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## DIAGNOSTIC APPARATUS IN ONCOLOGY

Early diagnosis of cancer is the basis of prophylaxis and effective treatment. All present-day means of instrumental diagnosis which have attained to a high state of development because of the great advances made by natural science and engineering are used in diagnosing precancerous states and cancer. The Soviet medical institutions, including oncological establishments, now have at their disposal modern diagnostic apparatus utilising the latest achievements of physics, chemistry, electronics and optics.

The general diagnostic appratus used in oncological hospitals and departments and displayed at the Exhibition include apparatus for extenral examination, medical examination of cavities and photography, electronic diagnostic apparatus for recording bio-electric potentials, apparatus for measuring basal metabolism and diagnosing pulmonary disease, apparatus for clinical and laboratory methods of diagnosis, and ultrasonic apparatus for diagnosing tumors.

**Apparatus for Examination and Photography.** Apparatus for examining body cavities play an important part in the diagnosis of malignant tumors. The methods of examination and photography are never contraindicated, and, according to the most prominent clinicians, apparatus of requisite quality make it possible to establish the existence of cancerous and precancerous changes in almost all cases in which these changes can be established histologically. The Soviet medical industry manufactures, as is well known, a wide assortment of optic diagnostic apparatus of original design and high quality; the most interesting of these apparatus are demonstrated at the Exhibition. Some of these apparatus, for example, the photodiagnoscope, are equipepd with an ultraviolet illuminator which extends the diagnostic possibilities of the apparatus and makes it possible to differentiate the

tissue affected with cancer more clearly and distinctly, and detect more definitely the atypical complexes of cancer cells which differ from normal epithelial cells in the character of their luminosity. The 14-reflex luminary for lighting the operative field in surgical operations in also equipped with ultraviolet illuminators, which enables the surgeon to detect tumor metastases.

A group of modern endoscopic apparatus for examining the cavities of different organs — the trachea and bronchi, the stomach, urethra, urinary bladder, etc. — and photographic devices for these apparatus are represented at the Exhibition. The modern endoscopic apparatus developed in the USSR are **controllable**, which greatly extends their possibilities and increases the probabilities of reliable diagnosis. Thus, according to the Kirov Military Academy, examination of the trachea and bronchi by means of the optic bronchoscope with a variable (controlled) angle of sighting has raised the percentage of cancer diagnosis from 47 to 90.

Luminous specula designed for recording and simultaneously illuminating mobile organs offer additional possibilities in diagnosis and surgical intervention.

**Cystoscope with Panoramic View.** This instrument is designed for visual examination of the cavity of the urinary bladder and for ureteral catheterisation. It is equipped with an optic tube which has a variable angle of observation and makes it possible to examine parts of the urinary bladder mucosa inacessible to the usual optic tube used in cystoscopy.

The instrument also makes easier a panoramic view of the cavity (in a plane perpendicular to the optic axis).

The instrument is size 21, according to Charriere's catheter gauge.

Working length — 230 mm.

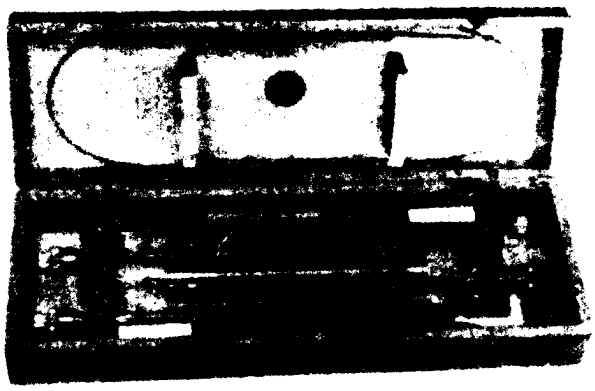
Angle of sighting from 50° (retrograde) to 130° (progressive).

General angle of sighting — about 125°.

Magnification — 1.5×.

Linear field of vision — 25 mm
Resolving power not less than 17 line/mm

(for an object located in the air at a distance of 25 mm from the protective object glass)



Panoramic cystoscope

Electric battery 3 V.

**Gastroscope with Controllable Bend and Panoramic View.** This instrument is desinged for examing the stomach in order to diagnose diseases of the mucosa (tumors, including malignant neoplasms, gastritis, ulcer).

The instrument has panoramic (all-round) sighting achieved by turning the specially-designed head prism about the axis of the optic tube. The device is operated by means of a control ring located near the eyepiece. The head can be turned in both directions. The gastroscope allows observations of 360° without being turned about its axis in the cavity. It is equipped with a device for a compulsory bending of its distal end in one plane. The instrument can be bent in both directions at an angle of up to 70°.

The mechanism is operated by means of a fly-wheel on the ocular part of the instrument. Equipped with a controllable bend and a panoramic view the instrument makes it possible to examine parts of the gastric mucosa invisible through other gastroscopes.

Normal voltage 4 v.

**Optical Bronchoscope.** The instrument is designed for examining bronchial walls and brochial ramifications. It

considerably extends the field of observation acessible to an ordinary bronchoscope, which is extremely important for diagnosis. The instrument has a special device, which makes it possible to change smoothly the direction of the sighting and pencil of light which illuminates the part under examination.

The object glass and illuminator lens are turned by means of a turning ring located at the ocular end of the instrument. The instrument is designed so as to permit of examining the bronchial branches issuing from the bronchi in different directions.

The optical tube with a variable angle of observation obviated the necessity of having a set of tubes with different angles of sighting, which considerably facilitates the examination and reduces the cost of the instrument.

The bronchoscope set includes two optical tubes of different length.

The cross-section of the optical tubes is 5.1×4.6 mm.

Working length of the tubes: long tube — 440 mm, short tube — 350 mm.

Field of vision is 16 mm.

At a distance of 18 mm from the first optic surface.

The angle of observations changes (with respect to the tube axis) from 45 to 135°.

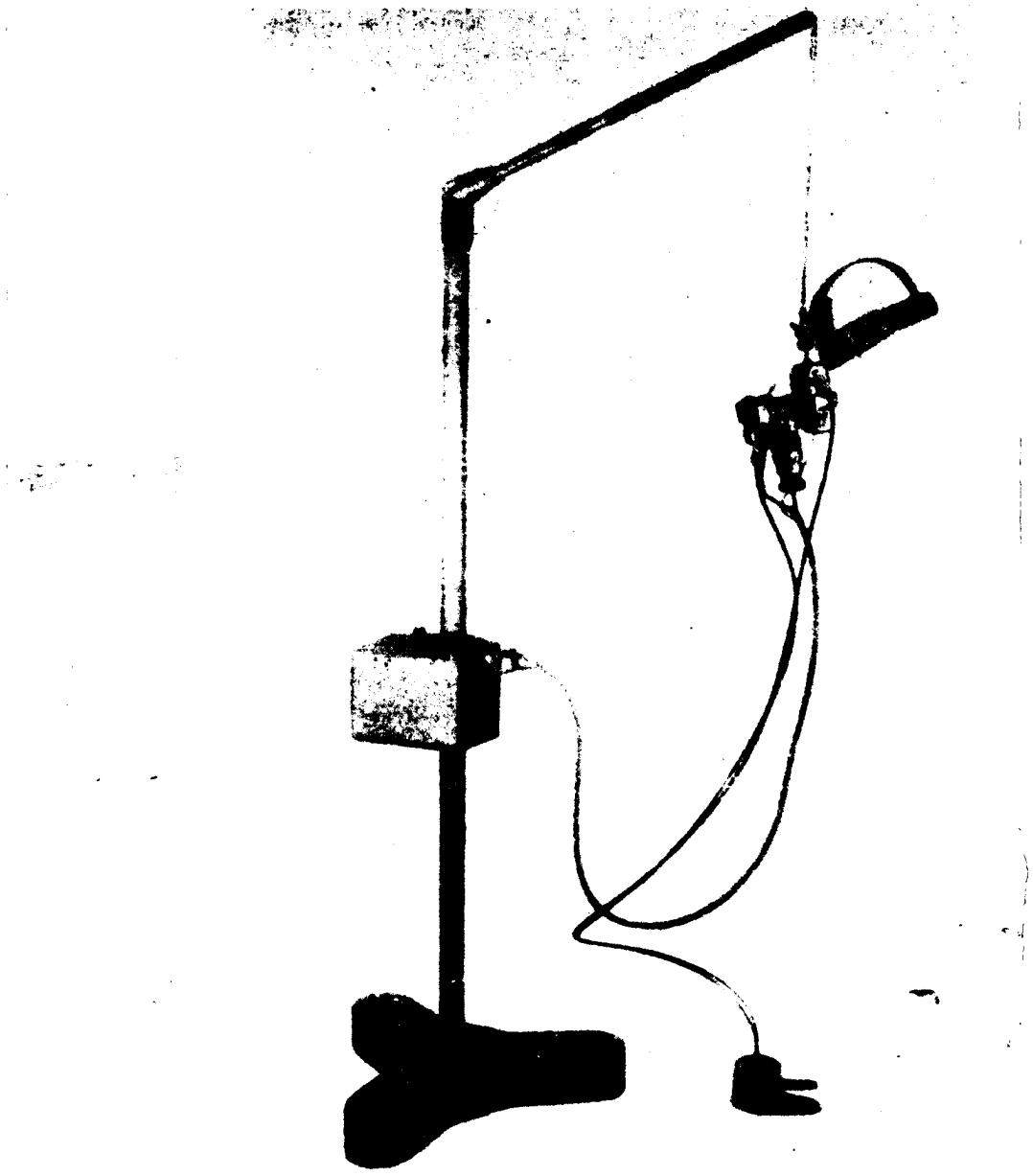
Complete angle of observation — 130°.

**Photolaryngoscope**. The instrument is designed for photographing the larynx, ear, pharynx and nose. It permits of photographing on coloured, as well as black and white film.

The principal merit of the instrument it that it can be fastend to the physician's head and has a foot shutter snap, which frees the physician's hands and enables him to hold the laryngeal speculum and the patient's tongue, while rather rapidly taking a series of pictures. The weight of the instrument is counterbalanced by a weight located in the support so that the physician barely feels it. The lighting system of the instrument directs a good light at the object during both visual observation and photography.

An IFK-120 impulse lamp and a nonperforated 16-mm motion picture film are used for photography.

The main parts of the instrument are a «Narcissus» camera, a hoop, a head with illuminators, object-glass,



Photolaryngoscope

control pedal with cables and a support with the power feeding block.

**Main Technical Specifications:**

Focal distance of the object-glass — 70 mm.

Size of picture on the film — not less than 10 mm.

Linear field of vision — 20.4 mm.

Voltage in the photolaryngoscope lamp during visual observation — 8 V.

Diameter of the illumined field during visual observation — 30 mm.

Illumination of the field — not less than 4,000 lux.

Voltage in the mains — 127 or 220 v.

Size of picture slot in the camera — 12×19 mm.

Weight of the instrument (without the support) — 1.2 kg.

**Apparatus for Recording Bio-electric Potentials.** The methods of recording the bio-electric potentials of the different organs are an inalienable part of any complex diagnostic examination, including that of cancer. Only few of the apparatus for recording bio-electric potentials are represented at the Exhibition. They are mainly apparatus broadly used by the medical profession and those employed for ascertaining clinical findings. The apparatus on display include electrocardiographs, phonocardiograps, electroencephalograps and electrogastrograps. The methods of electrogastrography make it possible to examine the motor function of the stomach and the function of the pancreas without duodenal tube.

**Electrogastrograph EGG-3.** This instrument is designed for examining the motor function of the human stomach by recording its bio-electric potentials. It is an amplifier of bio-electric potentials with built-in source of stabilised voltage of feeding the anode and incandescence and with an ink recording device. To record the bio-electric potentials, a paper band 50-mm wide with a millimetre grid in inserted in the instrument.

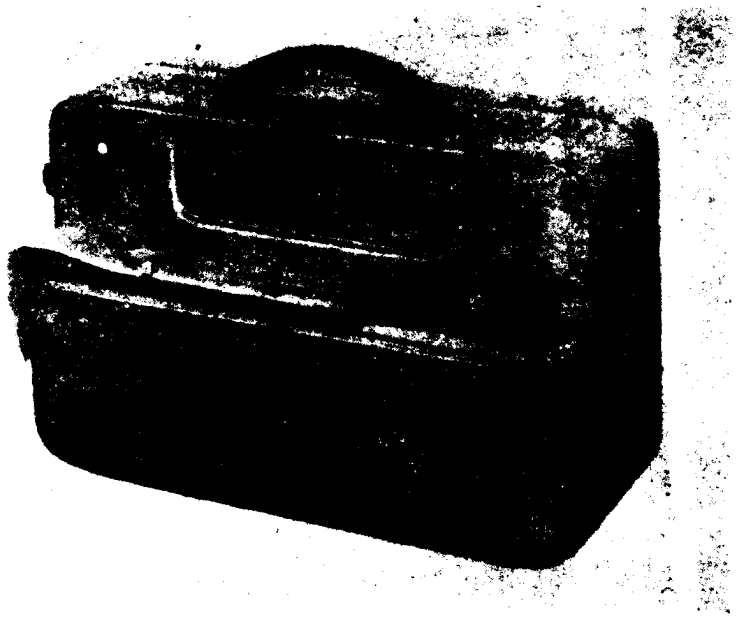
The instrument works on 127 and 220 v alternating current.

Amplifying coefficient — $0.5 \cdot 10^6$.

Sensitivity — 0.9 mm/μV.

Maximal recording amplitude — 18 mm.

Time constant — 6 sec.



Electrogastrograph

Range of working frequencies (irregularity of frequency characteristics — not more than 20 per cent) — 0.02 – 0.2 Hz.

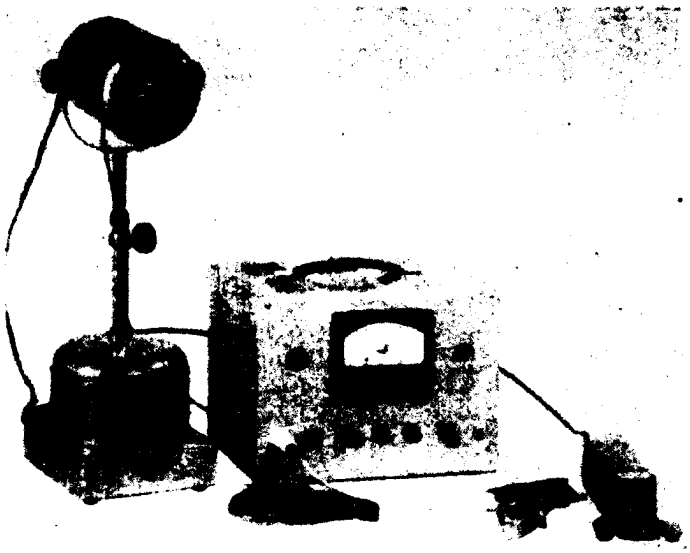
Rate of travel of the paper band — 10 mm/min.

The instrument is equipped with a set of electrodes.

**Stroboscope (Strobophone).** This instrument is designed for examining the vocal chords, both normal and diseased. It consists of 2 main units — a control block and illuminator connected by a cable. The instrument is also equipped with a laryngophone and foot pedal for switching on the illuminator.

The distinguishing feature of the instrument is a watching system which automatically changes the impulse regimen of the illuminator during changes in the frequency of phonation in the frequency band from 50 to 1,000 Hz.

The instrument works on 127 and 220 v alternating current.



Stereoscope

Power used not more than 120 W.

**Apparatus for Determining Basal Metabolism and Diagnosing Pulmonary Disease.** These apparatus have of late been considerably developed. All the existing apparatus for determining the gaseous metabolism are based on two methods volumetric and gas analysis. Apparatus of both groups, each of which has its own advantages, are represented at the Exhibition. The apparatus of the first group are more exact, while those of the second group with a physical gas analyser make it possible to automate the calculation of metabolic values. The Exhibition is displaying spirographs for general and differential bronchospirography, spirometabolographs, apparatus for determining the residual volume of the lungs and modifications of pulmonary ventilation, apparatus for measuring basal metabolism with physical gas analysers, and chemical gas apparatus. In addition, there is a pneumotachograph an instrument which allows of all-round examination of the function of the respiratory system.

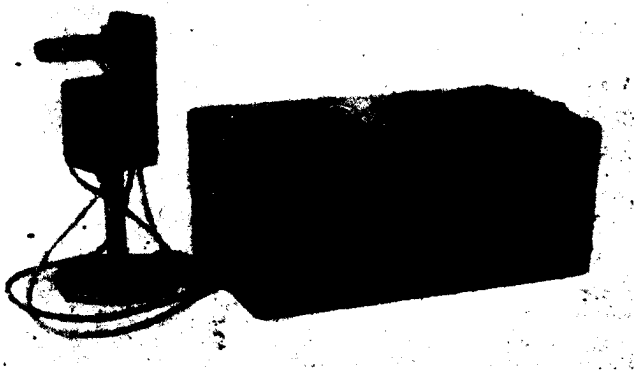
**Universal Pneumotachograph.** This instrument is designed for functional diagnosis of pulmonary diseases. It

serves to record pneumotachograms — curves of change in the volumetric respiration rates in time and for measuring intra-alveolar and intraesophageal pressure. The instrument makes it possible to record the forms of respiration, judge the duration of the respiratory cycle, the ratio between inhalation and exhalation, the patency of bronchial tree and its resistance during the movement of air in it.

