JSMP Medical Physics Summer Seminar 2011

in Aso-KUMAMOTO
Thursday, September 1(afternoon)－Saturday, 3(noon), 2011

＊JSMP医学物理サマーセミナー2011；
会場：リソートホテル阿蘇いこいの村　(tel:0967-34-2151)
会期：9月1日（木）～9月3日（土）
会場受付：9:1:12:30-13:00
開講式　：9:1:13:00～13:15
閉講式　：9:3:12:00～12:15

＊お知らせ
①セミナー講義資料は、以下よりログインし、必ず、事前に資料ダウンロードの上参加ください。ＬＯＧ　ＩＮ

②9/1;熊本空港⇒会場Hotel送迎バス；
・第1便；10:15発予定
・第2便：11:55発予定
送迎バス利用者集合場所・発着場所：
熊本空港：団体口ビー⇒国際線ターミナルビル前 (MAP.pdf)
バスは国際線ビル前に停車しています。発車5分前には各自バスに乗車下さい。　バス利用希望など事前申込み者番号リスト

③9/1：ホテルで昼食を必要とする方
9月1日昼食はプログラムに含まれていません；ホテルでの昼食を希望する場合は申込みが必要です。申込み者リストを確認下さい。基本的にホテル昼食は予約制になっていますのでご注意ください。
ホテル昼食の追加申込みは事務局宛にご連絡下さい（〆切；8/23）

④他交通手段ご利用の場合は現地集合でお願い致します。
アクセス；http://www.aso-ikoi.jp/access/index.html
1）JR「阿蘇駅」、JR「いこいの村駅」到着の方はホテルへ電話連絡によりホテルからの送迎車が利用可能です。(tel:0967-34-2151)
2）熊本空港からリムジンバスを利用される方は、阿蘇・大分方面行きを　利用し、ＪＲ「阿蘇駅」で下車してください。(tel:0967-34-2151)

⑤ 9/3; 会場Hotel⇒熊本空港行きバス
・第１便：12:20頃発－13：20頃着予定
・第２便：13:00過ぎ発　　予定

事務局:JSMP教育委員会サマーセミナー実行委員
mailto：<jsmp11_summer@nirs.go.jp>
問合せsubject名<Summer Seminar>

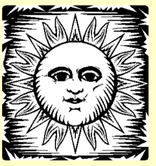
JSMP医学物理サマーセミナー2011

September 1-3,2011 Aso-KUMAMOTO

Day 1: Thursday Sep 1		
13:00	13:15	Welcome, Course overwiew
13:15	14:35	Radiation Protection and Safety 1(赤羽恵一)
14:45	16:05	Radiation Protection and Safety 2(赤羽恵一)
16:15	17:35	Magnetic Resonance Imaging 1(山本　徹)
17:45	19:05	Magnetic Resonance Imaging 2(山本　徹)
19:30		Banquet
Day 2: Friday Sep 2		
5:30	6:30	Walking
7:00	8:30	Breakfast
9:00	10:20	External Photon Beams: Physical Aspects(荒木不次男)
10:35	11:55	Electron Beams: Physical and Clinical Aspects(荒木不次男)
12:00	13:00	Lunch
14:00	15:20	Nuclear Medicine/Imaging 1(山谷泰賀)
15:35	16:55	Nuclear Medicine/Imaging 2(山谷泰賀)
18:00	19:00	Supper
20:00	22:00	Night session & Informal Q&A
Day 3: Saturday Sep 3		
7:00	8:30	Breakfast
9:00	10:20	MV-CBCT(IGRT)(隅田伊織)
10:35	11:55	Special Procedures and Techniques in Radiotherapy(SRS,SRT)(塩見浩也)
12:00		Closing remark

