortium - Castellón de la Plana, Spain)

- García Rafael (Director Cyberknife Unit Madrid Cancer Institute Foundation - Madrid, Spain)
- Guedea Ferran (Director Radiotherapy Department Catalonian Cancer Institute - Barcelona, Spain)
- Guggiari Gustavo (Chief Medical Officer National Cancer Institute - Capiatá, Paraguay)
- Habrand Jean Louis (Professor of Radiotherapy University of Caen Director Radiotherapy Department François Baclesse Centre; Caen, France)
- Haie-Meder Christine (Head Brachytherapy Unit Radiotherapy Department Gustave Roussy Institute - Paris, France)
- Huertas Judith (Director Radiotherapy Department FUCAM - Mexico City, Mexico)
- Ismael Carla (President SFBO / Founder and Director Oncology Center, CTO - Petropolis, Brazil)
- Kasdorf Pedro (Radiotherapy Professor Uruguay University / Director Radiotherapy Department National Cancer Institute - Montevideo, Uruguay)
- Krengli Marco (Radiotherapy Professor Universidad de Novara, Director Departamento Radiotherapy Department Hospital de Novara, Italia)
- Lara Pedro (President SEOR / Director Canarian Cancer Research Institute / Radiotherapy Professor Las Palmas Gran Canaria University - Las Palmas, Spain)
- Lartigau Eric (Radiotherapy Professor Lille University, General Director Centre Oscar Lambret - Lille, France)
- Lengua Rafael (Vice Director Hope International - Guatemala City, Guatemala)
- Libonati Sergio (Chief Medical Officer Radiotherapy and Oncology Center - Sao Paulo, Brazil)
- Luongo Gardi Alvaro (Director Graduate Course for Radiotherapy Technicians Republic University - Montevideo, Uruguay)
- Malicki Julian (Editor-in-Chief Reports of Practical Oncology and Radiotherapy / Director Radiotherapy Department Greater Poland Cancer Centre - Poznań, Poland)
- Mehta Minesh (Director Radiotherapy Department Miami Cancer Center - Miami, USA)
- Muto Paolo (Director Radiotherapy Department National Cancer Institute G. Pascale - Naples, Italy)
- Orecchia Roberto (Radiotherapy Professor University of Milan / Scientific Director European Institute of Oncology - Milan, Italy)
- Ospino Rosalba (Radiotherapy Department Marly Oncology and Radiotherapy Center - Bogota, Colombia)
- Peccatori Fedro (Scientific Deputy Director European School of Oncology / Director Fertility and Cancer Unit European Institute of Oncology - Milan, Italy)
- Pinillos Luis (Radiotherapy Professor Peruvian University Cayetano Heredia - Lima, Peru)
- Poitevin Adela (President SOMERA - Mexico City, Mexico)
- Polo Alfredo (IAEA Consultant - Vienna, Austria)
- Poortmans Philip (Director Radiotherapy Department Curie Institute - Paris, France)
- Quarneti Aldo (Radiotherapy Professor British Hospital - Montevideo, Uruguay)
- Rebolledo Thais (Radiotherapy Professor Venezuela Central University - Caracas, Venezuela)
- Ricardi Umberto (President Elect ESTRO / Radiotherapy Professor Turin University / Director Radiotherapy Department Le Molinette Hospital- Turin, Italy)
- Rivera Sofía (Head Breast Unit Radiotherapy Department Gustave Roussy Institute- Paris, France)
- Roth Bertha (Director Radiotherapy Department Roffo Institute - Buenos Aires, Argentina)
- Rovirosa Angeles (Head Brachytherapy Unit Clinic Hospital - Barcelona, Spain)

- Ruiz Fernando (Chief Medical Officer Luis Carlos Sarmiento Cancer Institute - Bogota, Colombia)
- Sallabanda Kita (Neurosurgery Professor San Carlos University Hospital - Madrid, Spain)
- Sanchez Nestor (Radiotherapy Department Clinical Hospital - Caracas, Venezuela)
- Sarria Gustavo (Director Radiotherapy Department INEM - Lima, Peru)
- Schiappacasse Luis (Director Radiotherapy Department UNIL-CHUV - Lausanne, Switzerland)
- Vera Veronica (Radiotherapy Department Marie Curie Foundation - Cordoba, Argentina
- Weltman Eduardo (President Brazilian Society of Radiotherapy / Radiotherapy Professor / Director Radiotherapy Department Albert Einstein Jewish Hospital - Sao Paolo, Brazil)
- Zubizarreta Eduardo (IAEA Consultant - Vienna, Austria)
- Zunino Silvia (Director Radiotherapy Institute Marie Curie Foundation - Córdoba, Argentina)