Since in addition to pneumotachograms, the instrument is also used for recording intra-alveolar and intraesophageal pressure it is made correspondingly with three channels for recording pressures of up to 10, 70 and 500 mm $H_2O$. During determination of the respiratory characteristics the subject is connected to the instrument through a pick-up tube by means of a mouthpiece. To measure intraesophageal pressure, a catheter is introduced through the subject's nose.

The main parts of the instrument are the pick-ups of respiration with an overlap mechanism and pressure self-recorder which consists of an optical manometer for measuring the pressure, an optical kymograph, tape transport and light sources.

A paper highly sensitive to ultraviolet radiation and scarcely sensitive to a high spectrum frequency is used for recording.



General — purpose pneumotachograph.

The instrument makes it possible to record processes operating at the rate of movement of the beam of light up to 50 m/sec. The time of illumination with diffuse daylight required for developing the recording is 10—15 sec. The instrument works on 127 and 220 v alternating current at 50 Hz.

Power used 600 W.

The instrument is supplied with a set of respiratory tubes, photopaper, mouthpieces, parts.

**Apparatus for Clinical and Laboratory Diagnostic Methods.**

The Exhibition is displaying several instruments and apparatus which demonstrate the development of new ideas in laboratory diagnosis, including automation of laboratory examinations, automatic count of blood cells, an automatic device for histological processing of tissues, electrophoretic apparatus and apparatus for chromatography.

**Apparatus for Diagnosing Eye Diseases.** The Exhibition has on display several apparatus required for diagnosing eye diseases: an apparatus for photographing the funds and other parts of the eye, slit lamps, including a lamp for examination in infra red rays of the spectrum, a projection ophthalmoscope, adaptometers and adaptoperimeters.

**ADM Adaptometer.** This instrument is designed for examining nocturnal and twilight vision (light sensitivity and visual acuity in a weak light).

The ADM adaptometer permits of an all-round examination of nocturnal vision and recording in a short period of time the curve of increasing light sensitivity after blinding with a beam of light or after a prolonged stay in the dark.

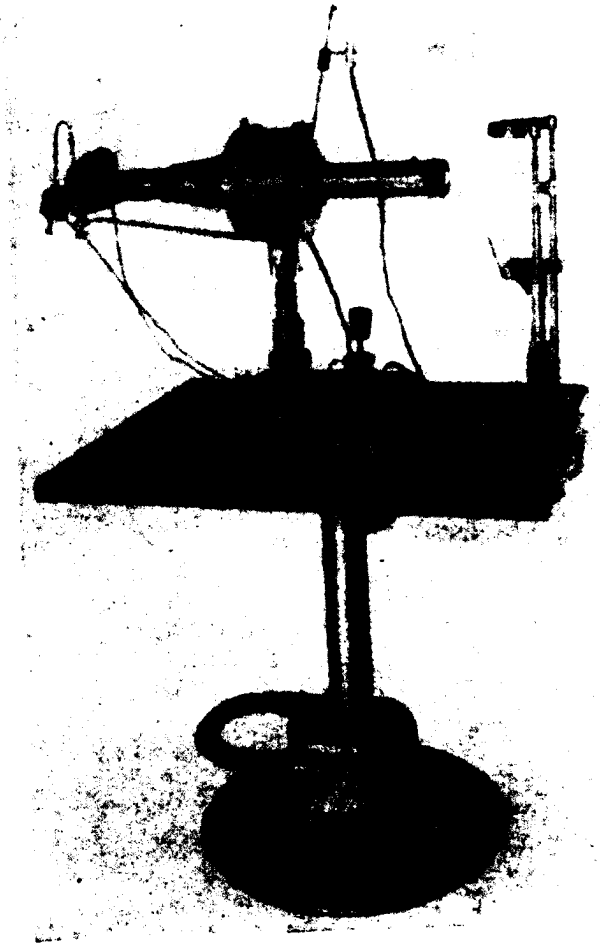
The instrument consists of a measuring device, a sphere for light adaptation and a control panel. It works on 127 and 220 V alternating current through a voltage stabiliser located in the control panel.

The brightness of the objects changes within the limits of $1 - 25.10^{-10}$.

The brightness of the walls of the sphere of preliminary light adaptation — 2500, 1250, 625, 312, 6.5 asb.

Weight of the instrument — 18,5 kg.

**Apparatus for Photographing the Fundus and Other Parts of the Eye.** This apparatus ensures production of coloured photographs of the fundus without the light reflexes and haze from the surfaces of ocular media and optical parts of the apparatus. The image scale of the parts of the fundus measured in angular values is the same for



Apparatus for Photographing the Fundus and Other Parts of the Eye.

eyes with different degrees of ametropia, owing to which it is possible to make measurements in the fundus. The apparatus is equipped with a special device — compensator for astigmatism — by means of which it is possible to make clear pictures of the fundus of an astigmatic eye.

The apparatus works on 127 and 220 V of alternating current.

Magnification of the film — 2×.

Angle of the field of vision — 24°

The apparatus compensates for the patient's ametropia from —20 to +20 diopters and astigmatism — up to 5 diopters.

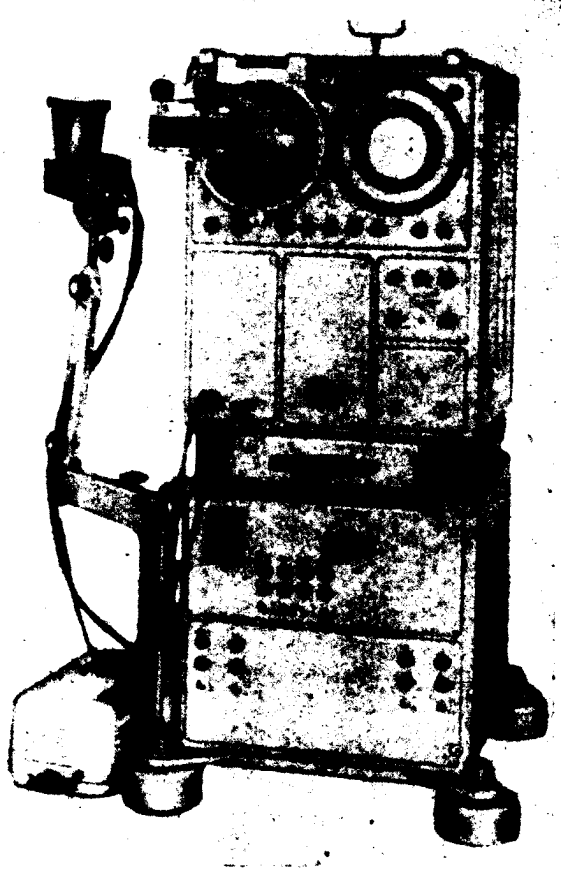
**Apparatus for Ultrasonic Diagnosis.** Of late the attention of investigators has been increasingly attracted to ultrasonic methods of diagnosing malignant neoplasms because these methods can serve as a substantial supplement to roentgen methods of examination.

The USD-4, one of these apparatus developed in the USSR for ultrasonic diagnosis of tumors, is displayed at the Exhibition.

**USD-4 Ultrasonic Diagnostic Apparatus.** This apparatus is designed for diagnosing and determining the localisation of tumors and other pathological changes in the human organism by reflected ultrasonic impulses by the ultrasonic location method. The method is based on the difference in the densities of tumoral and normal tissues. The ultrasonic impulse sent through the tissues is reflected from the denser structures and enters the pick-up which transforms the ultrasonic energy into electric energy. The reflected impulse is amplified and recorded on the screens of cathode-ray tubes.

Ultrasonic echolation is an important supplement to the roentgen method of examination because it makes possible early diagnosis of malignant tumors which are not discovered for their small size and density, the latter being close to that of the surrounding tissue, or are inaccessible for other reasons.

The apparatus is mounted in a metal case on wheels. The lower compartment contains two power blocks on whose anterior panels are tumbler handles, signal bulbs, safety fuses, switch buttons and handles for regulating the generator power.



Ultrasound diagnostic apparatus, UZD-4

The upper compartment contains all the other blocks of the apparatus with the corresponding control elements. The photocone is located on top; during the photography of echograms it is lowered and fixed against the screen of any of the tubes. A «Zorky» type camera and a numerator of the photographed echograms are fastened on the photocone. The numbers are set manually.

Working frequency of the apparatus — 2.5, 5, 10 and 15 MHz.

Depth of action:

| | | | | |
|---|---|---|---|---|
| at a frequency of | 2.5 | MHz | — 90 | mm |
| » | 5 | » | — 55 | » |
| » | 10 | » | — 30 | » |
| » | 15 | » | — 15 | » |

Resolving power:

a) depth: at a frequency of 2.5 MHz — 3.5 mm

| | | | | | |
|---|---|---|---|---|---|
| » | » | 5 | » | — 2 | » |
| » | » | 10 | » | — 1.2 | » |
| » | » | 15 | » | — 1.2 | » |
| b) azimuth: » | » | 2.5 | » | — 3.5 | » |
| » | » | 5 | » | — 10 | » |
| » | » | 10 | » | — 5 | » |
| » | » | 15 | » | — 5 | » |

Duration of the temporary sweep — 300 μsec.

Scanding speed — 0.8 1/sec.

Maximal size of image field in scanning — 150×150 mm.

Duration of impulses — 1 — 4 μsec.

Mean power of ultrasound — 0.2—0.02 W.

Amplification coefficient of the high-frequency tract — about 100 db.

The apparatus works on 220 V alternating current at 50 Hz through two ferroresonant stabilisers (C—0.75) supplied with the apparatus.

## DIAGNOSTIC X-RAY APPARATUS

Usual diagnostic X-ray apparatus are employed for examining oncological patients: the apparatus include those designed for examining all parts and organs of the body, as well as specialised devices for ascertaining the diagnosis.

The industry manufactures stationary apparatus of two classes designed for large medical institutions and for the medical system at large, i. e., rural, district and urban hospitals and polyclinics. In addition, the industry produces apparatus for the mobile X-ray units, i. e., designed mainly for individual rural communities, and portable apparatus for examining patients in wards and at home.

Fluorographs — miniature (film size — 31×31 mm) and largesize (63×63 mm) — are manufactured for prophylactic screening of large sections of community.

**F-59P Large-Size Fluorograph.** This apparatus is designed for mass radiological screening of the population.

It consists of a hoisting support with base, camera, prop, roll and single casettes, and control panel.

The fluorograph is semiautomatic.

Films are taken on 70-mm nonperforated film with a 63×63-mm size of image. The 350×350-mm screen is fluorescent and cylindrical.

The apparatus is equipped with roll and single casettes. The roll film casette is rewound automatically by motor.

The time relay makes it possible to set a definite exposition from 0.06 to 2 sec.

The patient is moved vertically by means of the hoisting support within the range of 500 mm, with the aid of the drive at the rate of 2 m/min.

The design and electric scheme of the fluorograph make it possible to use it together with its roentgen installation. The control panel is fed through the roentgen installation.

The fluorograph has two picture counters — one in the rollcasette and the other in the control panel.

The apparatus has a device for inserting and illuminating the registration card and imprinting its number on the picture.

The fluorograph set includes various accessories, spare parts and instruments.

**RKS-60 Scintillating Electrokymograph.** This instrument is designed for recording:

1) contractions of different parts of the heart shadow,

2) pulsations of different parts of the shadow of the major blood vessels,

3) capillary pulse of the pulmonary parenchyma fixed at any point of the pulmonary tissue,

4) differential pulmonary ventilation,

5) electrocardiograms.

The instrument makes it possible to record simultaneously two processes: any of the foregoing processes and an electrocardiogram, differential pulmonary ventilation of both lungs, and two leads of an electrocardiogram. Combined with the roentgen diagnostic apparatus this instrument ensures objective recording of the functional state of the lungs and determination of normal and pathological states of the heart muscle an dthe large blood vessels.

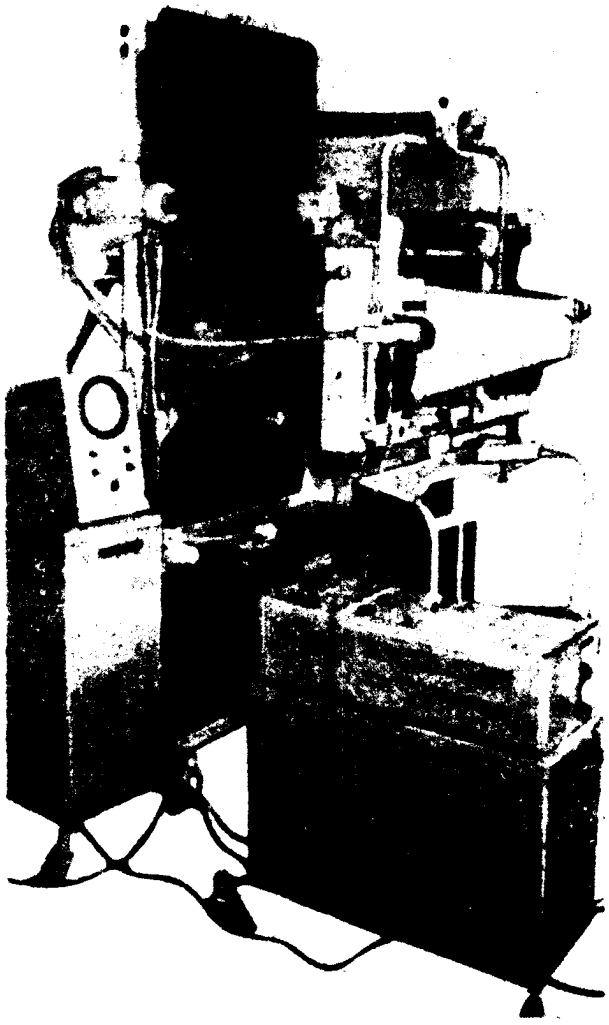
The scintillating electrokymograph is of a block design and consists of the following independent blocks:

1) scintillating kinetic transducer,

2) photoelectric static transducer (the transducers are adapted for installation directly on the roentgen screen),

3) amplifying and recording block which unites a twocanal photoamplifier, two-canal electrocardiograph with an ink recording device and a system of stabilised power sources mounted on a portable table,

4) two-canal cathode-ray oscilloscope mounted on a portable table.



Scintillation electrokymograph

5) signalisation panel.

The blocks are interconnected by electric cables.

The instrument works on 127 and 220 v alternating current.

Power used from the mains — 600 W.

**ARD-3-125-B4 Diagnostic X-ray Apparatus.** This apparatus is desinged for X-ray department of large medical institutions.

It consists of the apparatus proper, a support for fluoroscopy and aimed examinations, support for pictures with a device for tomography, and a support for teleradiographs. In addition, the apparatus is adapted for connections with various devices used in special examinations, including angiocardiography.

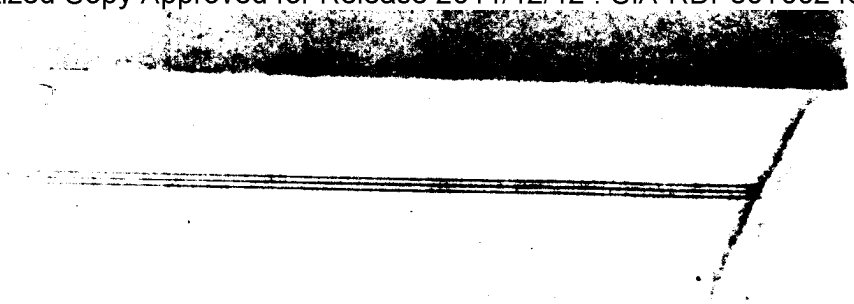
The generation tension is regulated from 40 to 100 kV in fluoroscopy and from 40 to 125 kV in photography.

In roentgenoscopy the anode current is regulated smoothly within the range of 0.2—10 mA, in radiography — in stages of 500 (in tensions of up to 80 kV), 300, 200, 125, 80 and 50 mA.

The time relay with a logarithmic scale ensures expositions of 0.02—6 sec.

Sharp-focus X-ray tubes may be used in the apparatus.

Highest power used — 47 kW.



## APPARATUS FOR RADIOISOTOPE DIAGNOSIS

The methods of diagnosis with the aid of radioisotopes present great opportunities, which are still far from being exhausted. Radioisotopes can help identify most of the diseases.

The instruments for radioisotope diagnosis can be classified into the following groups:

1. Clinical radiometers designed for determining the nature and degree of accumulation of gamma-active substances in different parts of the body, as well as for studying the dynamics of their movement.

2. Gamma-topographs designed for obtaining the picture of distribution of gamma — or positron radiators introduced into the body.