＊本プログラム参加の機構認定単位数は下記の通り：
医学物理士認定機構; 医学物理士業績評価単位::10
放射線治療品管理機構認定単位：C2-1

Medical Physics Summer Seminar 2011 in ASO-IKOINOMURA-KUMAMOTO
Syllabus



1-1.Radiation Protection and Radiation Safety
赤羽　恵一（放医研）

1. Introductions and Historical Perspective
(a) Discovery and early application of ionizing radiation
(b) Observed radiation injury
(c) Suggested radiation protection practices
(d) Pre-regulatory initiatives
2. Interaction Physics as Applied to Radiation Protection
(a) Indirectly and directly ionizing radiation
(b) Bethe-Bloch formalism for coulomb scattering, shell effects, polarization phenomena,
nuclear processes, adiabatic scattering, track structure, target phenomena, radioactive
processes, Anderson-Ziegler parameterization, Janni tabulation, and effects due to
shower cascade phenomena
(c) Electromagnetic interaction: photoelectric effect, Compton effect, pair production,
(d) Neutron interactions: elastic and non-elastic processes
3. Operational Dosimetry
(a) Units
(b) Kerma and absorbed dose
(c) Dose equivalent
ii. Dose/dose equivalent interpretation
iii. TLD energy, dose, dose rate response
(c) Dose equivalent instrumentation
i. Energy dependence
ii. Pulse field response
5. Shielding: Properties and Design
(a) Directly ionizing particles
(b) Indirectly ionizing particles
(c) Build-up parameterization
(d) Stochastic sampling: Monte Carlo
i. Source description and sampling
ii. Interaction sampling
iii. Geometry effects
iv. Scoring
v. Public domain codes
(e) Particle Accelerators
i. Primary particle shielding
ii. Secondary-tertiary particle shielding
iii. Energy and particle type dependence
iv. Interlocks and access control
v. Modeling radiation environment
(f) NCRP (National Council on Radiation Protection and Measurements) shielding
recommendations and techniques
6. Statistics
(a) Statistical interpretation of instrument response
(b) Design of experiments
(c) Stochastic and nonstochastic error analysis
(d) Interpreting experimental results
7. Radiation Monitoring of Personnel
(a) Instrumentation and techniques
(b) Integral and active devices
(c) Dynamic range and response sensitivities
(d) Film, TLD, Lexan, and CR-39
(e) Pocket ion chambers and GM counters
(f) Pregnant workers and fetal dose limits
8. Internal Exposure
(a) ICRP 26, ICRP 2A recommendations
(b) Medical internal radiation dose (MIRD) dosimetry
(c) Monitoring and radiation control
(d) Biological assay
(e) Dispersion in a working environment
(f) Allowed limit of intake and derived air (or water) concentrations
9. Environmental Dispersion
(a) Release of radionuclides to the environment
(b) Dosimetric consequences
(c) Environmental Protection Agency (EPA) and U.S. Nuclear Regulatory Commission
(NRC) air and water dispersion models
10. Biological Effects
(a) Basic radiation biology
(b) Nonstochastic and stochastic responses
(c) Biological experimental data base of radiation injury
(d) BEIR (Biological Effects of Ionizing Radiation) and UNSCEAR (United Nations
Scientific Committee on the Effects of Atomic Radiation) Reports
(e) Patient and fetal dose issues
11. Regulations
(a) What is; what is not
(b) 10CFR19-70; 49USDOT300-399, 198; 219SFDA 278; 290SHA; 42USPHS; 40USEPA
(c) States: agreement or not
(d) Relationship to NCRP and ICRP (International Commission on Radiation Protection)
12. High/Low Level Waste Disposal
(a) USNRC/USDOE/USEPA Repository (U.S. Nuclear Regulatory Commission/
Department of Energy/Environmental Protection Agency)
(b) Low level compacts
(c) Future impacts
13. Nonionizing Radiation
(a) Electromagnetic and sound hazards
(b) Device emission requirements
(c) Measurement techniques
(d) Regulatory control

