

RADIATION MEDICINE

Guidelines for the 2nd year students (Faculty for International Students)

LESSON № 1: RADIATION MEDICINE. THE HISTORY OF DEVELOPMENT. CONNECTION WITH CLINICAL DISCIPLINES

THE AIM: to get acquainted with the basic concepts of radiation medicine;
to learn the basic terminology and application of the law of radioactive decay to predict changes of radiation situation;
to master practical skills of calculating projected at different times of the quantity of radionuclides and evaluation of the results;
to perform laboratory work.

DURATION: 3.0 hours.

PLACE: STUDENT CONTROLLED INDEPENDENT WORK.

EQUIPMENT: methodical grant, tables, PowerPoint presentation, tasks according to the topic.

Required theoretical knowledge

1. Radiation medicine: the concept, purposes, tasks, methods, connection with clinical disciplines.
2. The history of radiation medicine development.

Literature

Basic:

1. Радиационная медицина: учебник / А.Н. Стожаров [и др.]; под ред. А.Н. Стожарова. – Минск: ИВЦ Минфина, 2010. – 208 с.: стр. 3 – 14.

Additional:

1. Мойсеёнок, Е.А. Лекции по радиационной медицине (в таблицах) = Lectures on Radiation Medicine (in tables): пособие для студентов факультета иностранных учащихся (на английском языке) [изд. на CD-дисках] / Мойсеёнок Е.А. – Электрон. текст. дан. и прогр. (объем 29 Мб). – Гродно: ГрГМУ, 2012. – 1 электрон. опт. диск (CD-ROM).
2. Radiation and Ecological Medicine: Electronic Educational and Methodological Complex. Access: <http://edu.grsmu.by/course/view.php?id=99>

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LESSON № 2: RADIOACTIVITY. UNITS OF MEASUREMENT

THE AIM: to get acquainted with the basic concepts of radioactivity;

to learn the basic terminology and application of the law of radioactive decay to predict changes of radiation situation;

to master practical skills of calculating projected at different times of the quantity of radionuclides and evaluation of the results;

to perform laboratory work.

DURATION: 3.0 hours.

PLACE: student's workshop.

EQUIPMENT: methodical grant, tables, PowerPoint presentation, tasks according to the topic.

Required theoretical knowledge

1. Radioactivity: the concept, systemic and traditional units of radioactivity, their relationship.
2. The law of radioactive decay.
3. Types of radioactive transformations of nuclei: alpha-, beta-, gamma-transformation of the nuclei.
4. The phenomenon of induced radioactivity.

Laboratory (individual) work of students

1. Solution of situational tasks.

Literature

Basic:

1. Радиационная медицина: учебник / А.Н. Стожаров [и др.]; под ред. А.Н. Стожарова. – Минск: ИВЦ Минфина, 2010. – 208 с.: стр. 3 – 14.

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LESSON № 3: THE CONCEPT OF DOSES USED IN RADIATION MEDICINE. RADIATION DAMAGE TO HUMANS

THE AIM: to get acquainted with classification of ionizing radiations, their properties;
to study stages of radiation injury;
to master the main types of cell reactions to irradiation;
to perform laboratory work.

DURATION: 3.0 hours.

PLACE: student's workshop.

EQUIPMENT: methodical grant, tables, PowerPoint presentation, tasks according to the topic.

Required theoretical knowledge

1. Classification of ionizing radiations, their properties.
2. Stages of radiation injury: direct and indirect action.
3. The radiolysis of water, the main products of radiolysis. The influence of oxygen on radiolysis.
4. Types of cell reactions to irradiation.

Laboratory (individual) work of students

1. To master the principles of operation of the detector setup PЗБ-05 to control contamination in surfaces of the arms, legs, body and clothing of human beta-active radionuclides.

Basic:

1. Радиационная медицина: учебник / А.Н. Стожаров [и др.]; под ред. А.Н. Стожарова. – Минск: ИВЦ Минфина, 2010. – 208 с.: стр. 3 – 14.

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LESSON № 4: DOSIMETRY AND RADIOMETRY

THE AIM: to get acquainted with the main dosimetric units;
to examine the basic units of doses and the rules for their use;
to master the methods of ionizing radiation registration;
to perform laboratory work.

DURATION: 3.0 hours.

PLACE: student's workshop.

EQUIPMENT: methodical grant, tables, PowerPoint presentation, tasks according to the topic.