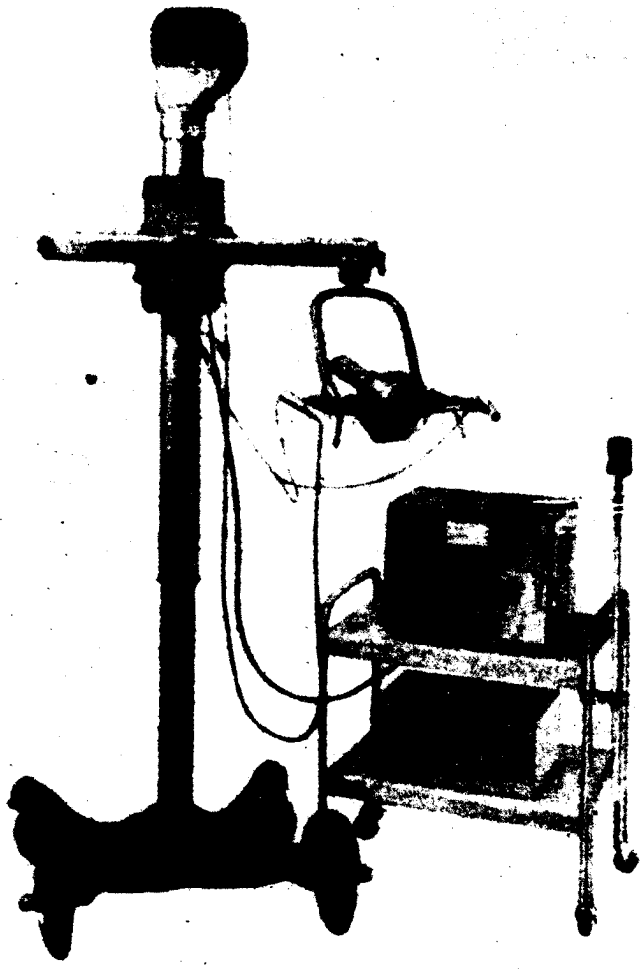
3. Scintillation and gas-discharge beta-sondes for locating newgrowths within vacities and tissues by means of betaradioisotopes.

4 Instruments for measuring radioactive biosubstrates in various aggregate conditions.

The instruments of the first three groups are intended for in vivo investigations while the instruments of the fourth group are designed for clinical laboratory investigations conducted in vitro.

Shown on the Exhibition are instruments of all of the four groups.

**The DSU-60 Diagnostic Scintillation Unit.** The unit is intended for diagnosting diseases caused by changes in the functional state of the thyroid gland with the aid of radioiodine introduced into the patient's body in tracer doses. In clinical conditions, the unit can be broadly used for the diagnosis of thyrotoxicoses, myxedemas, goitre,



Diagnostic scintillation unit.

etc. At the same time, it can be used for locating metastases of thyroid cancer.

The sensitivity of the unit is $10^{-2}$ microcuries with double excess against the background and in measurements at a distance of 10 cm. from the radioactive source. This permits to carry out examination with a 1 microcurie dose at a distance of 10 to 30 cm. from the patient's neck.

The unit permits to conduct measurement of the activity accumulated in the thyroid gland directly in per cents relative to the activity of the single dose administered to the patient. The readings are taken from the scale of a pointer instruments graded in per cents. The time of measurement dose not exceed 4 min.

The unit is provided with a device ensuring semi-automatic compensation of both the natural radiation background and the background from permanent sources.

The support with an optic adjuster makes it possible quickly to set the scintillation pick-up in the required position and at a set distance from the patient's neck. The setting is made according to the light spot produced by the optic adjuster.

The unit is equipped with an output for connecting onto a recorder of the N370-A type for registering a time count and an output into conversion unit with an output pulse amplitude equal to 2 V.

Power supply is from an A.C. mains of 127/220 v., 50 Hz.

Power consumption is 120 W.

**The GT-60 Gamma-Topograph.** The instrument is designed for studying the distribution pattern of gamma-radioactive substances introduced into the body for a diagnostic or therapeutical purpose by way of automatic scanning of examined parts of the human body with the aid of a collimated scintillation pick-up. A focal and functional diagnosis of malignant tumours and their metastases in the thyroid gland, liver and other organs, as well as to study the distribution and localisation of gamma-radiations can be done with this device.

The basic elements of the unit are the case with a hydrolifting device, a built-in electronic radiometer, a scanner a recording unit and a collimated scintillation pick-up.

The basic technical characteristics are as follows:

The maximal dimensions of the scanning area — 250×350 mm.

The minimal surface activity of radioiodine registered at a distance of 150 mm. from the scintillator butt and with a double excess over the background of 0.2 microcurie per $sm^2$.

Linear resolution (at a distance of 150 mm. from the scintillator butt) is 0.5 to 1.0 mm/sec.

The scanning length is continuously regulated from 4 to 20 mm.

The recording system is graphic, on common paper typewriter a carbon tape.

Power supply is from an A.C. mains 220 V.

Power consumption is 750 W.

**The BRK-61 Clinical Beta-Radiometer.** This is a recording instrument connected to various scintillation and gas discharge beta-sondes designed for the diagnosis of cancerous tumours in cavities and tissues with the aid of phosphorus radioisotopes $P^{32}$. These sondes enable the following investigations:

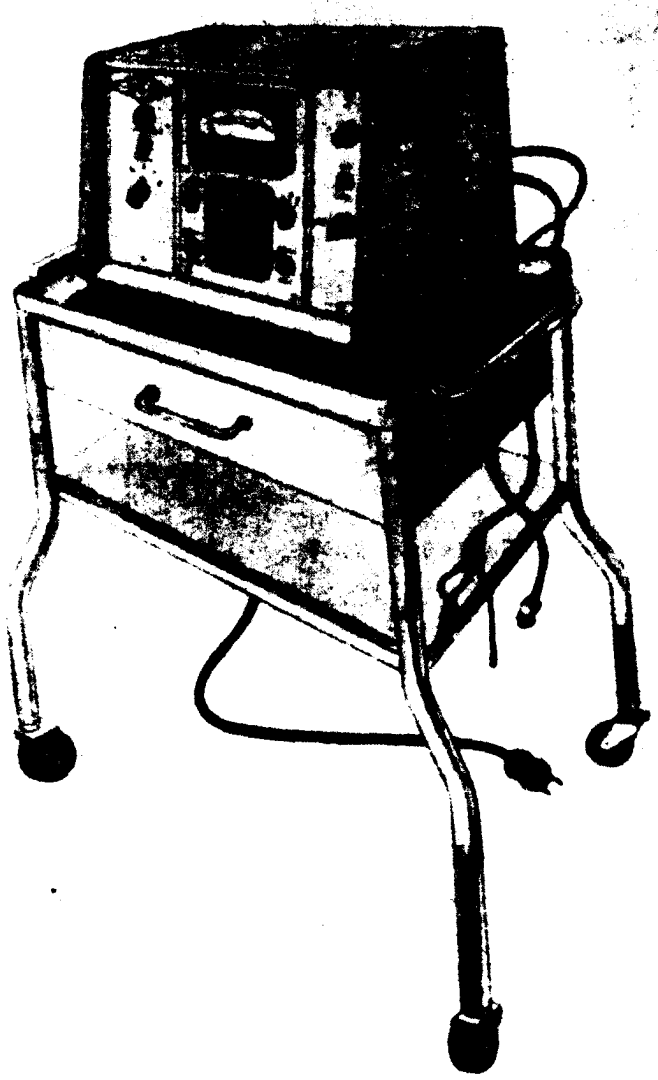
1. Diagnosis of cancer of the cervix uteri with the aid of the 10 BES-61 sonde.
2. Diagnosis of stomach cancer with the aid of the 6 BEG-61 sonde.
3. Diagnosis of cancer of the skin, mammary gland with the aid of the 25 BES-61 sonde.
4. Diagnosis of cancer of the anterior optical wall with the aid of the 8 BES-61 sonde.
5. Diagnosis of cancer of the posterior optical wall with the aid of the 2.5 IBZG-61 sonde.

The voltage of the power supply is 127/220 V.

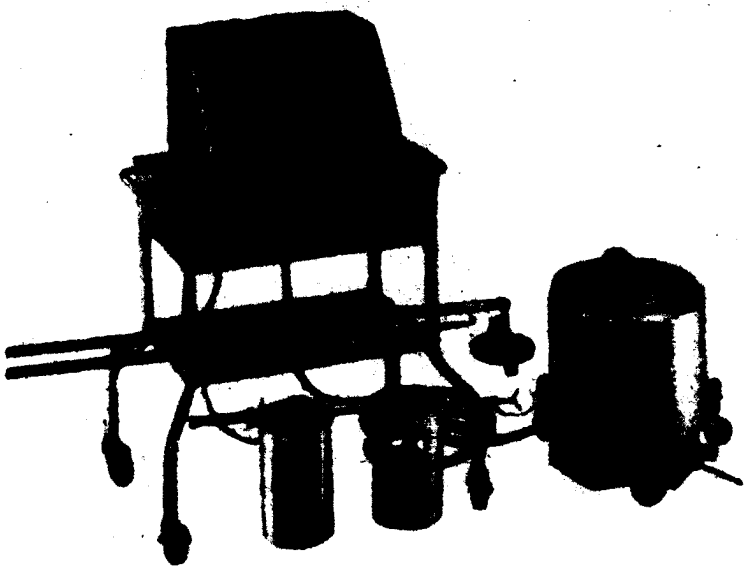
The weight of the instrument is 12 kg.

**Radiometer of Biological Liquids (RBZ-61).** The instrument is designed for measuring the activity of the gamma-active isotope introduced into the body with therapeutical aims in the daily or single quantity of urine, without dissolution or evaporation.

The instrument indicates a percentage output of gamma-active isotope in two litres of the investigated biological liquid with activity of 70 microcuries to 0.05 microcuries.



Clinical beta-radiometer, BRK-61



Radiometer for biological liquids

The instrument has two measuring scales: «per cents» and «pulses per sec.».

The integrating circuit of the instrument has a time constant of 0.1 to 30 sec. depending on the range of measurement.

The instrument ensures the detection of decay in conducting measurements of radioiodine $J^{131}$ in urine for the three days after administration to the patient.

The design of the instrument provides for a lower dose of irradiation for the service personnel, which is not over the limit dose even at the maximal activity of 70 microcuries.

The power supply voltage is 127/220 V.

The weight of the instrument is about 60 kg.

## DOSIMETERS AND RADIOMETERS

A sharp increase in radioactive materials production in recent years and their wider application for diagnosis and treatment, as well as the growing number of people affected by ionizing radiation, resulted in the necessity of designing precision instruments for determining the radiation dose both for treatment purposes, and for the protection of personnel. Dozens of various dosimeters can be used for measuring the doses received by various organs and by the entire body of the patient treated, as well as for determining the field limits, and for control and calibration of the working instruments. A great variety of dosimeters is also needed, since complicated energy distribution, and a wide range of quantum doses and effective energies accompany the practical work of emitters in clinics.

Some models of dosimeters are to be found at the exhibition, for measuring dose rates from hundredths of a microroentgen per second (protection control) up to

Condenser dosimeter.

hundreds of roentgens per minute (unit gamma-therapy) and thousands of roentgens per second (close-focal X-ray therapy), as well as doses from hundredths and thousandths of a roentgen (individual dosage) up to thousands and tens of thousands of roentgens (local dose in the course of therapy).

**Condenser Dosimeter for Roentgen and Gamma Radiation (KD-1-M).**

The KD-1-M dosimeter is used to measure the doses and dose rates of roentgen and gamma radiation with quantum effective energies of 20 keV to 20 MeV. The dosimeter is a condenser type instrument, with connection to electrometer with replaceable ionization chambers. The dosimeter is supplied with four ionization chambers, one of which, connected by a flexible wire, is used for remote radiation control.

Among the chambers there is also a special sphere-type small volume ionization chamber — 0.7 $cm^3$.—for soft roentgen radiation measurements.

The range of the dose rates measured is from 2 R/min to 10,000 R/min. The range of the doses measured is from 1 R to 2,500 R. The dosimeter's measurement error does not exceed 10% of the value of the measured doses or the dose rates. The instrument has a special device for radioactive control of the accuracy of the measurements.

A specially designed generator with semiconductor tubes P3V and D7Zh is used for loading the dosimeter's electrostatic system. Rectified voltage of about 1,000 is obtained at the generator's output.

The generator's power supply is provided by two batteries of the KBS-L-0.50 type, or by the alternating-current mains with the voltage of 127 or 220, and with the frequency of 50 Hz.

**«Medic» Radiometering Unit.**—The unit used for absolute measurements of activity and for assessing the spectral composition of low-energy beta-emitters. The unit makes it possible to analyze simultaneously two components in a mixture, i. e. tritium and carbon.

The unit consists of the following main parts: a detecting element with two FEU-13 photomultipliers, a light screen and a cuvette with liquid scintillator, an electronic unit with two amplifiers, a coincidence circuit with a commutation block, a two-channel differential discriminator,

two scaling units, an electronic chronometer, a control unit, a power unit and a high-voltage power unit, and a cooler with protective shell, which provides for the cooling of the detecting element to 10° Centrigrade.

The efficiency of carbon registration is 80%, with the background of 60 counts per minute.

The efficiency of tritium registration is 20% with the background of 70 counts per minute.

The stability of the registration efficiency in time is not lower than 10% after 8 hours of continuous work.

The count capacity of the scaling units is $10^6$ counts, with the resolution time of 1 μsec.

The time of count measurements of 1, 10, 100, 1,000 and 10,000 sec. can be given automatically by the electronic chronometer.

The circuit elements of high stability and precision have tubes, while logical assemblies—i. e. the anticoincidence circuit, the commutation block, etc.—have semiconductor triodes.

The power supply is from the alternating-current mains of 220 V.

**Pocket Radiometer RK-01.** This instrument is used for radiation safety control by the gamma- and hard beta-radiation in shops, laboratories and in the field.

The instrument has the following ranges of measurements by the gamma radiation:

1. from 0 to 1 μR/sec;
2. from 0 to 10 μR/sec;
3. from 0 to 100 μR/sec;
4. from 0 to 1,000 μR/sec.

The range of the gamma-quantum energies measured is from 200 keV to 2 MeV.

The scales for the beta-radiation measurements are calibrated on the spot, under normal exploitation conditions.

With the radiation intensity showing a significant increase (up to 10,000 μR/sec.) within any range, the instrument's needle is above the maximum point of the scale, and does not return to its initial position. This is a guarantee of the accuracy of measurements in high fields.

The measurement error in all ranges does not exceed ±10%. The power supply is provided by one element of the 1KS-U-3 type. The radiometer can work continuously

for 200 hours with one element. The weight of the instrument is about 650 g.

**Higher Precision Roentgenmeter RP-1.** The roentgenmeter is used for checking the accuracy of the dosimeters and roentgenmeters for measurements of roentgen and gamma-radiation dose power within the energy range of 60 kev to 2.5 MeV. It is a standard instrument of 2nd category. The instrument consists of the measuring desk and a remote block with a set of ionization chambers with the volumes of 21. and 20 $cm^3$.

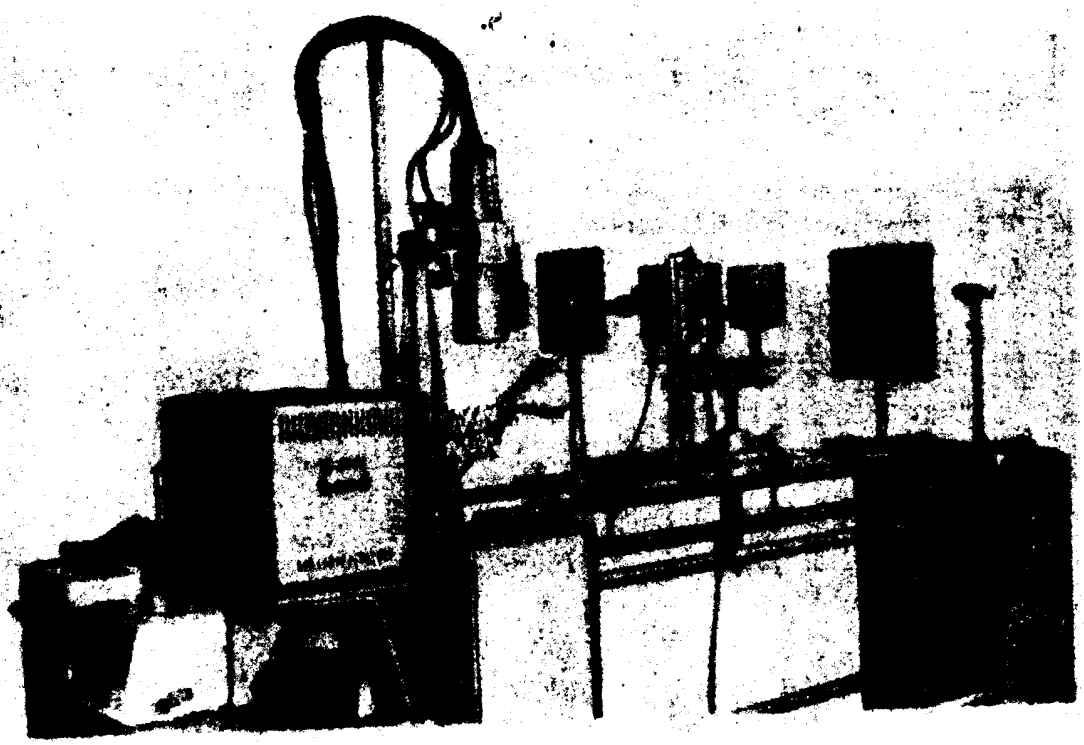
The maximum error in the range between 0.3 and 30,000 μk/h is ±5% of the nominal scale value. The additional error with the power-line fluctuations of ±10% is ±3%. The additional temperature error is ±1° Centrigrade. The error in the energy dependence is ±5% throughout the energy range, with due consideration to the correction factors (constants). The weight is 9.6 kg. The seven-conductor cable allows for the detecting element to be installed 10 meters from the instrument.