E. **Admission prerequisites and procedures**

Requisites:

- Medical Degree (according to the current laws of each country)
- Specialization Degree in Radiation Oncology (or Radiotherapy, according to the legal definition of each country). Exceptionally, forth-year radiotherapy resident will be accepted, if ARCAL-member states deem it indispensable for the future development of radiotherapy in the country
- The candidate should have between two- and five-year experience after achieving their specialization degree (not applicable to residents)
- Theoretical and practical command of 3D radiotherapy
- Preferably aged 40 years or younger
- Health status compatible with the clinical and academic activities of the Program (an official medical certification is required)

Application Procedure:

- Curriculum Vitae presented according to the IAEA Fellowship Form
- Endorsement letter by the Institution of origin (University, Hospital or Ministry)
- Application Deadline: 24th March

Admission procedure:

Applications will be evaluated and approved (or rejected) by the Academic Committee through

- Evaluation of the applicant's CV and background
- Successful entry exam (on theoretical knowledge of general oncology and one or more practical cases in 3D radiotherapy)

Admission results will be communicated to each applicant and published before May 1st each year

F. Enrollment fees and taxes

IAEA will finance a limited number of fellowships

IV. ORGANIZATION AND MANAGEMENT

A. Program staff

The program will be coordinated by the Coordinating teacher, Dr. Hugo Marsiglia, together with the Academic Committee of the program. There will also be a supporting financial committee composed by a FALP delegate and an IAEA delegate.

B. Biographical resources

- Los Andes University library
- FALP library
- IAEA library (online access Human Health Campus - https://humanhealth.iaea.org/hhw/)
- **Books:**
    - De Vita, Hellman and Rosenberg. *Cancer. Principles and Practice of Oncology.*
    - Schaaban Blodgett. *Imaging diagnosis in oncology*. 2012 Marban Madrid Spain.
    - Kransdorf, Murphey: *Imaging of soft tissue tumors*. Second edition. Lippincot William & Wilkins.
    - *Oxford Textbook of Paliative Care*. Derek Doyle, Geoffrey Hanks, Nathan Cherny, Kenneth Calman. 3° Ed. 2003.
- **Journals:**
    - European Journal of Cancer
    - Head &Neck
    - The New England Journal of Medicine
    - Thyroid
    - Journal of Clinical Oncology
    - The Lancet Oncology
    - European Archives of Oto-Rhino-Laryngology
    - Journal of Paliative Care
    - Pain
    - International Journal of Radiation Oncology Biology Physics (red journal)
    - Radiotherapy and Oncology (green journal)
- **Treatment Guidelines**
    - FALP Treatment Guidelines for tumors
    - NCCN Guidelines / www.nccn.org
    - ESMO Guidelines / www.esmo.org
    - NCI Guidelines / www.nci.org

- National Comprehensive Cancer Network / www.nccn.org

C. **Interfaculty agreements**
None

D. **SENCE management and processing, if applicable**
Does not apply

APPENDIX I: ACTIVITY CHRONOGRAM

Theoretical online and onsite courses	**Duration**
Theoretical Course in General Oncology (Online access to the Los Andes University Postgraduate Course in Oncology – Saval's platform)	48 weeks 144 hours (self-study 3 hours per week)
Introduction to Radiotherapy (online self-study and on-site classes) • Radiobiology • Radiophysics • Hypofractionation • Single dose • Abscopal effect • Imaging-guided simulation • Introduction to 3D techniques for conformal radiotherapy • Contouring • automated Contouring	13 weeks, 52 hours (4 hrs per week)
Biostatistics and Methodology of research (online course) • Clinical epidemiology • Analysis of results • General Biostatistics and Biostatistics applied to oncology • Variables and basics of measurement • Research designs and clinical analysis of biomedical literature; PICOT format of research questions	5 weeks, 15 hours (3 hours per week)
Advanced techniques in Radiotherapy (self-study online and on-site classes): • Modern Radiotherapy • IGRT • IMRT • Tomotherapy • VMAT/Rapid Arc • Intracranial Radiosurgery • SBRT • IORT • Brachytherapy • Protontherapy	18 weeks, 45 hours
Clinical application to different sites: • Breast • Prostate • Head and neck • Lung • Gastrointestinal tract: Liver, pancreas, rectum, anal canal • Central Nervous System • Pediatrics: state of the art 2017 • Gynecological cancers • Sarcomas	18 weeks, 45 hours
Course on Radioprotection for healthcare professionals (CEPRO –	2 weeks, Monday to