Required theoretical knowledge

1. Dose: exposure, absorbed, equivalent, effective; SI and non-SI units of doses, the ratio between them.
2. General and individual dosimetry. The collective dose. Monitoring of external irradiation doses of a man.
3. Classification of ionizing radiation registration methods. Detectors and instruments used for registration and measurement.
4. Radiometry. Principles of radiometric researches.
5. Control of internal exposure of the population. Methods of incorporated radiocesium measurement.

Laboratory (individual) work of students

1. Solution of situational tasks.

Literature

Basic:

1. Радиационная медицина: учебник / А.Н. Стожаров [и др.]; под ред. А.Н. Стожарова. – Минск: ИВЦ Минфина, 2010. – 208 с.: стр. 3 – 14.

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LESSON № 5: NATURAL SOURCES OF IONIZING RADIATION. RADIATION BACKGROUND EXPOSURE OF THE EARTH

THE AIM: to get acquainted with the main natural sources of radiation;
to study the main reasons for the increase of human exposure through natural radiation sources;
to master the principle of work СРП-88П, СРП-68-01 to measure the exposure dose;
to perform laboratory work.

DURATION: 3.0 hours.

PLACE: student's workshop.

EQUIPMENT: methodical grant, tables, PowerPoint presentation, tasks according to the topic.

Required theoretical knowledge

1. Radiation background exposure of the Earth: its components and their contribution to the annual effective dose of radiation.
2. Characteristics of cosmic radiation and cosmogenic radionuclides.
3. Radionuclides that form the main exposure on the organism: U-238, Th-232, Ra-226, Rn-222, Po - 210, Bi-210.
4. Radon, its sources and conditions of exposure.
5. Natural radionuclides which are not included in the radioactive series. The value of K-40 in the formation of exposure on the population in the Republic of Belarus.
6. Technologically changed background radiation.

Laboratory (individual) work of students

1. Get acquainted with the principle of work СРП-88П

Literature

Basic:

1. Радиационная медицина: учебник / А.Н. Стожаров [и др.]; под ред. А.Н. Стожарова. – Минск: ИВЦ Минфина, 2010. – 208 с.: стр. 3 – 14.

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LESSON № 6: MEDICAL EXPOSURE. THE PRINCIPLES OF RADIATION DOSE REDUCTION IN HUMANS

THE AIM: to get acquainted with the principles of reducing radiation dose on the human body;
to study methods of protection from ionizing radiation;
to master the structure and principle of x-ray apparatus operation and doses of x-ray radiation;
to perform laboratory work.

DURATION: 3.0 hours.

PLACE: student's workshop.

EQUIPMENT: methodical grant, tables, PowerPoint presentation, tasks according to the topic.

Required theoretical knowledge

1. Medical irradiation: a concept. The concept of closed and open sources of ionizing radiation.
2. The main documents that regulate the work with ionizing radiation sources.
3. Methods of protection against ionizing radiation "protection by amount", "protection by time", "distance protection", "protection by screen".
4. Radiation safety of personnel and population in the conditions of the existing exposure.
5. The principles of radiation dose reduction in patients.

Laboratory (individual) work of students

1. Get acquainted with the structure and principle of operation x-ray apparatus and mammographic x-ray units "Melody B", "Image Giotto".

Literature

Basic:

1. Радиационная медицина: учебник / А.Н. Стожаров [и др.]; под ред. А.Н. Стожарова. – Минск: ИВЦ Минфина, 2010. – 208 с.: стр. 3 – 14.

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LESSON № 7: PROGRAM TO ERADICATE THE CONSEQUENCES OF THE CHERNOBYL ACCIDENT. THE MAIN DOSE-FORMING RADIONUCLIDES OF THE CHERNOBYL RELEASE

THE AIM: to get acquainted with the peculiarities of the radiation situation in the Republic of Belarus after the Chernobyl accident;
to study the characteristics of the main radionuclides of the Chernobyl release;
to master the concept of protection in cases of radiation accidents;
to perform laboratory work.

DURATION: 3.0 hours.

PLACE: student's workshop.

EQUIPMENT: methodical grant, tables, PowerPoint presentation, tasks according to the topic.

Required theoretical knowledge

1. The concept of radiation accidents. Protection of the population in cases of radiation accidents.
2. Radiation safety in situation of radiation accidents.
3. Chernobyl disaster the dynamics of emission in time and space.
4. Characteristic (physico-chemical characteristic, entering, distribution and derived from the body, biological effects) of the basic radionuclides of the Chernobyl release: C-14, Cs-137, Am-241, Sr-90, H-3, I-131, Pu-239, "hot particles".
5. Principles of radiation doses formation after radiation accidents in the dependency from the period of its development.
6. The concept of population protection in radiation accidents at the nuclear power plants.