**Standard Calibration Unit for Dosimeters Within the Energy Range of 20 to 60 keV.** The unit is used for checking and calibrating dosimeters by comparing their measurements with those of the standard calibration unit itself. The unit gives absolute measurements of the X-ray dose power with the voltage on the Roentgen tube of 20 to 60 keV. The limits of the dose power measurements with the standard ionization chamber in the unit's set are from 1 to 10,000 R/min. The measurement error does not exceed ±5% if the voltmeter of 0.2 cl., with which the EMU-8 is supplied, is used as the output instrument.

The unit consists of the following main elements: a standard ionization chamber, a calibration bench, and en electromeasuring and feeding element. The roentgen installation RUM-7 with the BPV-60 Roentgen tube is used as the source of roentgen rays. The ionization chamber is of the plano-parallel type, and includes the potential, measuring and shielding electrodes.

The ionization current in the standard chamber is measured with the electrometering amplifier EMU-3. The removable cascade EMU-3 is connected with the output of the measuring electrode by a coupling nut.

The calibration bench includes a cylindrical guide fixed on a special support, and a movable calibration stage



Standard Calibration Unit for Dosimeters.

with two platforms — for the standard chamber and for the chamber of the calibrated instrument. On the one side of the calibration bench there is a bracket for the Roentgen tube, and on the other — a support for the telescopic magnifier. A cross-hair is marked in front of the eye-piece for better focussing.

A hinged lamp is fixed on the Roentgen tube beside the bracket, to give light for focussing the chambers in a ray beam.

A VS rectifier is used to create an electric field between the electrodes. A potential of about 3,500 V is needed to obtain saturation current while measuring the dose powers of approximately 10,000 R/min.

The standard chambe is put on the platform of the calibration stage and fixed with clamps resembling in principle screws with coupling nuts. The chambers of the checked instruments are fixed on the second platform of the calibration stage. Here either a stand, or a thimble chamber holder could be used. Both platforms are rigidly connected, and can be moved in horizontal direction, perpendicularly to the ray beam, with the help of the screw-nut pair. The measurement of the distance is made on the ruler fixed on the stage.

**Standard Dosimeter DIM-60.** The instrument is used for measuring the doses and dose powers of roentgen-radiation within the voltage range of 80 to 300 kV, and of gamma-radiation with the quantum energy of 0.08 to 1.3 MeV. The scale of the instrument is calibrated in roentgens and roentgens per minute. The dosimeter is used

Reference dosimeter, "DIM—60".

in medical roentgen and gamma-laboratories, and in checking laboratories.

The dosimeter measures the ionization currents appearing in thimble chambers under the influence of radiation. The ionization currents originating in the irradiated chember are measured with a special electromeasuring device which consists of a quadrant electrometer, high-resistance measuring resistors, and measuring condensers. To check the accuracy of the dosimeter's work, it has a special radioactive control ionizer inside.

The dosimeter consists of the following:

1. Electromeasuring unit — the rectifier, electrometer, measuring resistors and condensers — in a cast metal shell.

2. Ionization chambers the main one — of the 5 cm.³ volume — and the chamber for shield — checking — of the 800 cm³, volume — wiht removable aluminium caps 2 mm. thick for radiation measurements of 0.5 MeV. The chambers are made of special plastic.

3. Two connective, highly-isolated cables.

The cable is fixed to the main chamber with epoxide resin, and it cannot be disconnected.

The cable is connected with the shield-checking chamber by means of a locking screw. The cables are single-conductor, screened ones

The dosimeter works from the alternating-current mains of 220, 127 and 110 V. The instrument consumes 10 watts.

The limits of the dose powers and doses measured:

a) with the main chamber — of the 5 cm.³ volume — the dosimeter can be switched on for the following scales:

1. the position of the range-switch.
2 — 15 R/min.,
3 - 60 R/min.,
4.— 300 R;

b) with the shield-checking chamber — of the 800 cm.³ volume — the position of the range-switch,

5.— 30 μR.

The error of the measuring instruments is ±3% of the maximum value on the scale, with due consideration to the chamber's energy dependence. The weight of the dosimeter is 9 kg.

## EQUIPMENT FOR RADIATION THERAPY

Roentgen radiation is successfully used for the treatment of malignant newgrowths in some organs. A range of X-ray therapy apparatus for various voltages are manufactured for this purpose. In the treatment of skin and superficial pathological foci voltages of 10 to 60 kV. are used with X-ray tubes having an output window of beryllium, as well as commontype apparata for 100 kV voltage.

Both stationary and rotation type apparatus for voltages of up to 250 kV are manufactured for the treatment of pathological foci at moderate depths. Deep-lying pathological foci are treated, as a rule, with artificial radioactive preparations, primarily radiocobalt $Co^{60}$.

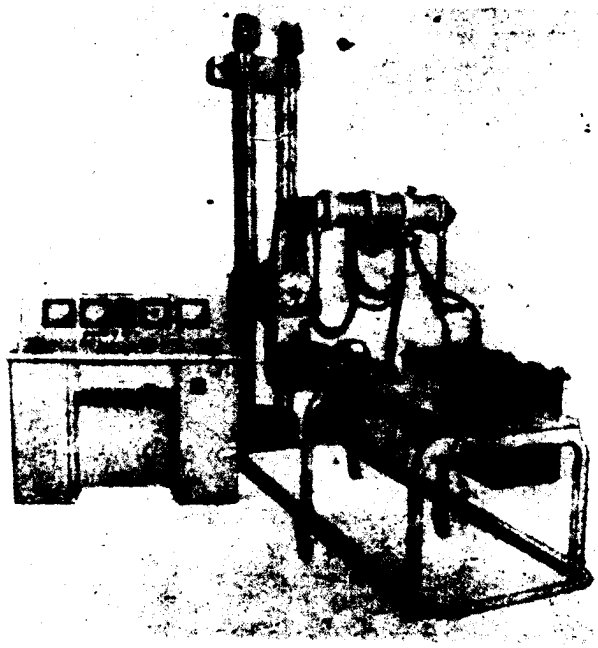
For a number of years, the USSR manufactured only one type of static apparatus with the radiation source of 400 g. of radium equivalent. In recent time, designs have been made and manufacture started of new units with a $Co^{60}$ cource for both static and rotation irradiation. The source activity of these apparatus varies from 2,000 to 4,000 curies.

Besides, the Exhibition has on display 15 and 25 MeV. betatron units for hard gamma- and beta-radiation, and a 5 MeV. linear accelerator.

**The URT-200-20-3 (RUM-11) X Ray Therapeutical Apparatus.**

This modern therapeutical unit is designed for the radiation treatment of various diseases, and above all, malignant tumours of the visceral organs. Its capacity is 20 mA. at 200 kV.

For their penetrating capacity, homogeneity and favourable spatial distribution, the radiations from the



RUM—13 apparatus.

X-ray tube create conditions where it is possible to obtain considerable depth doses with the least possible injury to the skin and normal tissues. The comprehensive use of the URT-200-20-3 for total, multiple field and transvaginal irradiation treatments is ensured by the movements of the X-ray tube and the patient's table which are necessary for a normal therapeutical procedure, as well as by a large choice of adjust objectives requiring no additional protection of the patient.

The generating device is a half-wave circuit using two kenotrons.

The X-ray tube has a protective case against unused roentgen radiation.

The support of the apparatus permits to shift the X-ray tube within the limits required for treatment procedures.

The support column bearing a mobile carriage with the X-ray tube is fixed on a stationary base plate, on

which a high-voltage generating set is also installed. The movements of the X-ray tube are accurately balanced, and special holders keep it fixed in a set position. The patient's coach can be adjusted to any position.

Set of filters Al — 3, Cu — 0,5, Cu — 0,8, Cu — 1, Pb — 6.

Power supply: 220/380 V (50 Hz).

Power consumption — about 6 kW.

**The RUT-250-15-1 (RUM-13)—Type Stationary Roentgenotherapeutical Apparatus for Mobile Irradiation.** This is an up-to-date X-ray uni for the treatment of deep-fying foci by mobile irradiation methods.

Its output is 15 mA. at 250 kV., built on a constant voltage circuit.

The angle of swing is 30—360°. The velocity of swing is 0,5 r. p. m.

The swing radius is 50 cm. The generating set is based on the doubling circuit at fixed voltage. The selenium rectifier is highly stable and has a good life expectancy.

The small-sized 4 BTM-250 X-ray tube produces a dose of up to 100 r. per min., and is enclosed in a protective case.

The control circuit is equipped with an automatic stabilization of the X-ray tube anode voltage and low-inertia automatic stabilization of anode current at 5, 10 and 15 mA. settings.

The required setting is obtained by depressing keys on the control panel in 5 sec. at the most.

The patient's coach is of the console-type on a light tubular support.

The table top sized 500 by 2,000 mm. can be moved 150 mm. in the transverse direction.

The check-up on patient's position and the accuracy of direction of the X-ray beam to the focus of irradiation are ensured by three beam definers and two fluorescent screens for mirror vision, whose system is located under the console part of the patient's table.

The set of adjust diaphragms for mobile irradiation permits to set 17 rectangular and found fields of various size for a swing radius of 50 cm

For irradiation with a static beam the apparatus is provided with a set of 11 adjust objectives with focal length of 30, 40, 50, and 60 cm., each equipped with ope-

nings for the ionisation chamber and for observations of the irradiation field.

Power supply is taken from the three phase 220/380 V, 50 Hz.

Power consumption is about 8 kW.

**The RUT-60-20-1 Mobile X-Ray Unit for Close-Range Therapy.** This apparatus is designed for near focus surface therapy with the roentgen radiation passing out of a window covered with a beryllium disc.

The generated voltage is continuously regulated from 10 to 60 kV, the anode current — up to 20 mA.

The unit is provided with a control milliammeter for a regular check-up on the principal set. The voltmeter has a kilovolt scale. Voltage decrease in the apparatus and in the mains is compensated automatically, the heating current for the X-ray tube is stabilized.

The whole unit is mounted on a carriage, which can be moved by one person.

The apparatus is supplied with four aluminium filters, their thickness 0.1, 0.5, 1.0 and 2.5 cm respectively.

The auxiliary part set also includes 8 adjust objectives, the diameter of the irradiation field ranging from 5 to 50 mm.

**Betatrons.** Betatron units producing hard gamma and beta-radiations are designed for the treatment of malignant neoplasms in various organs of the human body. These units are in fact accelerators of light charged particles (electrons). The electrons as accelerated in the betatron are directed to the target producing a braked gamma radiation. Whenever accelerated electrons are sent directly from the accelerating chamber into the surrounding space, beta radiation can be used.

Betatrons are classified by radiation energy and types of installation (stationary, mobile, pendulum-type, etc.).

15 mev medical betatron Pendulum-type

The major portion of gamma-radiation of high-energy electrons generated by the betatron is radiated in a very narrow corporal angle, which makes the betatron a valuable source of radiation. At the same time a notable feature of high energy radiation is the possibility of employing large depth doses without injury to the skin.

**Characteristics of Medical Betatrons**

| Parameters | Mobil | Swinging, pendulum type |
|---|---|---|
| Energy of accelerated electrons, MeV | 5—25 | 3—15 |
| Weight of active steel, kg | 1,625 | 420 |
| Weight of electromagnet, kg | 2,700 | 650 |
| Weight of upper detachable part, kg | 1,200 | 300 |
| Cooling system | forced, air | forced, air |
| Ventilator capacity, m³ per hour | 2 by 500 | 600 |
| Frequency of power supply, Hz | 50 | 50 |
| Intensity of radiation at a distance of 1 m from the target, R per min. | 30 | 8*) |
| Weight of lead screen, kg | 585 | 400 |
| Accelerating chamber | sealed-off | sealed-off |
| Type of betatron | B—4 | B—15, 4.5 |

* in the swing centre (800 mm. from the target).

## RADIOACTIVE PREPARATIONS

Radioactive preparations (isotopes) play an increasingly important part in research and medical practice, in diagnosis and treatment of malignant tumors. An increasingly growing number of medical institutions use gamma-apparatus with a charge of radioactive cobalt, radiocobit needles, applicators, and various radioactive preparations in the form of labeled compounds and open sources for diagnosis and therapy. In 1961 the number of such institutions in the USSR exceded 400.

Today the USSR is manufacturing many different sources of alpha, beta, gamma and neutron radiation. More than 50,000 control $\alpha$ and $\beta$ radiators for graduating instruments, including dosimetric and special medical apparatus, and only on the basis of $Sr^{90}$ and $Pu^{239}$, alone are manufactured annually. Close to 600 various labeled compounds with 120 radioactive isotopes are produced on a mass scale. Most of them are listed in the isotope catalogue («Isotopes, Radiation Sources and Radioactive Materials», Atomizdat, Moscow 1959), although the assortment of preparations used for medical purposes has now considerably increased.

The system of individual orders, accordings to which it is possible to order not only serially produced preparations listed in the catalogue, but also labeled compounds or sources in requisite amounts and in accordance with individual technical requirements has fostered the development of a series of new diagnostic and therapeutic methods using radioactive preparations.

In order fully to satisfy any demand for extensively used preparations with isotopes $P^{32}$, $J^{131}$, etc., even when they were not ordered in due time, the factories and All-

Union Isotope Agency have set up a continously replenished reserve of all radioactive preparations, including those with short lived isotopes. To supply the organisations in outlying districts with radioactive preparations, especially with short lived isotopes, new preparation laboratories are being put in operation in different Soviet cities.

The clinical-purpose radioactive preparations are dispensed in standard portions (packing) in order that these portions may essentially constitute single doses used on location.

The preparations designed for injections are tested biologically for sterility and pyrogenesis. Many preparations are dispensed in sterile isotonic solutions ($P^{32}$, $Cl^{36}$, $K^{42}$, $Co^{58}$, $Co^{60}$, $As^{74}$, $Y^{90}$, $I^{131}$, etc.).

Most of the medical preparations are delivered in light containers with additional external antiseptic packing, which spares the consumer the trouble and expenses connected with transportation and makes it possible in a number of cases to use the transport containers for storing the isotopes.

The aforesaid packing has been worked out in conformity with the new rules and requirements set forth in the «Sanitary Rules for Working with Radioactive Substances and Sources of Ionising Radiations» No 330—60.

Some 50 preparations with radioactive isotopes used in diagnosing and treating tumors are demonstrated at the Exhibition. In addition to such well-known and long-used therapeutic and diagnostic radioactive preparations as sodium chloridde (with $Na^{24}$), monobasic sodium phosphate ($P^{32}$), sodium chromate and chromic chloride ($Cr^{51}$), ferrous ascorbate ($Fe^{59}$), sodium iodide ($I^{131}$), colloidal gold ($Au^{198}$), etc., many new preparations now used in medical practice are represented at the Exhibition. These are, in the first place, a group of therapeutic preparations in the form of colloidal solutions containing various radioactive isotopes and having different physicochemical properties. Thus, for example, of interest to radioatherapy are the colloidal preparations with $P^{32}$ and $Y^{90}$ (short lived β-radiators with hard β-radiation and an energy of 1.7 and 2.2 MeV respetively), chromium phosphate and zirconyl phosphate with $P^{32}$. The latter is dispensed in the form of positively and negatively charged radiosols

which are mixed before injection in various proportions to obtain the required degree of dispersion or to coagulate the sol. Colloidal solutions of yttrium fluoride, yttrium phosphate and yttrium silicate are also represented.

The short half-life of $Y^{90}$ (64 hours), hard β-radiation and adsence of γ-radiation make this isotope very promising for clinical radiology, radiation therapy in particular.

In addition to the colloidal solution of $Au^{198}$, preparations of colloidal $Au^{198}$ covered with inactive silver are now produced, the silver playing the role of conductor for transporting colloidal particles along the lymphatics.

Solutions of short lived $Ag^{111}$ (half-life — 7.6 days, β-radiation with the energy of 1.4 MeV and γ-radiation with the energy of 340 keV). Silver preparations of those covered with silver possess, as is well-known, bactericidal action, which is their additional merit.

Of considebrale interest for diagnosis is a series of iodised preparations (with $I^{131}$)—Bengal rose, diiodfluorescein, cardiotract (3,5-diiodo-4-piridon-N-acetic acid diethylamine), triiodothyronine, glyceryl trioleate, human serum albumin, etc.

Of the hard β- and γ-sources intended for radiotherapy, such as needles and applicators, as well as things inrtoduced into the body in radiosurgical methods of treatment, the Exhibition is demonstrating sets of radiocobalt ($Co^{60}$) needles and applicators, gold grains ($Au^{198}$) for introduction into the tissues by means of a special pistol, self-resorbing substances, skin β-applicators, etc.

The flexible skin applicators with $P^{32}$ are made on the basis of ion exchange materials. Such applicators 5×10 and 10×10 cm in size, packed in a thin lavsan film (for additional safeguarding against possible contamination), are very effectively used for the treatment of skin diseases. Made on the basis of various cationic and anionic membranes such applicators are also produced with radioactive thallium ($Tl^{204}$) and promethium ($Pm^{147}$).