Elementos de Protección Radiologica Operacional para la Salud): CCHEN radioprotection course on the safe management of ionizing-radiation generating sources and equipment in healthcare. Students will receive an professional license from CCHEN.	Friday from 13:30 to 17:30 (37 hours)
Radiotherapy Administration: introductory information, organization and efficiency. Quality Control, protection and safety in Radiotherapy. Current laws and regulations.	5 week, 10 hours (2 hours/week self-study)
Applied Bioethics	4 weeks , 8 hours (2 hours /week)

APPENDIX II: DETAILED PROGRAM OF EACH COURSE

List of subjects:

1. Theoretical course in general oncology
2. Introduction to Radiotherapy
3. Biostatistics and research methodology
4. Advanced techniques in radiotherapy
5. Clinical application to different sites
6. Preparation of a thesis or essay
7. Course on Radioprotection for healthcare professionals
8. Radiotherapy Administration
9. Applied Bioethics
10. Workshops
11. Final exam

List of workshops

1. Introduction to the course on advanced-technique radiotherapy
2. Application of new technologies I: Protontherapy, Tomotherapy
3. Application of new technologies II: IMRT, IGRT
4. Application of new technologies III: Brachytherapy, Intraoperative Radiotherapy
5. Application of new technologies IV: SBRT
6. Treatment of specific sites: breast, lung, prostate, digestive tract, CNS, gynecology, head and neck, pediatrics, sarcomas

THEORETICAL COURSE IN GENERAL ONCOLOGY.

Coordinating teacher: Dr. Luis Marin
Site: online sessions.
Duration and schedule: 12 months

1. Course generalities

Objectives:	• The resident will acquire knowledge of disciplines crossing oncology such as: management of registries and databases; public healthcare; cancer surgery; radiotherapy; chemotherapy; and palliative medicine • The resident will develop skills that enable him/her to diagnose and plan the treatment of different neoplasias • The resident will know and make his/her own the contribution of the medical specialties involved in the clinical management of cancer patients
Contents	• Diagnosis, staging, treatment and follow up of cancers by site
Units	• Unit 1: Cellular and molecular biology of cancer • Unit 2: Integral assessment of the cancer patient • Unit 3: Multidisciplinary treatment - principles of clinical management • Unit 4: Head and neck tumors • Unit 5: Breast tumors • Unit 6: Esophageal and gastric cancer • Unit 7: Primary and metastatic liver tumors • Unit 8: Pancreatic cancer and biliary tract neoplasias • Unit 9: Rectal cancer • Unit 10: Cancer of the lung and mesothelioma • Unit 11: Gynecological neoplasias • Unit 12: Urologic neoplasias • Unit 13: Sarcomas and others • Unit 14: Cancer patient support • Unit 15: CNS tumors
Activities	• Online lessons. • Discussion of clinical cases.
Grading	• Online, multiple-choice test for each unit.

2. Lesson plan

Unit 1: Cellular and molecular biology of cancer	• Course introduction • Basic notions in cellular and molecular biology • Carcinogenesis • Oncogenes and tumor-suppressing genes • Cellular cycle and its regulation • Apoptosis