1-2 Magnetic Resonance Imaging
山本　徹（北海道大学）

1. Basic Principles
(a) Intrinsic and extrinsic parameters affecting MR image contrast
(b) Required properties of nuclei that are useful in MR
(c) The static magnetic field (B_0) and the equilibrium distribution
(d) The Larmor frequency and the radiofrequency field (B_1)
(e) The lab and rotating frames of reference
(f) Relaxation mechanisms (T_1, T_2, T_2*) and effects of common contrast agents
(g) The basic spin-echo sequence
(h) Contrast in spin-echo imaging
(i) Spatial encoding using linear magnetic field gradients (G_x, G_y, G_z)
i. Slice selection
ii. Frequency-encoding
iii. Phase-encoding
iv. 2D vs. 3D acquisitions
(j) Properties of "*k*-space"
2. Hardware
(a) The static magnetic field subsystem
i. Common field strengths and magnet designs
ii. Siting issues
(b) The radiofrequency (RF) field subsystem
i. Coil designs: volume, surface, phased array
ii. Radiofrequency shielding requirements (siting)
(c) The gradient field subsystem
i. Maximum amplitudes, risetimes, and slew rates
ii. Eddy current effects and compensation techniques
3. Basic Image Quality Issues
(a) Signal-to-noise ratio and contrast-to-noise ratio in MRI
(b) Resolution
(c) Image acquisition time
4. Basic Pulse Sequences
(a) Spin-echo sequence
(b) Gradient-echo sequences
(c) Fast spin-echo sequence
(d) Inversion recovery sequences and applications [STIR, FLAIR (Short Time Inversion Recovery, Fluid-Attenuated Inversion Recovery)]
(e) Common sequence options (spatial and chemical saturation techniques)
(f) Ultrafast imaging sequences (echo planar imaging and spiral techniques)
(g) MR flow sensitive sequences
i. Flow-related phenoma
ii. Time-of-flight MRA
iii. Phase contrast MRA
iv. Bolus contrast agent-enhanced MRA
v. Perfusion sensitive imaging
vi. Diffusion-weighted and diffusion tensor imaging
(h) Functional MRI neuroimaging techniques
i. Physiological basis
ii. Imaging methods
iii. Experiment design and analysis
(i) MR spectroscopy (MRS) sequences
(j) Parallel imaging techniques
5. Artifacts and Methods for Artifact Rejection/Reduction
(a) Motion
(b) Aliasing or "wrap-around"
(c) Metal objects
(d) Chemical shift
(e) Truncation
(f) System-related
i. Distortions
ii. RF coil problems and RF interference
iii. Ghosting
iv. Receiver/memory/array processor problems
(g) Spatial accuracy limits and optimization
6. Safety and Bioeffects
(a) Static field considerations (projectile, effects on implants, physiological effects)
(b) RF field considerations (tissue heating, specific absorption rate, burn injuries)
(c) Gradient field considerations (peripheral nerve stimulation, sound pressure levels)
(d) Food and Drug Administration (FDA) guidelines
(e) MR and pregnant patients, technologists, and nursing staff
(f) Common MR contrast agents
7. Quality Control
(a) The ACR (American College of Radiology) standards related to MRI
(b) The ACR MR Accreditation Program (MRAP)
(c) The ACR MR Quality Control Manual and its recommended quality control aspects
(d) Other guidelines, including AAPM task group reports and NEMA (National Electrical
Manufacturers Association) reports