In addition to the clinical preparations represented at the Exhibition, Soviet industry manufactures a large number of labeled organic compounds, including drugs, hormones, etc., intended for experimental work in medico-biological institutions. Among them there are many com-

pounds labeled with $H^3$, $C^{14}$, $S^{35}$, $Ce^{36}$, $P^{32}$ and $I^{131}$. The industry will annually master production of about 50 new labeled organic compounds.

**Instruments for Introducing Isotopes and Applicators into Tissues and Organs.**

The Exhibtion is demonstrating sets of instruments and devices for introducing various radioactive preparations and substances, applicators, needles and grains into the tissues and cavities of the organism. Liquid radioactive preparations (with $I^{131}$, $P^{32}$, etc.) are administered by means of special syringes two types of which are manufactured with protection against β-radiation and γ-radiation, and with a capacity of 2.5, 10 and 20 mm. The syringe with protection against — γ-radiation differs only in the construction of its protective case.

To administer a colloidal solution of radioactive gold into tissues and cavities, there is a special apparatus which consists of a container and pumping device.

All devices used for administering radioactive substances can be sterilised.

For sterilisation of solutions in ampules protective electric sterilisers designed for a marginal activity of 50 millicuries are manufactured. In this case the steriliser ensures reduction of radiation to 0.05 R during a 4-hour working day.

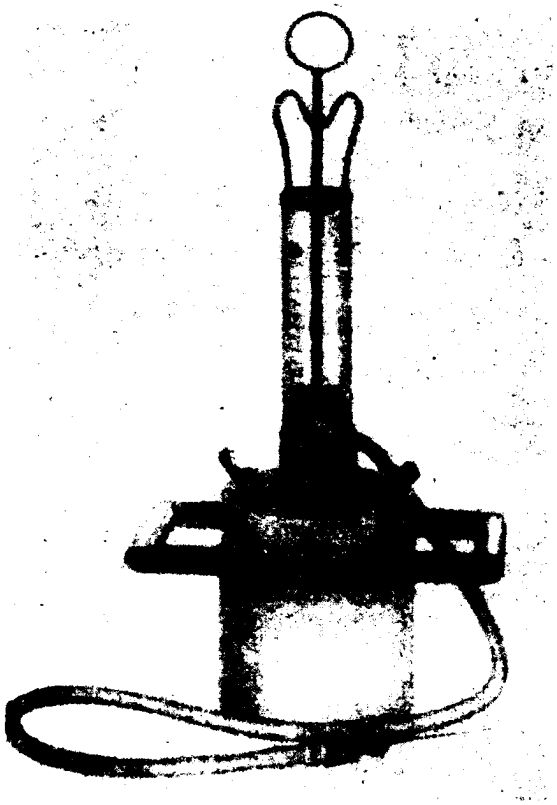
Several devices for introducing radioactive needles and grains have been elaborated and are being manufactured; these include a device for mechanical introduction of radioactive needles into itssues, pistols for administering needles and grains into tissues, a set of instruments for administering radioactive preparations into the root of the tongue.

The Exhibition is also demonstrating, a set of instruments for work with radioactive needles, the set being used for various manipulations with the needles during preparation for their introduction into tissues.

**Pistol for Administering Radioactive Grains.** The pistol is designed for administering gold radioactive grains (rods) into tumorous tissue. The size of the rganis is: diameter — 0.8 mm, length — 2.5 mm. After administration the grains remain in the tissues permanently.

The pistol is charged with an irradiated aluminium magazine containing 15 goldg rains; until administration

Gun for injection of radioactive grains.



Instrument for introduction of radiogold into cavities.

the magazine is kept in the container or some other protective device.

**Apparatus for Administering Radioactive Gold into Cavities.** The apparatus is designed for interstitial and intracavitary administration of colloidal solution of radioactive gold.

The apparatus consists of two main parts: container and pumping device with hose and needle.

The entire pumping system is filled beforehand with physiologic saline solution which is administered into the patient's tissues. This is followed by administration of radioactive gold, for which purpose, with the needle introduced into the tissue, the handle is turned to «gold» and pressure is applied to the syringe plunger. To administer the entire dose of the preparation, physiologic saline solution is fed into the hose, the solution simultaneously cleaning the system of the gold.

The apparatus is filled with radioactive gold $Au^{198}$ behind a protective device which protects the body against irradiation.

The protection of the hands of the attending personnel is ensured by the distance between the hands and the source of radiation.

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## RADIOPROTECTION EQUIPMENT

The range of radiation protection equipment used for work with closed and open preparations, as well as of auxiliary protective equipment manufactured in the Soviet Union is quite veratile and could not be fully represented at the Exhibition in view of its limited space. The Exhibition has on display only some samples of equipment for work with closed and open preparations. General-purpose protective equipment, such as hermetic chambers, draught hoods, lead bricks, screens, lead safes and boxes, sterilizers, manipulating instruments, collectors, filters, overalls, masks, sanitary engineering equipment, profiled articles of plasticate are constantly demonstrated at the special shop «Isotopes».

The Exhibition displays the smallest set of radiation protection equipment for work with closed and open preparations.

The central part of the exposition is occupied by the protective storage with a bridge crane and a transporter diverging on both sides of the storage. The storage is intended for keeping working containers with radioactive preparations and applicators and for their mechanised transportation from the storage to the working sites of radiological department using closed and open sources of radiation, and back. Along the left-hand branch of the transporter, equipment is laid out intended for work with open radiactive preparations. Demonstrated here are an up-to-date mechanised radiomanipulating unit, GRK-61, a transfer table, an attendant's screen, sterilizers, containers for the transportation of preparations and waste, and unpacking tools.

Along the right-hand branch of the transporter, there is equipment for work with closed preparations, such as a radiomanipulating table with a set of curved manipulating instruments, a bandaging table, protective screens and sterilizers, a moulage screen, a safe and a roller carriage for patients.

**Protective shelf with a bridge crane and transporters.** The protective shelf consists of two concrete walls and a horizontal shelf shaped in section H-wise. On the shelf, there are numbered pits for containers, while the vertical walls serve to absorb the total radiation from the sources placed in the containers and to enable the movement of the bridge crane along them. In each pit of the shelf, there is a container set on its own roller-borne cart and bearing the same number as the pit. The containers have a standard appliance for clutching the hold of the bridge crane.

The bridge crane consists of a frame moving along the shelf on rails set on the latter's walls and a carriage with a lifting mechanism travelling across the shelf along the frame guides. The bridge crane is moved along and across the shelf by hand, while lifting and lowering the containers is made with a button-operated electric drive. A mirror ensures visual observations of the manipulations in gripping the containers or setting them into the pit.

The containers are delivered from the shelf to the working sites by means of a system of transporters consisting of a trunk chain transporter and branching transporters to every working site. The trunk chain transporter passes through all of the rooms of the radiological department, to which purpose windows are made in the walls of adjacent rooms. The transporter chain is laid in a masking trough where it moves with an electric drive.

The cart with the container, when set on the transporter, becomes engaged with the chain, and the container can be delivered from the storage to any room of the department or carried back. The transporter is controlled either from the storage equipped with a panel bearing a programmed bush-button device, or from any working site by means of starting and stopping push-buttons.

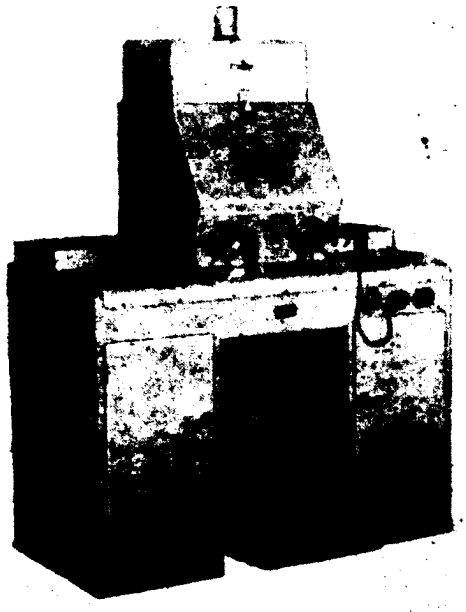
The containers reach each working site by way of branching transporters on which they are transferred from the trunk line by means of manipulating tools.

The protective shelf, the bridge crane and the transporters have been designed by the State Scientific Research Institute of Roentgeno-Radiology under the Ministry of Health of the Russian Federation.

The use of these appliances has shown that the irradiation level for the personnel of the radiological department has decreased several times over.

**The GRK-61 Radiomanipulating Unit.** The radiomanipulating unit is a stationary protective device used in the preparation of solutions of radioactive and toxic preparations, as well as aggressive chemicals for medical applications.

The unit makes it possible to work with Sodium 24 radioisotopes with activity of up to 5 millicuries, Iodine 131 with activity of up to 200 millicuries, Gold 198 with activity of up to 200 millicuries and with other radioac



**Radiomanipulating unit GRK—61.**

tive substances equivalent to the above for their activity and energy of radiation.

The working operations on the unit are carried out semiautomatically and by way of manipulation without any direct contact with radioactive or toxic substances; at the same time protection is ensured against external alpha-, beta- and gamma-irradiation, as well as against contamination of the sourrounding air with gases and aerosols of radioactive and toxic substances.

The following operations can be made with the aid of the unit; the opening of sealed glass ampules, test-tubes with a ground-in stopper and other inner packing of preparations, dissolution of preparations in powder — or tablet — form in dosed portions of liquid, transfusion of liquids from one vessel into another, dilution of solutions with dosed portions of liquid, macro- and microdosing of liquid, sterilization of solutions in various packing or vessels and the handing out of portions ready for use.

The operations with liquids, movement of instruments and appliances are made by means of electromechanical and hydraulic drives with push-button control, and certain operations are made with the aid of hand-controlled mechanisms.

The volume of chamber is 0.13 $m^3$.

The single volume of liquid put out by dosing devices is between 0.001 and 20 ml.

The temperature of sterilization is 125°C.

The air exchange rate is 200 volumes per hour.

The normal vacuum in the chamber is 5 mm $H_2O$.

The power supply is from an A.C. circuit at 127 or 220 v., 50 Hz.

The weight is about 1,000 kg.

**The «RMS» Radiomanipulating Table with a Set of Radiomanipulating Instruments «RMI»** This table is designed for work with closed radioactive sources of cobalt, radium-mesothorium, and cesium in the stationary conditions of radiological institutions.

The thickness of protective layers is calculated for work with irradiation sources of radiocobalt with the average stipulated activity of 40 millicuries placed in the central point of the working zone. This ensures a decrease in the physical dose to 0.05 R. for a 4-hour working day.

The set of radiomanipulating instruments provides for the following operations:

1. Extraction of preparation or needles from the containers and their preparation for use.
2. Assembly and dismantling of moulages.
3. Placing of preparations or needles back into the container for storage.

The table and set of instruments are intended for work in the sitting posture. The chair has a rotating seat permitting to adjust its height to the heigh of the operator.

The table is easily taken to pieces. The table has eight drawers to keep radiomanipulating tools.

The characteristics feature of the set of radiomanipulating tools is the surved shape of their handles or blades, so that the operator's hands are laways protected during work with the radiation sources. The set consists of 17 items (13 names in all).

## DRUGS FOR TREATING MALIGNANT TUMORS

Medicinal therapy of malignant tumours has been assuming an ever increasing significance recently. It is especially effective when accompanied by other known methods, and with the surgical ones in particular, since the experience has shown that many medicinal substances affect metastases more actively than primary tumours.

Wide research is carried out in the Soviet Union in the field of new antiblastic preparations with selective specific influence upon malignant tumours. Parallel with that the methods are being elaborated of tumour chemotherapy combined with surgical intervention, X-ray therapy and with the medicinal substances of a wide range of effectivity. Therefore not only specific preparations for tumour chemotherapy are represented at the exhibition, but also a number of medicines used in combined treatment. The total number of the preparations exhibited is 140.

Hormonal preparations were the first to be successfully applied in medicinal therapy of tumours. Certain sex hormones and corticosteroids are used most often. Both male hormones or androgens, and the female ones, or estrogens and progesterones, are finding application. Of the androgens testosterone-propionate, methyltestosterone and methylandrostanediol are represented, and of the estrogens — diethylstilbestrol, diethylstilbestrol-propionate and synestrol.

Together with them the corticosteroids are exhibited, which are applied for «chemical» adrenalectomy in neglected cases of cancer of mammary and prostate glands, as well as for treating some malignant diseases of the blood, and lymphogranulomatosis.

The first synthetic chemotherapeutic preparations to be used in tumour chemotherapy were derivatives of di-beta-chloroethylamines or nitrous analogues of yperite (nitroyperites), whose final biological effect is in many respects similar to that of irradiation. These substances actively affect on tumour tissue, and especially to the cells of the blood-forming tissue.

Novoembichine, sarcolysin, dopane and embitol — the preparations used on a large scale here in the Soviet Union — are exhibited.

**Novoembichine,** or 2-chloro-propyl-di(beta-chloroethyl)-amino-chloro-hydrate, is indicated in cases of granulomatosis, chronic myelosis and polycythemia. Positive results have been obtained with novoembichine in metastses of cancer of mammary gland in lympth nodes, which develop after radical operations.

**Sarcolysin,** or chloro-hydrate-di-para-di(beta-chloroethyl)aminophenylalanine, is mainly used in cases of metastases of testicle seminoma, Ewing tumour, myeloma, reticulosarcoma and angioendotheliioma. Thus, the preparation can be used in combined therapy of a number of tumours, parallel with surgical treatment and X-ray therapy.

**Dopane,** or 4-methyl-di(beta-chloroethyl)amino uracil, is mostly applied in cases of granulomatosis and myeloleukosis. Dopane is produced in tablets. It does not affect the cardiovascular system, liver or kidneys of treated patients.

Embitol, is a mixture of ortho-para-isomers of xylil-di (beta-chloroethyl) amine. Embitol is effective in cases of lymphogranulomatosis and reticulosarcomatosis.

Thiophosphamide, ethymidine and dipine — these derivatives of ethylenimine are produced and widely used here in the Soviet Union. Recently the use of benzoteph has started.

**Thiophosphamide,** or Thio-Teph(triethylenthiophosphoramide), is effective in cases of neglected cancer of ovary, and skin metastases of breast cancer. It is well tolerated.

**Ethymidine,** or 2,6-diethylenimino-4-chloro-pyramidon, is effective in cancer of the ovaries (Ryabov, F. L.), and can also be used in inoperable cancer of the lungs.

**Dipine,** or tetra-(ethylenamide)-piperazine-N,N' of diphosphoric acid, has been synthesized recently, and is un-

dergoing tests in quite a number of clinics. According to preliminary data, dipine is highly effective in cases of chronic lympholeukosis.

**Benzoteph,** or benzyl-$N^{I}$,$N^{I}$,$N^{II}$,$N^{II}$-diethylenamide of phosphoric acid, is an effective anti-blastic preparation for treating cancer of the lungs with metastases and with pleural involvement, as well as pleural endothelioma, breast cancer with metastases, and cancer of the ovary. Patients tolerate the preparation better than they do thiosphamide. Benzotept is also more gentle affects on haemopoiesis.

In tumour chemotherapy, besides the derivatives of chloroethylamines and ethylenimine, esters of methanesulphooxyacids are used, of which myelosan is the most interesting one.

**Myelosan,** or 1,4 di(metanesulphonil-oxy)butane, is indicated in cases of leukemic form of chronic myeloleukosis with moderate or marked splenomegaly. The advantage of this preparation is its internal application and the fact that patients tolerate it well.

The antimetabolite group, i. e. the preparations disturbing the synthesis of nucleic acids, which affects the growth of tumour tissue, is represented at the exhibition by purine's antagonist — 6-mercaptopurine.

**6-mercaptopurine** is the most effective preparation among purine's antagonists. It is effective in cases of acute leukoses both in children, and in adults. The best results are obtained when antimetabolites are administered together with preparations of the cortisone group, or ACTH.

Antiblastic preparations of vegetable origin and antibiotics are also exhibited. Most interesting among them are colchamine, or omaine ointment, neocyde and crucine.

**Colchamine,** or N-desacetylmethylcolchicine, is used in treating chronic myelosis and lymphogranulomatosis. Colchamine is effective with the tumours of epithelial origin. The best results are obtained with the colchamine (omaine) ointment of a new composition, i. e. containing hyaluronidase (lidase), ephedrine, or mesothrone and birtadione.

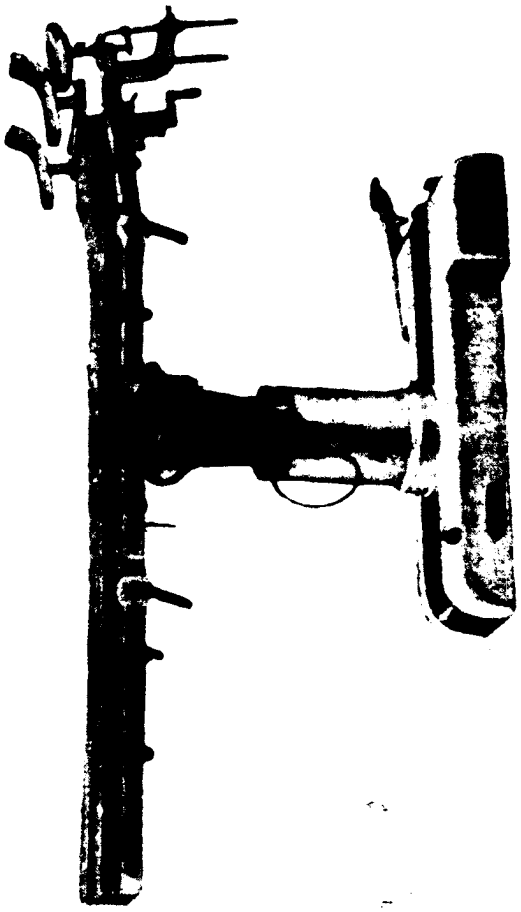
Besides preparations affecting tumours specifically, a great number preparations of symptomatic effects are also to be found at the exhibition.