	• Epigenetics and cancer • Migration mechanisms and metastasis • Molecular bases of angiogenesis • Stem cells and cancer • Main signaling pathways involved in cancer.
Unit 2: Integral assessment of the cancer patient	• Clinical Evaluation, Work Up, TNM and AJCC Staging • Imaging and cancer. Diagnosis and evaluation of the cancer patient. • Nuclear medicine in the cancer patient's evaluation (Bone and PET/CT scans) • Pathological evaluation (Macroscopy, microscopy and IHC) • Molecular diagnosis of tumors, predictive markers. • Multidisciplinary evaluation and diagnostic summary. Work plan.
Unit 3: Multidisciplinary treatment - principles of clinical management	• Cancer surgery. Basics and rationale of its use • Principles of systemic cancer treatments. Evaluation of treatment response • Chemotherapy. Basics and rationale of its use • Immunotherapy. Basics and rationale of its use
Unit 4: Head and neck tumors	• Natural history, epidemiology and biological bases of head and neck tumors • Treatment of UADT tumors • Thyroid cancer • Cancer of salivary glands
Unit 5: Breast tumors	• Natural history of the disease / Epidemiology / Biological bases of breast cancer / Clinical features, study and TNM • Multimodal treatment of breast tumors: Early stages • Multimodal treatment of breast tumors: Advanced stages • Breast oncoplastic surgery: Definition / Classification / Treatments / Complications
Unit 6: Esophageal and gastric cancer	• Natural history, epidemiology and biological bases of esophageal neoplasms • Clinical features, study, staging and multimodal treatment of esophageal neoplasms • Natural history, epidemiology and biological bases of gastric cancer • Clinical features, study, staging and multimodal treatment of gastric cancer
Unit 7: Primary and metastatic liver tumors	• Natural history, epidemiology and biological bases of liver tumors • Clinical features, study, staging and multimodal treatment of liver tumors • Natural history, epidemiology and biological bases of metastatic liver tumors • Clinical features, study, staging and multimodal treatment of metastatic liver tumors
Unit 8: Pancreatic cancer and biliary tract neoplasias	• Natural history, epidemiology and biological bases of ductal and non ductal pancreatic tumors • Clinical features, study, staging and multimodal treatment of pancreatic tumors.

	• Natural history, epidemiology and biological bases of tumors of the gallbladder and bile ducts • Clinical features, study, staging and multimodal treatment of tumors the gallbladder and bile ducts
Unit 9: Rectal cancer	• Natural history, epidemiology and biological bases of rectal cancer • Clinical features, study and staging of rectal cancer • Multimodal treatment of rectal cancer
Unit 10: Cancer of the lung and mesothelioma	• Natural history, epidemiology and biological bases of NSCLC • Early stage NSCLC: Clinical features, study, staging and multimodal treatment • Multimodal treatment in advanced stage NSCLC, mesothelioma • Early stage SCLC: Clinical features, study, staging and multimodal treatment
Unit 11: Gynecological neoplasias	• Cervical cancer • Ovarian cancer • Endometrial cancer • Carcinomas of the vulva, vagina and others
Unit 12: Urologic neoplasias	• Transitional cell carcinoma of the urinary bladder and other segments • Renal cancer • Prostate cancer • Testicular cancer
Unit 13: Sarcomas and others	• Definition, epidemiology, biological bases and classification of sarcomas • Soft tissue sarcomas • Bone sarcomas • Gastro-Intestinal Stromal Tumors (GIST)
Unit 14: Cancer patient support	• Evaluation of the patients with cancer pain • Multidisciplinary management of acute pain • Therapeutic tools for the management of cancer pain
Unit 15: CNS tumors	• Natural history, epidemiology and biological bases of CNS tumors • Clinical features, histological classification, multidisciplinary management of CNS tumors • Neurologist's role in oncology

INTRODUCTION TO RADIOTHERAPY

Coordinating teacher: Dr. Loreto Yañez, Dr. Ariel Fariña.
Site: Online and on-site sessions.
Duration and schedule: 3 months, 8 hrs per week.

1. Course generalities

Objectives:	The resident will acquire knowledge of: • Radiobiology • Radiophysics • Hypofractionation and single-dose treatments • Bystander and abscopal effects • Imaging-guided simulation • 3D techniques for conformal radiotherapy • Volume delimitation in radiotherapy • Pre-radiotherapy consultation, tumor boards
Contents	• Basic radiobiology, radiobiology of hypofractionated treatments and radiosurgery • PET/CT and CT simulation imaging • Virtual simulation • Techniques of 3D conformal Radiotherapy, dose prescription • Pre-radiotherapy consultation, tumor boards.
Units	• Unit 1: Basics of Radiobiology and fractionation • Unit 2: Simulation, contouring • Unit 3: Radiotherapy in clinical practice
Activities	• Self-study online and on-site lessons .
Grading	• Evaluation by coordinating teacher according to guidelines. Weight 60%. • Theoretical exam with grades from 1 to 7. Weight 40%.

2. Lesson plan

Unit 1: Basics of Radiobiology and fractionation	• Radiobiology • Types of fractionation. • Basics of radiophysics • Hypofractionation • Single dose • Abscopal effect
Unit 2: Simulation, contouring	• Imaging-guided simulation • Basics of 3D conformational radiotherapy techniques • Generalities of contouring • Contouring in different diseases
Unit 3: Radiotherapy in clinical practice	• Radiotherapy consultation • Tumor boards.