2-1. External Beam Radiation Therapy
荒木不次男（熊本大学）

1. Clinical Photon Beams: Description
(a) Basic parameters: Field size, source-skin distance, source-axis distance, sourcecollimator
distance
(b) Field size options: Circular, square, rectangular, irregular
(c) Field collimators: Primary, secondary, and tertiary placement of collimators;
rectangular (upper and lower jaws); circular; multileaf collimators
2. Clinical Photon Beams: Point Dose Calculations
(a) Percentage depth dose (PDD)
(b) Peak-scatter factor (PSF)
(c) Tissue-air ratio (TAR)
(d) Tissue-maximum ratio (TMR)
(e) Tissue-phantom ratio (TPR)
(f) Scatter function
(g) Scatter-air ratio (SAR)
(h) Scatter-maximum ratio (SMR)
(i) Collimator factor
(j) Relative dose factor/output factor
(k) Off-axis ratio
3. Clinical Photon Beams: Basic Clinical Dosimetry
(a) Factors affecting the fundamental dosimetry quantities
(b) Relationships between the fundamental dosimetry quantities
(c) Collimator and phantom scatter corrections
(d) Irregular fields and Clarkson's integration method
(e) Tissue heterogeneities and corrections
4. Clinical Electron Beams
(a) Electron treatment head
i. Energy selection
ii. Beam broadening methods: dual scattering foil vs. scanned beam
iii. Collimating methods: trimmers vs. applicators (cones)
(b) Depth-dose distribution
i. Characteristics (D_0,D_x,R_{100},R_{00},R_x,R_{00-10})
ii. Variation with energy and field size
(c) Energy spectrum
i. Characteristics (_E, E_0)
ii. Specification at surface (range-energy relationships) and depth
(d) Dose distribution
i. Beam flatness and symmetry
ii. Penumbra
iii. Isodose plots
(e) Determination of monitor units
i. Method of dose prescription
ii. Output factor formalisms
(f) Effect of air gap on beam dosimetry
(g) Fundamental principles
i. Square-root method
ii. Effective vs. virtual source
iii. Side-scatter equilibrium
5. Special Photon and Electron Beams
(a) Intensity-modulated radiation therapy with photon beams
i. Linacs with multileaf collimators
ii. Tomotherapy
iii. Stereotactic beams and robotic linacs
(b) Intensity-modulated radiation therapy with electron beams

2-2. Nuclear Medicine/Imaging
山谷泰賀（放医研）

1. The Gamma Camera
(a) Camera characteristics
(b) Collimators
(c) Crystals
(d) Photomultiplier tube array
(e) Image formation
(f) Spectrometry
(g) The pulse height analyzer
2. Radionuclide Image Quality
(a) Contrast
(b) Blur and visibility of detail
(c) Image noise
(d) Uniformity
(e) Clinical gamma camera applications
3. Radionuclide Tomographic Imaging
(a) Positron Emission Tomography (PET) and PET-CT
i. Principles of PET imaging, hardware, resolution, acquisition modes
ii. Clinical PET imaging procedures
iii. Quantitative PET imaging
iv. Cine (4D) PET
(b) Single Photon Emission Computed Tomography (SPECT)
i. Principles of SPECT imaging, hardware, resolution
ii. Clinical SPECT imaging procedures
iii. Quantitative SPECT imaging
4. Statistics: Counting Error
5. Patient Exposure and Protection
(a) Internal dosimetry
(b) Clinical dosimetry and typical doses for common imaging procedures
(c) Radionuclide therapy dosimetry
6. Personnel Exposure and Protection
(a) Effective dose equivalents
(b) Exposure limits
(c) Exposure sources
(d) Area shielding
(e) Personnel shielding
(f) Exposure from radioactive sources
7. Radiation Measurement
(a) Ionization chambers
(b) Survey meters
(c) Activity measurement
8. Principles of Radiochemistry, Radioimmunoimaging, and the Radiopharmacy
(a) Radiochemistry principles
(b) Radioimmunoimaging and radioimmunotherapy principles
(c) Radiopharmacy techniques
9. Quality Control Issues in Nuclear Medicine

3-1.IMAGING FOR TREATMENT GUIDANCE AND MONITORING
隅田伊織（大阪大学）

3.1.1 Portal Imaging
(a) Portal film, electronic portal imaging
(b) Types of imaging panels, technologies
(c) Scatter
(d) DRR calculation from CT
(e) Registration to DRR
(f) Imaging dose
(g) QA
3.1.2 Cone-Beam CT
(a) Large-field CT, field size
(b) MV cone-beam CT
(c) Scatter, scatter rejection
(d) Imaging quality
(e) Imaging artifacts
(f) Imaging dose (Dose incorporation to plan)
(g) QA

3.2 Special Techniques in Radiotherapy
塩見浩也（大阪大学）

1. Special External Beam Radiotherapy Techniques: Basic Characteristics, Historical
Development, Quality Assurance (Equipment and Treatment), Diseases Treated
(a) Stereotactic radiosurgery
(b) Stereotactic radiotherapy