## SURGICAL EQUIPMENT AND INSTRUMENTS

Surgery is one of the radical methods of treating tumors, the possibilities for surgical treatment of cancer of different localisations continuously extending. In connection with this the assortment of equipment, apparatus and instruments employed is also expanding. The Exhibition has on display equipment of a modern operating room and instruments for intervention in general and thoracic surgery, neurosurgery, gynecology and ophthalmology.

This section demonstrates a universal operating table with push button controls, modern apparatus for inhalation anesthesia, artificial respiration and control of the depth of anesthesia, a large H-reflex luminary for lighting the operating field and at the same time making it possible to photograph the operating field and transmit the image through a television canal. The section also has on dipslay apparatus for artificial circulation and an artificial kidney, installations for sterilising the air in the operating room, and other accessory apparatus. Moreover, there is an electric knife and an installation for sharpening cutting surgical instruments electrolytically. Among the instruments used for surgical intervention there are more than two dozen models of instruments and apparatus for suturing various organs and tissues. In addition, there is a wide assortment of surgical instruments and equipment for surgical gynecology, ophthalmology and otolaryngology, as well as neurosurgery.

**Operating Table with Automatic Controls.** The table is designed for various surgical operations. A special device makes it possible to place the patient in any position ensuring the most convenient access to the operated parts of the body, and organs. The table consists of the follo-



Operating table.

wing main parts: base, pedestal, panel, control panel with panel box, and removable devices.

The panel consists of five sections and a kidney support made of organic glass. The two central sections and kidney support are power-driven, the remaining three sections (one head and two foot) turn and are fixed manually by means of a special lock and radial toothing.

The panel has a lever for successively switching on 12 mechanised movements of the table. The table is so constructed as to permit of changing the position of the panel longitudinally and transversely, as a whole, and the relationships of its individual sections. The table has a hydraulic drive duplicated from the electric motor and foot pedal.

If the operating room has special apparatus for roentgenoscopy and roentgenography, the table can be used for necessary examinations. The low panels and absence of handles for driving the table enable the surgeon to work conveniently both standing and sitting.

The table works on 110 and 220 v alternating current at 50 Hz.

Power used — 220 W.

Lift of panel from extreme low position — 400 mm.

Angle of longitudinal tilt of the panel (after Trendelenburg) 50°.

Angle of transverse tilt of the panel 25°.

Lift of the kidney sceppar — 120 mm.

Dimensions of the table — 1800 · 430 · 700 mm.

**Apparatus for Cutting and Coagulation with High-Frequency Currents (TVHCh-1 Electric Knife).** This apparatus is designed for operations with high-frequency currents with coagulation and cutting various soft tissues (muscle, fat, pulmonary tissue, etc.). It is a two-tube high-frequency generator assembled according to the condenser system.

The apparatus has a filter to eliminate conducted interference to radio-reception.

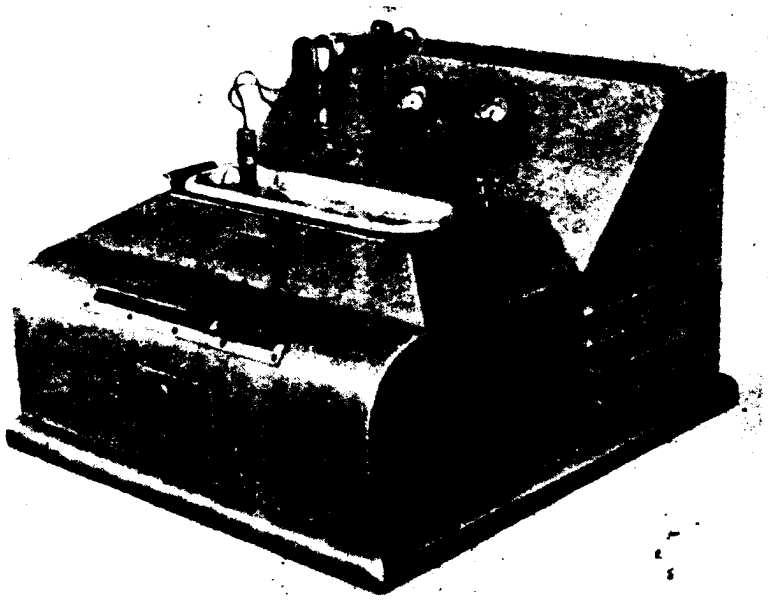
The apparatus works on 127 and 220 v alternating current. Nominal output power of the apparatus — 240+60 W. Main frequency — 1900 kHz. Power used from the mains — not more than 1500 W. The apparatus is supplied with a set of electrodes — pin-shaped, spherical, plate and lead- and knives.

By request of the buyer the apparatus can be supplied with a special set of bipolar and monopolar electrodes.

**Installation for Electrolytic Sharpening of Medical Instruments.** This installation is designed for electrolytic sharpening and honing of cutting medical instruments and microtomes. It consists of the following main parts: bath for the electrolyte, thermostat for heating the bath, contact thermometer, rheostat with movable contact, relay, heating elements, feeding block, ammeter, voltmeter, thermometer and switch.

The electrolytic sharpening of instruments is based on anodic dissolution of the metal in the electrolyte at a temperature of 70°C. To sharpen an instrument, only its working part is immersed in the electrolyte. The termoregulator ensures maintenance of a constant temperature of the electrolyte.

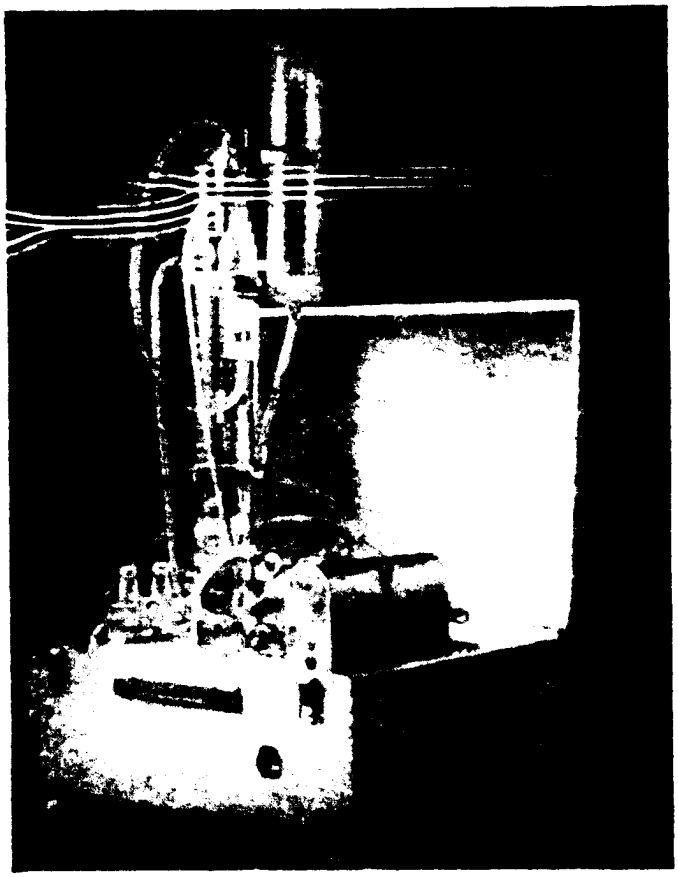
The installation makes it possible to sharpen and hone knives and other instruments with blades up to 260 mm long and 15 - 35° angle of sharpening.



Electrolytic grinding equipment

The installation works on 127 and 220 V alternating current at 50 Hz. Power used — 700 W.

**AIKO-61 Artificial Circulation Apparatus for Local Perfusion in Malignant Neoplasms.** The apparatus is designed for isolated perfusions of chemical preparations into different organs in cases of malignant neoplasms. It consists of two main blocks — physiological in which blood circulates and is oxygenated, the preparation being dissolved in the blood, and a pneumatic drive which ser-



Apparatus for extracorporal blood circulation, AIKO-61.

ves to drive the perfusion pumps. The pneumatic drive works from a cylinder with compressed air. Both blocks are mounted in a metal case which is in its turn mounted in a valise.

All the main work controls are assembled on the panel so that they can be easily operated by one person.

Medico-technical specifications of the apparatus: stroke volume of each pump — 5 $cm^3$ per stroke; pulse rate — 5—100 boats per minute; productivity of the perfusion pumps — 1 liter per minute; effectiveness of the oxygenator — saturation up to 100 per cent of 1 liter of blood per minute.

**Apparatus for Production of Esophagointestinal and Esophagogastric Anastomoses.** The apparatus is designed for production of esophagogastric and esophagointestinal anastomoses with a mechanical clamp suture by a new method which substantially accelerates and simplifies the course of one of the most complicated operations and sharply reduces postoperative complications. The tissues being joined are sutured along their circumference simultaneously with U-shaped tantalum wire clamps. Simultaneusly with the formation of the round clamp suture a round opening forming an internal free passage between the sutured organs is cut with a special knife.

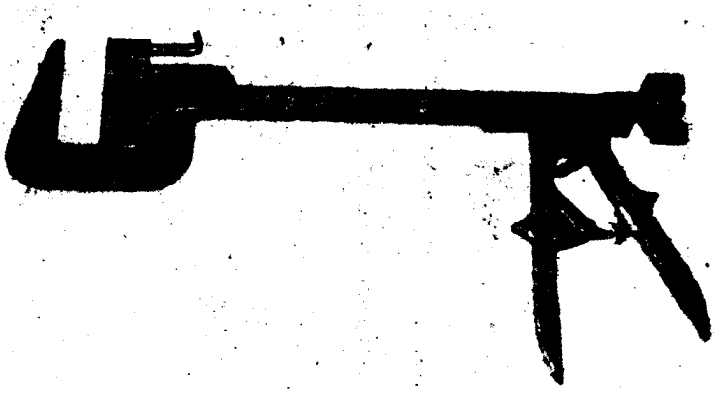
The apparatus consists of two main parts: tubular frame with handles and head with rod. On the flat surface of the head there are indentations in which the clapms rest and bend into a B-shape during the suturing of the tissues. In the butt end of the frame there are slots for the clamps. The tissues intended for suturing are placed between the apparatus frame and the head. The clamp suture and lumen between the sutured organs are formed by a single pressure on the handles.

The apparatus may be sterilised in an autoclave at a temperature of 120°C for 40 minutes, by boiling for 20 minutes in water or 10 minutes in a 1 per cent sodium bicarbonate solution.

**UKB-25 and UKB-16 Apparatus for Suturing the Stump of a Bronchus.** These apparatus serve for suturing the stump of a bronchus with metal clamps in pneumonectomy and lobectomy for cancer, bronchiectasis, etc.

The apparatus differ only in size. The UKB-25 serves to suture the stump of a bronchus up to 25 mm and the

Apparatus for suturing the bronchial stump, UKB



Apparatus for suturing the lung base, UKL

UKB-16 – up to 16 mm long. The latter is used mainly in operations on adolescents and children.

Each apparatus is supplied with 3,000 clamps.

**UKL-60 and UKL-40 Apparatus for Suturing the Lung hili.**

These apparatus are used for suturing lung hili, as a whole with two rows of metal clapms in pneumonectomies, lobectomies and segmentectomies. The apparatus con-

siderably accelerate and simplify radical operations on the lungs, suturing the bronchi, vessels and the pulmonary tissue, as a whole, reliably and hermetically. The two models are analogous and differ only in size, the former producing a suture 60 mm long, the latter 40 mm long.

## APPARATUS FOR CHEMICAL AND BIOCHEMICAL CANCER RESEARCH

Cancer research in the Soviet Union is conducted on a broad scale and with a large number of technical means. Only a small part of the apparatus and instruments used in chemical and biochemical cancer research is represented at the exhibition

There are the following two main groups of apparatus:

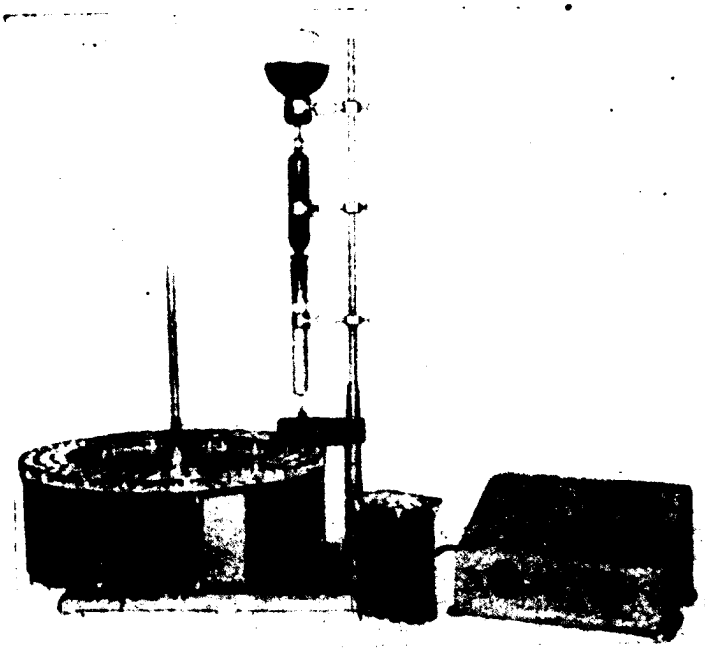
1. The apparatus for obtaining cell structures and for preparation fractionation: homogenizers, fraction collectors, centrifuges, electrophoresis apparatus, solution filters, thermostats, and apparatus for tissue and virus cultivation.

2. The instruments used for analyzing the structures and components obtained.

The apparatus of last group are represented at the exhibition by spectrographs and spectrophotometers, polarographs, a luminescent spectroelectrophotometer and an ultraviolet microspectrophotometer, apparatus of electronic paramagnetic resonance, an automatic instrument for chromatographic determination of the amino acid composition, electronic and other microscopes, a fluorometer, a mass spectrometer and quite a number of other interesting instruments.

**Chromatography Apparatus with Fraction Collector.** The apparatus is used for automatic selection of solvent microsamples in the course of liquid column chromatography analysis. It can be applied in biochemistry, agrochemistry, organic and physical chemistry, etc.

The KhKKV-1 apparatus selects liquid samples of the given number of drops (microanalysis), or in given time intervals.



Apparatus for chromatography with fractional collector

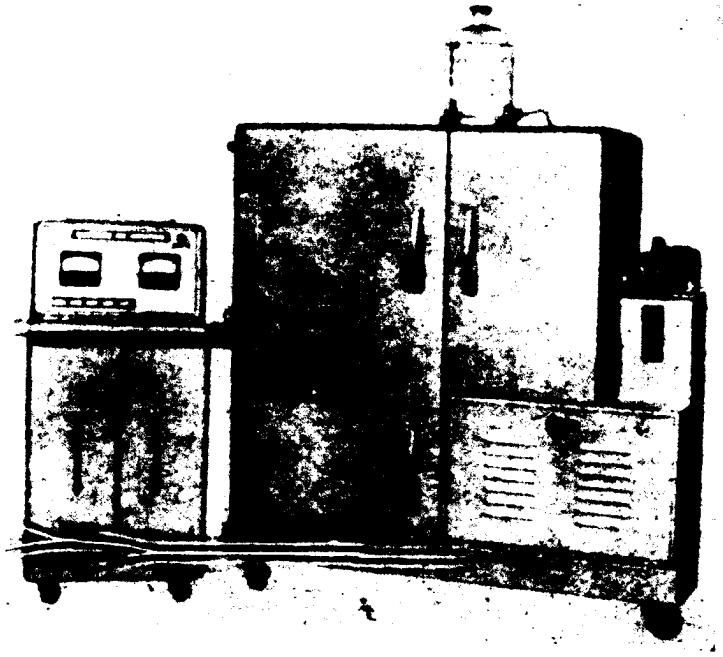
The selection of samples of the given number of drops is done by the counter consisting of a photoelectric data unit and an electronic counter block.

The switching of the apparatus from one programme to another is done merely by shifting of a corresponding tumbler switch.

The KhKKV-1 apparatus consists of a receiving collector, a control desk and a chromatographic column with an elution device (i. e. washing out).

| | |
|---|---|
| The set time intervals, min | from 1 to 55, |
| The set number of drops | from 1 to 110, |
| The volume of each vessel | from 15 ml. up |
| The number of containers | 150 |

**Preparation Apparatus EFP-2 for Continuous Electrophoresis in Supporting Medium:** The EFP-2 apparatus is used for preparation fractionation by electrophoresis in



Preparation apparatus, EFP 2

the supporting medium of the compounds moving in an electric field: proteins, amino acids, nucleic acids, various non-organic compounds, etc. It can be applied for research in chemistry, biochemistry, physiology and medicine.