	• Use of imaging in radiotherapy: PET/CT, CT, MRI.

BIOSTATISTICS AND METODOLOGY OF RESEARCH.

Coordinating teacher: Mr. Fernando Silva

Site: Online and on-site sessions.

Duration and schedule: 3 hours/week for 5 weeks (15 hrs total)

1. Course generalities

Objectives:	• The resident will acquire basic skills in biostatistics • The resident will learn to identify different kinds of research • The resident will propose defined strategies to address professional situations • The resident will learn to choose among published literature the most adequate references to keep up to date in his/her field, make decisions and to improve in research. • The resident will learn to of contextualize acquired skills in the analysis of risk factors, diagnosis, prognostic factors, treatment, revisions, economical analysis and clinical guidelines
Contents	• Clinical epidemiology • Critical analysis of scientific literature • Applied biostatistics. • Qualitative research • Design of research protocols
Units	• Unit 1: Clinical epidemiology • Unit 2: General Biostatistics and Biostatistics applied to oncology • Unit 3: Protocol design and critical analysis of biomedical literature.
Activities	• Online self-study and on-site lessons
Grading	• Online written test, graded 1 to 7

2. Lesson plan

Unit 1: Clinical epidemiology	• Analysis of clinical tests:
	  ○ Sensibility, specificity and predictive values
	  ○ Transformation from pretest to post-test probability
	  ○ Evaluation of risk and protection factors
	• Causality: association, etiologic fraction and confusion in risk definition.
	• Prognostic studies and survival analysis
	• Use of clinical trials in the evaluation of treatment effectiveness
	• Concept of causality in randomized clinical trials

Unit 2: General Biostatistics and Biostatistics applied to oncology. Variables and basic	• p value and hypothesis formulation; • Non parametric measurements: Definition and common uses • Linear and logistic regression • Association measurements: relative risk, odds ratio (OR) • Kaplan Meier analysis and Cox proportional risks

measurement concepts	• ROC curves to assess diagnostic tests or to define cut-off points in continuous variables
Unit 3: protocol design and critical analysis of biomedical literature	• PICOT structure of a clinical question • Observational and experimental studies • Prevalence and longitudinal studies. • Case Series • Cohort studies • Case control studies • Clinical trials • Quality of life studies • Elements for evidence reading in therapy, diagnosis, prognosis and etiology • Bias

ADVANCED RADIOTHERAPY TECHNIQUES (IMRT / IMAT / IGRT /SRS / SBRT)

Coordinating teacher: Dr. Maribel Bruna
Other teachers: Dr. Piero Bettoli, Dr. Ana Maria Cuidad, Dr Ariel Fariña, Dr. Moises Russo, Dr. Loreto Yañez.
Site: Department of Radiotherapy FALP
Duration and schedule: Reference online lessons, biweekly tutored practical sessions with staff.

1. Course generalities

Objectives:	• To acquire theoretical and practical knowledge of advanced techniques of IGRT-IBRT radiotherapy
Contents	• Modern simulation techniques in radiotherapy - Virtual simulation • Modern immobilization systems • Repositioning techniques • Gating-tracking • IGRT • IMRT • Tomotherapy • VMat/Rapid Arc • Intracranial radiosurgery (SRS) • SBRT • IORT • Brachytherapy • Protontherapy • Contouring and advanced applications in radiotherapy • Dosimetry and Dose Prescription in advanced radiotherapy
Units	• Unit 1: Modern simulation, immobilization and repositioning techniques: • Unit 2: Basics of Advanced Radiotherapy: • Unit 3: Dosimetry and dose prescription in Advanced Radiotherapy:
Activities	• Tutored practical rotations in the radiotherapy department. • Theoretical lessons.
Grading	• By coordinating teacher according to university guidelines. Weight 60%. • Theoretical exam with grades from 1 to 7. Weight 40%.

2. Lesson plan

Unit 1: Modern simulation, immobilization and repositioning techniques:	• Dosimetric CT scan (injection, slices) • Modern immobilization systems • Virtual simulation • Repositioning techniques • Gating-tracking • IGRT
Unit 2: Basics of	• IGRT

Advanced Radiotherapy:	• IMRT Tomotherapy VMAT / Rapid Arc: indications, prescriptions, quality controls, clinical cases. • Intracranial Radiosurgery: indications, prescriptions, quality controls, clinical cases. • SBRT: indications, prescriptions, quality controls, clinical cases. • IORT: indications, prescriptions, quality controls, clinical cases. • Braquitherapy: indications, prescriptions, quality controls, clinical cases. • Protontherapy: indications, dosimetry, clinical cases.
Unit 3: Dosimetry and dose prescription in Advanced Radiotherapy:	• 3D Planning and monoisocentric techniques • Contouring in advanced radiotherapy applications • Inverse planning, 4D and 5D planning • IMRT and tomotherapy planning • VMAT / Rapid Arc planning • Planning for intracranial radiosurgery and SBRT • ICRU recommendations • Prescription and dose-volume effect on critical organs. Tables of dose restriction for critical organs.