Laboratory (individual) work of students

1. Measurement of the exposure dose of the dosimeter MKC-AT1125

Literature

Basic:

1. Радиационная медицина: учебник / А.Н. Стожаров [и др.]; под ред. А.Н. Стожарова. – Минск: ИВЦ Минфина, 2010. – 208 с.: стр. 3 – 14.

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LESSON № 8: RADIOSENSITIVITY

THE AIM: to get acquainted with the data on the radiosensitivity of the organ and tissue;

to study individual and age differences of radiosensitivity;

to master the main factors that determine the radiosensitivity of the organization of the human body;

to perform laboratory work.

DURATION: 3.0 hours.

PLACE: student's workshop.

EQUIPMENT: methodical grant, tables, PowerPoint presentation, tasks according to the topic.

Required theoretical knowledge

1. The molecular basis of radiosensitivity. The factors that determine the radiosensitivity at the cellular and tissue levels.
2. The Bergonie-Tribondo rule. The factors that determine the radiosensitivity at the organ, organism and population levels.
3. Individual and age differences of radiosensitivity. The effect of radiation on the embryo and fetus.
4. Modification of radiosensitivity.

Laboratory (individual) work of students

1. To master the principles of operation of the detector setup PЗБ-05 to control contamination in surfaces of the arms, legs, body and clothing of human beta-active radionuclides.

Basic:

1. Радиационная медицина: учебник / А.Н. Стожаров [и др.]; под ред. А.Н. Стожарова. – Минск: ИВЦ Минфина, 2010. – 208 с.: стр. 3 – 14.

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LESSON № 9: RADIATION INJURY OF THE HUMAN ORGANISM. DETERMINISTIC AND STOCHASTIC EFFECTS OF IRRADIATION

THE AIM: to get acquainted with the medico-biological effects of radiation;
to study the association of dose with the degree of severity of the clinical syndromes;
to master the principle of working with alpha - and beta, gamma – spectrometer;
to perform laboratory work.

DURATION: 3.0 hours.

PLACE: student's workshop.

EQUIPMENT: methodical grant, tables, PowerPoint presentation, tasks according to the topic.

Required theoretical knowledge

1. The factors that determine the lesions of the body. The concept of "critical organ".
2. Characteristics of bone - marrow syndrome: pathogenesis, phases, causes of the organism death.
3. Characteristics of gastrointestinal syndrome: pathogenesis, causes of the organism death.
4. Characteristics of cerebral syndrome: pathogenesis, causes of the organism death.
5. Deterministic effects of irradiation: concept, types, dependence on the irradiation dose, period of development, characteristic effects, pathogenesis.
6. Stochastic effects of irradiation: concept, types, dependence on the radiation dose, period of development, characteristic effects, pathogenesis.
7. The concept of «small doses» of ionizing radiation. The effects of «small doses» of ionizing-radiation on the human body.

Laboratory (individual) work of students

1. Get acquainted with the principle of work alpha - and beta - spectrometer МКС-АТ1315.
2. Get acquainted with the principle of work gamma spectrometer МКС-АТ6101В.

Basic:

1. Радиационная медицина: учебник / А.Н. Стожаров [и др.]; под ред. А.Н. Стожарова. – Минск: ИВЦ Минфина, 2010. – 208 с.: стр. 3 – 14.

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LESSON № 10: CONTROL OF RADIATION SAFETY

THE AIM: to get acquaint with the methods and principles of ensuring radiation safety;
to study the basic techniques and measures to ensure radiation safety;
to master criteria for decision of making population protection in radiation accidents;
to perform laboratory work .

DURATION: 3.0 hours.

PLACE: student's workshop.

EQUIPMENT: methodical grant, tables, PowerPoint presentation, tasks according to the topic.

Required theoretical knowledge

1. Radiation safety: concept, basic principles and ways to ensure.
2. State government regulation in the field of radiation safety.
3. General characteristics of the main documents that regulate the work with ionizing radiation sources.
4. Categories and situations of exposure, categories of irradiated persons and the corresponding dose limits.

The differentiated test on the subject **"Radiation and environmental medicine"**

Literature

Basic:

1. Радиационная медицина: учебник / А.Н. Стожаров [и др.]; под ред. А.Н. Стожарова. – Минск: ИВЦ Минфина, 2010. – 208 с.: стр. 3 – 14.

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