The apparatus consists of the following two aggregates: a unit for electrophoretic separation and a control desk.

The electrophoretic separation unit has special devices for the elimination of the heat released during the electrophoresis process, for cooling the cassette during fractionation to −3°C, for the preservation of a constant level of the pH-buffer solution within the electrode system, for maintenaining the set speed of the continuous feeding of buffer solutions and the initial solution and for securing a uniform electric field in the separation zone.

The control desk has a built-in high-voltage rectifier, measuring instruments, a power stabilizer, and an emergency protection and signalling system. The apparatus is controlled with knobs on the front panel of the desk.

The electrophoretic separation takes place in a cassette filled with the supporting medium — i. e. fine glass dust with spherical grains — into which buffer solution and the initial preparation are continuously pumped.

The buffer solution, trickling down the capillary tubes in the glass dust, carries with it the fissioned substance. Influenced along their entire way by a constant electric field perpendicular to the direction of the liquid's movement, the components of the substance are oriented, and having divided by the moment the liquid reaches the lower part of the cassette, flow through corresponding outlet connections into the receivers.

## Specifications

The speed of the initial substance's flow into the cassette (efficiency) is regulated, from 0 to 100 ml. per 24 hours;

The temperature of the liquid cooling the cassette is 4° Centigrade;

The number of receivers is 48;

The capacity of a single receiver is 100 ml;

The voltage of the power supply unit, regulated, is from 100 to 1,000 v;

The maximum current of the power supply unit is 600 mA;

The overall dimensions and the weight of the apparatus:

| | The separation unit | The control desk |
|---|---|---|
| Length | 1,530 mm | 650 mm |
| Height | 1,510 mm | 1,160 mm |
| Width | 830 mm | 550 mm |
| Weight | 450 kg | 150 kg. |

The supporting medium — glass dust with spherical grains of 160—210 microns in diameter — is highly re-

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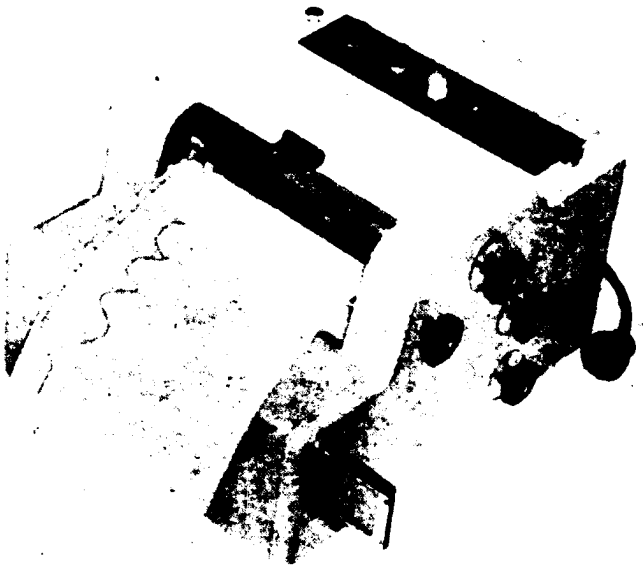
sistant chemically, has the lowest adsorption power, is washed easily, and does not deform.

The power supply output for the electrode system is power stabilized.

**Densitometer DI-1.** The DI-1 densitometer is used for mathematical processing of the electrophoregrams obtained during paper electrophoresis or the same on a thin



Densitometer DI-1

coating of some medium on a glass plate. The instrument automatically and objectively draws on common writing paper the curve of the electrophoretic separation of the preparation, i. e., the curve which corresponds on the changing density of the dyeing along the entire length of the electrophoregram.

Simultaneously marks are drawn on the same sheet of paper, whose number is proportionate to the integral value of the curve for its any gi-

ven sector. By counting the number of the marks one can easily and quickly determine the percentages of each separate fraction in the analyzed substance, since they correspond to definite parts of the curve obtained.

The DI-1 densitometer can be used in biochemistry, biology, microbiology, etc. The following units are mounted on the table covered with a metal shell.

a stand with an integrator and a drive from the electromotor for stretching electrophoregrams and diagram paper;

an amplifier with a control desk above;

an electromotor with the fulfilling mechanism;

a supply unit, and

an optical device with photocells.

The densitometer has three range sensitivity which correspond to the needle's deviation along the entire length of the 100-point scale — when the dye absorbing 90, 70 and 40% of the light respectively. By reprodusing one and the same electrophoregram the permissible deviation of the results is ±1% of the total amount of the proteins analyzed (which is considered to be 100%) whenever the fraction value is under 25%, and is ±2% whenever the fraction value exceeds 25%.

The instrument can process electrophoregrams 20 and 40 mm wide and up to 200 mm long, both on paper and agar, on plates up to 2 mm thick.

The electrophoregrams processed by the instrument are fixed in a frame between two optical glass plates, which excludes any possibility of damaging them while stretching.

The instrument's power supply is provided from the alternating current mains of 127 or 220 V, frequency of 50 cycles per second. The stability of the instrument's operation is compensated for supply voltage fluctuations of ±10%.

**Microscope MUF-3M for Observations in Ultraviolet Rays.**

The microscope is used for visual observation of micropreparations with selective absorption bands in the ultraviolet part of the spectrum, the objects being lit by transmission ultraviolet rays (with the wavelengths of 313 or 254—280 millimicrons), as wel as for studying

preparations in their luminescent light excited by the rays of the blueviolet part of the spectrum, coming through the lenses from the 01—23 luminescent light apparatus. The instrument is a simplified model of a biological ultra-violet microscope.

The lighting system and the stand of the MBI-1 microscope, a luminescent transformer and the 01—23 luminescent light apparatus are mounted on the table of the microscope.

The microscope has quarts-fluorite and mirror-lens objectives for operation in ultra-violet rays, and achromatic lenses for working in usual lighting conditions, as well as a set of oculars for visual observation.

The microscope is supplied with a set of special photolenses for photographing in ultra-violet rays.

The set of lenses with which the complete microscope is supplied complete with makes it possible to obtain the following magnifications:

96 to 980× in observations on the luminescent screen in transmission ultra-violet;

70 to 1,350× in observations in usual lighting conditions, in transmission light;

70 to 1,350× in luminescence observations in transmission light;

114 to 1.470× in luminescence observations in reflected light from the OJ-23 apparatus.

**Luminescent Microscope ML-2.** The microscope is used for observations of microbiological, histological and other preparations, luminescent in the rays of the blue-violet part of the spectrum, and in the ultra-violet rays with the wavelength of up to 360 millimicrons. The fluorescence of the preparations processed with special dyes has been made use of in the microscope.

The main parts of the instrument are the stand, a lighting device, a mechanism of initial and fine focussing, and a control desk.

Observation of luminescent preparations can be conducted with the light coming both from above, through the opaque illuminator and the lenses, and from underneath, through the condenser.

The set of lenses the microscope is supplied with makes it possible to obtain magnifications of 63 to 1,575× in visual observations.

Fluorometer FM—1.

The microscope is also supplied with two photolenses with the 10 and 15× magnifications.

To photograph luminescent objects the microscope attachment MFN-1, with various photocameras or with the «Zenith» film camera without the latter's lenses can be fixed on the microscope.

**Fluorometer FM-1.** The FM-1 fluorometer is a laboratory instrument used for quantitative analysis of fluorescent substances in solutions. The instrument is used in laboratory research in medicine, biochemistry, organic and physical chemistry, chemistry of oil products, metallurgy and in a number of other fields of science and technology.

Fluorescence of many chemical substances under the influence of ultra-violet rays is the phenomenon made use of in the instrument. The intensity of the visible luminescence of the irradiated substance is within definite limits, proportionate to the substance's concentration.

The main parts of the instrument are as follows: a source of ultra-violet light (the mercury lamp); optical primary (UFS-1, UFS-2 and UFS-3) and secondary light filters (a set of 16 interference light filters);

mechanical control devices, i. e. switches, shutters, stops, etc; power stabilizers; rectifiers; photoelectric receiver; a photoamplifier; and the meter.

## Specifications

The instrument's sensitivity, or the lowest detectable concentration of riboflavin is 0.002 mg-ml;
The number of cuvettes per cassette is 6;
The volume of a single cuvette is 3 ml;
The minimum amount of solution is 1.5 ml;
The number of primary light filters is 3;
The number of secondary light filters is 16;
The power consumed is 300 W.;
The voltage of the current 50 Hz is 127 or 220 V.

**Luminescent Spectroelectrophotometer ULF-1.** The ULF-1 luminescent spectroelectrophotometer is used for measuring the luminescence intensity of solutions lit with rays of the known wavelengths passing through light filters. With this instruments fluorescence and luminous absorption measurements can be made for objects lit by ultraviolet rays with the wavelengths of 254, 313, 365, 405, 436, 546 and 579 millimicrons.

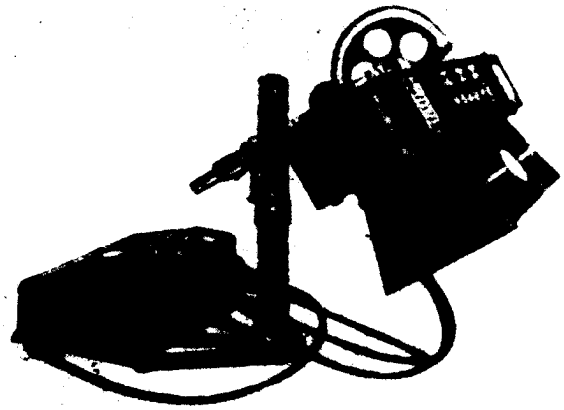
The source of ultra-violet rays in the instrument is a mercury-quartz very high-pressure lamp of the SVD-120 A type, with a special focussing quartz optical device.

The fluorescence or luminous absorption of the object under observation, be it a substance, a solution or a soil sample, is measured by comparing it with that of a standard sample.

The fluorescence or luminous absorption intensity is registered by a photomultiplier of the PEU-19 type with a standard amplifier circuit.

## Specifications

The minimum luminous flux is 1 by $10^{-6}$ lumens;
The minimum recorded change in the luminous flux is 0.5%;
Ranges are 1 : 1, 1 : 10, 1 : 100, 1 : 1,000;
The voltage of the mains is 220 V.
The weight is 35 kg.



Ultrachemiscope.

**Spectrophotometer SF-5.** This instrument is used for measuring the transmission (optical density) of liquid and solid transparent substances in the spectrum region from 380 to 1,100 millimicrons.

Transmission measurements are made by comparing its value with that of a reference sample transmission. The ratio between the luminous fluxes passing through a sample and through a standard sample, when the samples are put one after the other in one and the same beam of monochromatic light is determined with a compensation circuit by the light transmission scale of the counter potentiometer.

The main units of the spectrophotometer are as follows: a spectrophotometer stabilizer, a storage battery, and a rectifier.

The measurements ranges of the counter potentiometer scale, from 0 to 2 for optical density measurements, and from 0 to 100% for transmission measurements.

The monochromator's dispersion for the wavelength of
404.6 millimicrons is 29 Angström/microns;
486.1 millimicrons is 61 Angström/microns;
950.0 millimicrons is 483 Angström/microns.
**The weight is 100 kg.**

**Quartz Spectrograph ISP-28.** The ISP-28 quartz spectrograph is used for quantitative and qualitative emission spectral analysis of metals, alloys, ores, minerals and chemical preparations, as well as for other spectral research.

The spectrograph consists of the following main parts:

1. The ISP-28 quartz spectrograph;
2. A three-lense achromatic condenser;
3. A quartz condenser;
4. Shutters with attenuators.

The operation spectrum range is from 2,00 to 6,000 Å;
The spectrum length is 220 mm;
The collimator has lenses with the focal distance of 703 mm, 40 mm in diameter;
The linear dispersion at:
2,000 Å is 3.5, Angström/mm,
2,500 Å is 9 Angström/mm,
3,100 Å is 16 Angström/mm,
3,600 Å is 25 Angström/mm,
4,000 Å is 39 Angström/mm, and at
6,000 Å is 110 Angström/mm;
The weight of the spectrograph is 135 kg.

**Ultra-Chemiscope.** The ultra-chemiscope is used for chromatographic research and for titration. The fluorescence of the substance under observation is measured by comparing it with that of a reference sample.

In chromratographic research a chromatogram is coated with the analyzed and the standard solutions. The chromatogram is dried and put between the light filter and the luminescent plate. The instrument has three BUV-15 bactericidal lamps, i. e. sources of ultra-violet rays, as well as the UFS-1 light filters, transmitting the 235 millimicron line and retarding the visible parts of the spectrum.

The electrical part of the instrument is mounted on the table, together with the column for lamp-head movement.

The instrument has a stationary head and a portable one.

The portable head can be removed by 4 to 5 meters from the control desk. The working ultra-violet rays wa-

velength is 263.7 millimicrons, the voltage of the mains is 127, and the weight is 12 kg.

**Chromatographic Analyzer of Amino Acids PKhA-1.** The PKhA-- instrument is usetd for chromatographic separation of amino acid mixtures.

The instrument consists of the following parts:

1. A cabinet with three chromatographic columns and auxiliary chemical equipment inside; and

2. A desk, mounted together with the cabinet, with instruments controls, a recording unit and a photometer in it.

The principle of the analyzer's work is as follows: the absorbent is coated with the analyzed mixture, which is dislodged with the respective buffer solutions. The mixture moves along the column, at the same time dividing into its components. It goes through the thermic reactor afterwards, and reaches the flowing-liquid photometer. The results are recorded.

The instrument can separate amino acid mixtures with 0.1. to 3 micromoles in a sample. In this case the analysis error does not exceed 5% of the amount taken.

An analysis process takes no more than 48 hours.

The power consumed does not exceed 1.8 kW.

The weight of the instrument is 400 kg.

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# INSTITUTE OF EXPERIMENTAL AND CLINICAL ONCOLOGY

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USSR ACADEMY OF MEDICAL SCIENCES

# INSTITUTE OF EXPERIMENTAL AND CLINICAL ONCOLOGY

MOSCOW 1962

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# FORWARD

The Institute of Experimental and Clinical Oncology of the USSR Academy of Medical Sciences, one of the country's young institutions, celebrated its tenth anniversary at the end of last year. Youth is always time of growth, development, formation. And such was this period for the Institute, new departments and laboratories having been organised.

Most of the experimental laboratories, and a small clinic with 60 beds were already functioning in 1954, i. e., three years after foundation of the Institute. In the summer of 1960 the Institute was given a new building in which a 260-bed clinic was opened and branches of some of the theoretical laboratories (of biochemistry, tissue culture, immunology, biotherapy) connected with the clinic were organised. Moreover, a department for the study of cancerogens was set up. Construction of a complex of new buildings designed for the Institute is now nearing completion. The buildings occupy an area of 16 hectares. An experimental building, a clinical building (with a 400-bed clinic), a department of radiotherapy and a vivarium are being put up. This opens up prospects for further expansion and development of the Institute.

During these years the staff of the Institute has naturally increased, too. In 1952 the staff numbered 350 persons of whom 94 were scientific workers. Today the Institute employs 1,003 persons, those of scientific workers numbering 194. Most of the scientific workers have degrees in science: 18 have degrees of Doctor of Science and 87 — degrees of Master of Science. During the ten-year period the Institute conferred 4 Doctor's and 35 Master's degrees.

The Institute of Experimental and Clinical Oncology since the very day of its foundation has been headed by

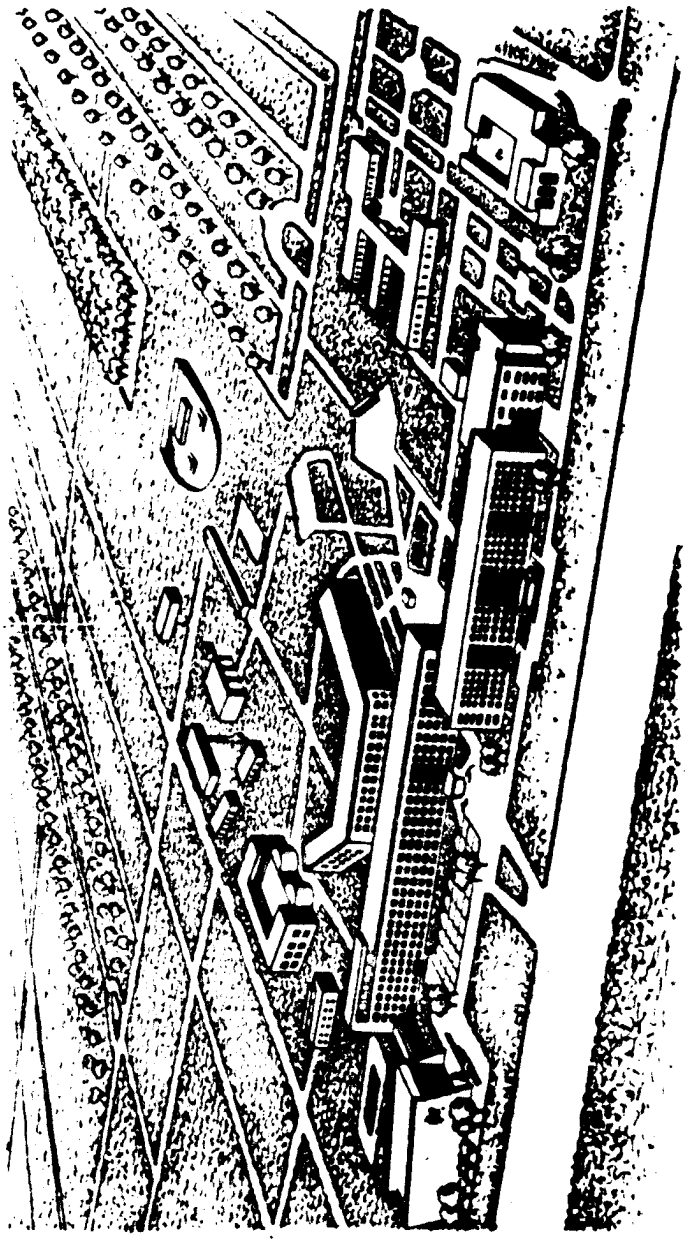

Fig. 1. Here Are New Buildings for Our Institute

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Professor N. Blokhin, President of the USSR Academy of Medical Sciences, L. Zilber, N. Krayevsky, A. Timofeyevsky and L. Shabad (members of the USSR Academy of Medical Sciences), and L. Larionov, M. Mayevsky and L. Novikova (corresponding members of the USSR Academy of Medical Sciences) are among the heads of laboratories and departments.