CLINICAL APPLICATION IN DIFFERENT BODY AREAS

Coordinating teacher: Dr. Moises Russo
Other teachers: Dr. Piero Bettoli, Dr. Maribel Bruna, Dr. Ana Maria Cuidad, Dr Ariel Fariña, Dr. Loreto Yañez.
Site: Department of Radiotherapy FALP
Duration and schedule: Reference online lessons, biweekly tutored practical sessions.

1. Course generalities

Objectives:	• To acquire knowledge of the applications of radiotherapy in different body areas: ○ Breast ○ Prostate ○ Head and Neck ○ Lung ○ Digestive tract: liver, pancreas, rectum, anal canal ○ Central Nervous System ○ Pediatrics: state of the art 2017 ○ Uterine cervix ○ Sarcoma
Contents	• Clinical application Breast – prostate ○ Breast: 3D ○ Breast: IORT, IMRT and tomotherapy ○ Prostate: 3D vs IMRT ○ Prostate: tomotherapy and cyberknife ○ Gating Breast-tracking prostate • Clinical application H&N-lung-rectum-cervix-anal canal ○ H&N: 3D vs IMRT ○ Lung: 3D-IMRT ○ Cervix-endometrium: 3D vs IMRT ○ Rectum -anal canal: 3D vs IMRT ○ Tomotherapy mediastinum-pelvis • Clinical application central nervous system (CNS) and pediatrics ○ SNC: Stereotactic RT ○ SNC: tomo radiosurgery ○ Pediatrics: 3D-IMRT ○ Pediatrics: tomotherapy ○ Tomotherapy and re-irradiations
Units	• Unit 1: Clinical applications in Breast cancer • Unit 2: Clinical applications in Prostate cancer • Unit 3: Clinical applications in Head and neck, lung, rectum, cervix, anal canal, sarcomas • Unit 4: Clinical applications in central nervous system (SNC) and pediatrics
Activities	• Tutored practical rotations in the radiotherapy department.

	• Theoretical online lessons.
Grading	• Evaluation by coordinating teacher according to university guidelines. Weight 60%. • Theoretical exam with grades from 1 to 7. Weight 40%.

2. Lesson plan

Unit 1: Clinical applications in Breast cancer	• 3D radiotherapy • IMRT • Tomotherapy • IORT.
Unit 2: Clinical applications in Prostate cancer	• 3D radiotherapy • IMRT • Tomotherapy • Cyberknife
Unit 3: Clinical applications in Head and neck, lung, rectum, cervix, anal canal, sarcomas	• 3D radiotherapy • IMRT • Tomotherapy • Cyberknife
Unit 4: Clinical applications in central nervous system (SNC) and pediatrics	• 3D radiotherapy • IMRT • Cyberknife

PREPARATION OF A THESIS OR ESSAY

Coordinating teacher: Dr. Eva Bustamante.
Tutor: Designated by the Executive Committee
Site: FALP
Duration and schedule: 9 months

1. Course generalities

Objectives:	• The resident will acquire knowledge of research in radiotherapy • The resident will prepare a research thesis on a clinical or technical aspect of radiation oncology. The research project will be approved by the Executive Committee before its inception. • The thesis will result in an article published in a Chilean medical journal and/or on an international journal (e.g. Practice in Radiation Oncology).
Contents	• Participation in weekly oncogenomics and clinical-trial tumor boards • Rotation in the Clinical Trial Unit at FALP • Preparation of a final dissertation in oncogenomics, radioimmunotherapy or clinical and technological subjects
Units	• Corresponding to the different stages of a thesis/essay preparation
Activities	• Active discussion of emblematic clinical cases seen during medical visits, tumor boards meeting or dosimetry
Grading	• Thesis defense against a jury designated by the Executive Committee. (Pass grade 5.0 or higher)..

2. Lesson plan

Unit 1:	• Choice of the dissertation subjects and its presentation to the academic committee for approval.
Unit 2	• Presentation of results to tutors
Unit 3	• Thesis/essay presentation to a designated jury; passing grade 5.0 or higher

BASICS OF RADIOPROTECTION FOR HEALTHCARE PROFESSIONALS

Coordinating teacher: Mr. Erik Herrera or proxy**.**

Site: Chilean Commission for Nuclear Energy (CCHEN)

Duration and schedule: 2 weeks, Monday to Friday, from 13:30 to 17:30. Total: 37 hours

1. Course generalities

Objectives:	• Give participants the necessary knowledge for the safe management of sources and equipment generating ionizing radiation in healthcare. • Give a background on the origin and behavior of radiations, as well as on current legislation in this area. • Establish the criteria to face radiological emergencies. • Obtain a license from CCHEN, to comply with current Chilean laws
Contents	• Safe management of sources and equipment. • Theoretical and practical knowledge of radiations • Laws and regulations • Management of radiological emergencies
Units	• Unit 1: Theoretical knowledge • Unit 2: laboratory activities • Unit 3: Simulation exercise
Activities	• Theoretical lessons • Group workshop
Grading	• Written test on the theoretical knowledge acquired and the practical workshops attended. Pass certification will be given only to participants graded 70% and over, who attended 95% of the course.

3. Lesson plan

Unit 1: Theoretical knowledge	• Origin of Ionizing radiations • Basics of Nuclear Physics • Quantification of radiations: Scales and units of measurement • Biological effects of Radiation • Operational Radiological Protection • Notions of Radiological Protection • Detection of Ionizing radiations • Methods of Protection against Ionizing radiations • Nuclear and Radiological Legislation • Dosimetry • Preparing for Radiological Emergencies and Evaluation of Radiological Accidents • Regulatory aspects of 1st class installations • Transporting Radioactive Materials • Management of Radioactive Hospital Waste

	• Radiological instrumentation for radiotherapy and nuclear medicine • Radiological risks of external radiotherapy Installations • Radiological risks of open sources, security and control
Unit 2: Group wprkshop	• Radioactive Decay Law • Radiation attenuation by shielding • Radiation attenuation by distance • Detection of scatter radiation • Management of contaminated surfaces
Unit 3: Simulation exercise	• Action and evaluation of radiological emergencies in radiotherapy and nuclear medicine

ADMINISTRATION AND MANAGEMENT IN RADIOTHERAPY

Coordinating teacher: Dr. Roberto Rosso

Site: Arturo López Pérez Foundation Cancer Center

Duration and schedule: 1 month, 2 hours a week. Total: 8 hours

1. Course generalities

Objectives:	• To acquire theoretical knowledge of administration and management for the correct design, organization and management of a radiotherapy department. • To know the laws and regulations as well as the standards of quality control and protection that allow the correct and safe running of a radiotherapy department both for patients and for personnel.
Contents	• Theoretical knowledge
Units	• Unit1: Basic notions of administration and management of a radiotherapy department • Unit 2: Current laws and regulations. • Unit 3: Quality Control, protection and safety in Radiotherapy. • Unit 4: Organization and design of a Radiotherapy Department
Activities	• Online lessons.
Grading	• Personal evaluation by the coordinating teacher, grades to 7

2. Lesson plan

Unit 1: Basic notions of administration and management of a radiotherapy department	• Health systems. Relation between remitter and purveyor • Costing and payment approval systems • Ways to pay service purveyors • Productivity indicators
Unit 2: Current laws and regulations	• Clinical recommendations • Current guarantee programs • Health regulations
Unit 3: Quality Control, protection and safety in Radiotherapy.	• Quality control • Radiological protection • Equipment maintenance and personnel training
Unit 4: Organization and design of a Radiotherapy Department	• Requirement calculation. Request estimate • Availability of physical, technological and human resources • Effectiveness flowchart • Design of treatment protocols

APPLIED BIOETHICS

Coordinating teacher: TBD by Los Andes University
Site: Los Andes University
Duration and schedule: 4 weeks, 2 hours/week

1. Course generalities

Objectives:	• To strengthen concepts of bioethics applied to cancer-patient care and to offer tools that allow the student to identify and resolve conflicts through ethical reasoning • To know the bioethical principles of clinical studies
Contents	• 4 on-site lessons at Los Andes University
Units	• One unit of applied bioethics
Activities	• Theoretical lessons and discussion of possible ethical conflict situations in clinical practice and clinical trials
Grading	• Grading by the coordinating teacher, from 1 to 7

4. Lesson plan

Unit 1: Applied Bioethics	• Bioethic of doctor/patient relations • Problem solution in cancer-patient care from a bioethical point of view I • Problem solution in cancer-patient care from a bioethical point of view II • Bioethics of clinical trials

WORKSHOPS IN ADVANCED RADIOTHERAPY

Coordinating teacher: Loreto Yañez
Site: Los Andes University - FALP
Other teachers: national and international experts
Bimonthly calendar: 2-day Workshops

1. Course generalities

Objectives:	The resident will acquire in-depth knowledge of • Management, quality control and safety in radiotherapy • IMGRT - IGRT • Protontherapy, Tomotherapy, Brachytherapy, IORT • SBRT • Clinical application of advanced radiotherapy to different body areas
Contents	• 6 workshops with national and international experts.
Units	• Unit 1: Introduction to advanced techniques in Radiotherapy • Unit 2: Application of new technologies I • Unit 3: Application of new technologies II • Unit 4: Application of new technologies III • Unit 5: Application of new technologies IV • Unit 6: Treatment of specific sites
Activities	• Theoretical on-site 2-day workshops every 2 months.
Grading	• Written exam graded 1 to 7 at the end of each unit. The final grade for this course will be the arithmetical mean of the 6 grades. Passing grade 5.0 or higher

5. Lesson plan

Unit 1: Introduction to the course on advanced techniques in Radiotherapy	• Radiotherapy management: basics, organization and efficiency • Quality Control, protection and safety in an Advanced Radiotherapy department • Current laws and regulations • Research in Radiotherapy: methodology and objectives • *Invited speakers: José Miguel Delgado; Pedro Lara; Alvaro Longo Guardi; Hugo Marsiglia; Rosalba Ospino; Luis Pinillos; Fernando Ruiz; Moises Russo; Karla Torzok; Eduardo Zubizarreta; CCHEN representative*
Unit 2: Application of new technologies I	• Protontherapy: generalities, dosimetric and radiobiological advantages, indications, limitations, future perspectives • Tomotherapy : generalities, dosimetric and radiobiological advantages, indications, limitations, future perspectives • *Invited speakers: Jean Louis Habrand; Hugo Marsiglia; Minesh Mehta;*
Unit 3: Application of new technologies II	• IMRT • IGRT • *Invited speakers: Ricardo Cendales; Andres Cordova; Marcos dos*

	Santos; Ariel Fariña; Pablo Gonzalez; Sebastián Solé; Veronica Vera
Unit 4: Application of new technologies III	• Brachytherapy • Intraoperative Radiotherapy • *Invited speakers: Leonardo Badinez; Felipe Calvo; Marcela de la Torre; Carlos Ferrer; Ferran Guedea; Christine Haie-Meder; Marco Krengli; Tomas Merino; Roberto Orecchia; Alfredo Polo; Angeles Rovirosa;*
Unit 5: Application of new technologies IV	• SBRT: generalities, dosimetric and radiobiological advantages, limitations, future perspectives. Main indications and results • *Invited speakers: Jean Bourhis; Enrique Chajon; Ariel Fariña; Nicolás Isa; Eric Lartigau; Paolo Muto; Moisés Russo; Kita Sallabanda; Luis Schiappacasse; Claudio Solé; Eduardo Weltman*
Unit 6: Treatment of specific sites	• CNS • Head and Neck • Breast • Lung • Digestive tract • Prostate • Pediatrics • Gynecology • Sarcomas • *Invited speakers: Maria José Alvés; Lijia Aviles; Ignacio Azinovic; Tracy Batchelor; Yisel Bautista; Piero Bettoli; Keith Britton; Maribel Bruna; Victor Caceros; Pablo Castro Peña; Enrique Chajón; Ana Maria Ciudad; Lisbeth Cordero; Marta Cotes; Christian Domenge; Maia Dzhusgashvili; Rafael García; Gustavo Guggiari; Judith Huerta; Carla Ismael; Pedro Kasdorf; Rafael Lengua; Julian Malicki; Fedro Peccatori; Adela Poitevin; Philip Poortmans; Aldo Quarneti; Thais Rebolledo; Umberto Ricardi; Sofia Rivera; Bertha Roth; Moises Russo, Nestor Sanchez; Gustavo Sarria; Veronica Vera; Loreto Yañez; Silvia Zunino.*