Many works of the Institute's collaborators have been published, publications including 11 monographs and collected works, and close to 1,000 articles in the periodical press.

The main trends of the Institute are: study of aetiology and pathogenesis of tumours, a search for new medicinal drugs, elaboration of new methods of malignant neoplasms diagnosis and treatment of patients. Many investigations are conducted by several departments and laboratories of the Institute jointly, and in association with the scientific institutions of Moscow and other cities. The aim of the research and clinical work is to find and develop new effective methods and means of treating malignant tumours. Extensive studies are conducted in the field of chemo- and hormonotherapy and application of the synthetised chemotherapeutic and hormonal drugs in combination with surgical and radiation methods of treatment.

Chemotherapeutic and hormonal compounds proposed by the Institute's departments and laboratories first undergo experimental testing, then the laboratory of pharmacology gives its characteristics to the agents, after which they are tested clinically. Two anti-tumour drugs developed in the Institute - **dopan** and **sarcolysine** have found extensive applications in clinical practice of Soviet oncology.

Thus, experimental departments and laboratories of the Institute maintain shoulder to shoulder contact with clinical departments and work in close collaboration with them.

# THEORETICAL DEPARTMENTS AND LABORATORIES

## Department of Aetiology and Pathogenesis of Tumours

(Head of the department – Prof. *A. Timofeyevsky*, Member of the USSR Academy of Medical Sciences)

The department comprises four laboratories: of tissue culture (Chief – Prof. *A. Timofeyevsky*, Member of the USSR Academy of Medical Sciences), tumour strains (Chief – *Ye. Pogosyants*, Doctor of Science in Biology), virology (Chief – *G. Piskunova*, Master of Science in Medicine), electron microscopy (Chief – *A. Shubin*, Master of Science in Medicine)

Main trends of the research conducted by the department are

1. Investigation of the role of viruses in the aetiology and pathogenesis of tumours in man and animals.
2. Production and studies of cell strains and clones in cultures *in vitro*.
3. Development and study of new strains of transplantable tumours of animals and man.

The laboratory of tissue culture works in the following directions: a) production and study of cell strains from man's tumourous and normal tissues; b) elucidation of the role of viruses in aetiology of certain malignant tumours in man; c) study of malignization of cultivated cells and tissues; d) study of antigenic properties of certain human cell strains during prolonged cultivation These four trends are to a certain extent interconnected. The studies are aimed at deepening the knowledge of the cancer cell biology. The development and studying the cell strains from tumourous and normal human tissues has proved the most effective. The laboratory has developed some unique strains (of cancer of the stomach and the breast, melanoma, sarcoma) from some of which

clones have been isolated; certain karyological studies have also been carried out. These strains are used for studying the ultrastructure of the cancer cell, for searching for virus particles in them and cultivating the sought-for viruses from human tumours, for studying the differentiation capacities of cells and the action of chemotherapeutic drugs.

In the laboratory of tumour strains working in the field of one of the most urgent problems of modern oncology development of experimental tumour models - research has been conducted in the following principal directions: a) development of new strains of transplantable tumours similar in localisation and type to the most widespread human tumours, b) development of models of metastasising tumours; c) development of human tumour strains by their transplantation to animals. Attention was also devoted to elaborating methods of regular and frequent induction in animals of tumours of some of the most important clinical localisations.

In the laboratory of virology the possibility of the cultivation of the globular bodies from the stomach polyps and from the human breast and stomach cancer upon the chorio-allantoic membrane of the chick embryo and in the tissue culture was studied. From the normal tissues of the mice ($C_{57}$×$C_3Hf$) $F_1$ and $C_3HA$ polyoma virus was isolated and the antibodies to it in mice of the Institute animal room were detected.

The research conducted in the laboratory of electron microscopy has made it possible to establish the presence of viruslike formations in 40-50 per cent of the extracts from human tumour tissues (cancer of the stomach, cancer of the breast, melanoma, leukaemia, sarcoma). The studies of ultrathin sections of human cancer cells and cultures of these cells have in some cases revealed virus particles of characteristic structure.

**Department for Studying Cancerogens** (Head of the department - Prof. *L. Shabad*, Member of the USSR Academy of Medical Sciences), the youngest department of the Institute, was organised in 1960.

The department comprises three laboratories: of chemical cancerogens (Chief — *Yu. Vasilyev*, Doctor of Science in Medicine), radiation cancerogens

(Chief — *M. Svyatukhin*, Doctor of Science in Medicine), prevention of cancerogenic hazards (Chief—Prof. *L. Shabad*)

The main trends in the work of the department are.

1. Study of the mechanisms of action of chemical and radiation cancerogens

2. Search for ways and means of detecting cancerogenic factors in the environment.

Fig. 2. In the Laboratory of Electron Microscopy

The department is studying the effect of cancerogenic hydrocarbons and azo compounds on the processes of reactive proliferation of connective tissue and epithelia

cells, and the effect of cancerogens on tissue and organ cultures of lungs and connective tissue. Recently conducted experiments have shown that in some processes of cancerogenesis the resistance of the cells to the toxic action of cancerogens increases. Morphological and histochemical changes in connective tissue in the course of development of sarcomas induced by cancerogenic hydrocarbons and polymeric films have been studied in the department. Primary pulmonary carcinoma was induced in rats by intratracheal intubation of cancerogenic hydrocarbons.

**Laboratory of Immunology** (Chief — Prof. *L. Zilber*, Member of the USSR Academy of Medical Sciences)

During the past years the work of the laboratory was essentially devoted to studies of the antigenic pattern of human and animal tumours. The antigenic changes during the process of cancerogenesis caused by chemical substances were studied. The most important result of the studies of tumour antigens is the establishment of the presence of specific antigens and simplification of the antigenic pattern of tumour tissue compared with the normal one. No less important is the establishment of the possibility of studying the problem of tumour immunology on the level of individual antigens.

In its work the laboratory uses the method of immunological tolerance. The use of this method to produce monospecific antitumour sera yielded no positive results, but its employment for heterotransplantation proved to be successful. Transplantation of the Brown Pearce tumour from rabbits to newborn rats and the effect produced on the process by preliminary administration to the hosts of various rabbit tissues were studied in detail. Studying the adsorption of tissue and viral antigens on erythrocytes murine leukaemia virus was isolated from mouse mammary tumour.

**Laboratory of Biochemistry** (Chief — Prof. *V. Shapot*)

The main trends of the work of the laboratory are:

1. Study of the metabolic peculiarities of tumour tissue: a) correlation between the catabolic and anabolic processes of nucleic acids in the tumour cell; b) activity of DNase and RNase in normal and tumour tissues;

c) comparison of the rates of various stages of protein synthesis occurring with the participation of cytoplasmic ribonucleic acid in normal and tumour tissues; d) interregulation of respiration and glycolysis in the tumour cell.

2. Study of the mechanism of action of antitumour preparations.

3. Clinical studies a) protein and carbohydrate metabolism in patients with certain localisations of malignant neoplasms; b) hormonal changes in certain localisations of malignant neoplasms.

**Department of Chemistry** (Head of the department — Prof. *A. Berlin*, Doctor of Science in Chemistry)

The department comprises the following laboratories: of chemical synthesis (Chief — Prof. *A. Berlin*), natural compounds (Chief — Prof. *G. Menshikov*, Doctor of Science in Chemistry), small-scale production of antitumour drugs (Chief — *Ye. Shkodinskaya*, Master of Science in Chemistry), analytical (Chief — *A. Chinayaeva*, Master of Science in Chemistry). The department is engaged in synthetising new chemical compounds for the treatment of cancer patients.

The main trends of the work of the department are:

1. Synthesis of antitumour compounds in the alkylating substances and alkylating metabolites.

2. Search for active preparations among the substances of plant origin and antibiotics.

3. Small-scale production of new chemical agents for experimental and clinical studies.

The staff of the laboratory of chemical synthesis has searched, in addition to other things, for new synthetic antitumour preparations among the di-(2-chloroethyl)-amines, including the derivatives of sarcolysine, among the ethyleneimine derivatives of triazine and benzoquinone, aliphatic and aromatic diazo compounds, phosphinic acids, urethanes, and in many other directions. The laboratory has submitted 165 preparations for investigation to the laboratory of experimental chemotherapy, of these preparations 15 have proved worthy of deeper study under clinical conditions.

**Laboratories of Experimental Therapy** chemotherapy (Chief—Prof. *L. Larionov*, Corresponding Member of the USSR Academy of Medical Sciences), biotherapy (Chief — Prof. *M. Mayevsky*, Corresponding Member of the USSR Academy of Medical Sciences), hormonotherapy (Chief N. Lazarev, Master of Science in Biology)

The laboratories are engaged in searching for new antitumour compounds chemical substances substances of biological origin (antibiotics, natural substances) and hormones. Each laboratory performs the screening of new drugs and elaborates tumour therapy methods.

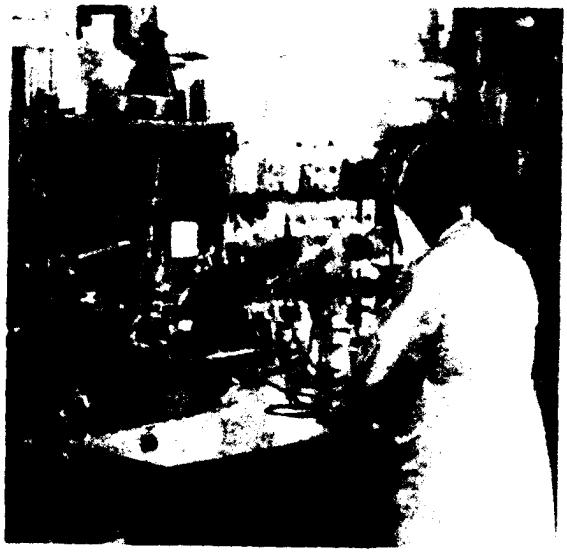

Fig. 3 In the Laboratory of Chemical Synthesis

The work of the laboratory of experimental chemotherapy is aimed mainly at finding new antitumour preparations among alkylating metabolities, i. e., substances in which a cytotoxic group with alkylating action is added to the normal products of nucleic, protein and other forms of metabolism.

As a result of experimental studies of such substances a number of compounds with varying degrees of antitumour activity were selected (bis-beta-chloroethylamine derivatives of pyridine, pyrimidine, thiazole, benzimidazole, phenylalanine). Two of these substances, namely, derivatives of pyrimidine and phenylalanine, which had the greatest selectivity of antitumour action, were tested in the clinic and proved effective in the treatment of certain forms of human tumours. In 1955 these agents—"dopan" and "sarcolysine"—were introduced into practice.

In the laboratory, there was determined high antitumour action of sarcolysine, peptides, amides and other derivatives, as well as that of phtor-derivatives of dopan and sarcolysine. Certain clinical effect is noticed to be the result of asalin, phenesterin, phtomethasarcolysine and phtorpan treatment of some tumours of man.

The laboratory is engaged in investigating the mechanisms of drugs' action, methods of combined chemotherapy and picture of preparations in tissue cultures.

The laboratory of experimental biotherapy has worked in association with other Moscow institutes engaged in antibiotic research and with other laboratories of the Institute. Considerable attention has been devoted to the question of methods because there is as yet no generally accepted method of screening antitumour antibiotics satisfying all the requirements. In addition to screening antibiotics and testing their antitumour activity the laboratory is studying the mechanism of their action, circulation in the organism and excretion. Many endeavours are devoted to studying the possibility of preventing, with the aid of antibiotics, relapses and metastases after excision of the basic tumour. Experiments have yielded promising results.

Theoretical basis of hormonotherapy and hormonoprophylaxis of dishormonal tumours, mechanisms of antitumour as well as cancerogenic effects of hormones are worked out and studied in the laboratory of experimental hormonotherapy. In collaboration with clinicians there are elaborated endocrinologically grounded hormonotherapy methods of treatment of tumours of mammalian glands, prostate and thyroid gland as well as that of mammary cancer metastases. Investigations in the field of mastopathy hormonotherapy are being carried out.

**Laboratory of Pharmacology** (Chief—*A. Belikova*, Master of Science in Medicine)

The laboratory compiles the main pharmacological characteristics of the selected compounds before their clinical testing. The laboratory has thus studied the pharmacological properties of antitumour agents from among haloidalkylamines, ethyleneimines, antibiotics, substances from the group of inhibitors of free radical processes and certain substances of plant origin.

## INSTITUTE'S CLINIC

Investigations carried out in the Clinical Department, of which Prof. N. N. Blokhin, member of the USSR Academy of Medical Sciences, is in charge, are mainly directed at studies on new methods of cancer treatment, in particular, on chemo- and hormonotherapy, improvement of

Fig. 4. The Thoracic Department. Perfusion

surgical and radiation methods, and their combination with chemotherapy.

The Clinic consists of the following departments and laboratories:

**The thoracic Department of the Clinic** (Head—*B. Peterson* Doctor of Science in Medicine) is designed for 60 patients; it has surgical facilities and a postoperative ward.

The department admits patients with tumours of the lungs, oesophagus and cardia. Besides the department also treats patients with other tumour localisations, mainly tumours of bones.

The main subject of scientific work is cancer of the lung, particularly, the study of the possibilities of treating patients with advanced and complicated forms of cancer of the lung. The possibility of combined surgical and chemotherapeutic — treatment of the tumour is under study. Various chemical compounds, mainly those synthetised in the chemical laboratories of the Institute, are used during the pre- and postoperative periods, as well as during operations. The department is also studying the method of regional chemotherapy and administering perfusions in tumours of the limbs. The method of surgical treatment of patients with cancer of the mid- and upper-thoracic parts of the oesophagus is also being elaborated.

**The Department of Abdominal Surgery** (Head — *V. Yanishevsky*, Master of Science in Medicine) has 60 beds, surgical facilities and a postoperative ward.

The department admits for surgical treatment mainly patients with tumours in the gastrointestinal tract, patients with tumours in the urogenital system and in retroperitoneal space are also treated in the department.

The main scientific subjects studied in the department are:

1. Diagnosis and indications for repeated operations in cancer of the stomach.
2. Techniques of gastrectomy with oesophagoduodenostomy.
3. Experimental elaboration of chemotherapy of malignant tumours of rectum by means of perfusion.

The **Gynaecological Department** (Head—Prof. *L. Novikova*, Corresponding Member of the USSR Academy of Medical Sciences) has 30 beds.

The department is working on two principal problems of clinical oncology:

1. Diagnosis of malignant neoplasms of the female genitalia.

Fig. 5. In the Operating Room of Gynaecological Department

2. Rational treatment of these neoplasms.

While working on the first problem use is made, as of supplementary methods, of cytological examination, colposcopy, hysterosalphingography, and pneumoperitoneum in combination with roentgenological examination of the gastrointestinal tract. For the solution of the second problem the department is searching for and elaborating

the most effective complex methods of treatment, including radiotherapy, surgery, chemo- and hormonotherapy.

Patients with the 1st and 2nd stages of cancer of the cervix uteri are treated mainly by a combined method which includes preoperative irradiation and an extended extirpation of the uterus and its adnexa. The efforts to treat the advanced stages of the disease by chemical agents are being made. In addition to the extended extirpation of the uterus with its adnexa and radiotherapy, patients with cancer of the corpus uteri are (when indicated) prescribed hormonotherapy and chemotherapy. Chemotherapy, surgery and hormonotherapy (in various combinations) are employed in malignant neoplasms of the ovaries.

The **Endocrinological Department** (Head — *O. Svyatukhina*, Master of Science in Medicine) has 30 beds.

The department is working out new endocrinologically substantiated methods of treating hormono-dependent tumours, mainly cancer of the breast. On the basis of the former experience of the clinic the department has elaborated a method of combined treatment of women affected with cancer of the breast, the method includes surgery, radiotherapy, chemotherapy and hormonotherapy. The use of this method resulted in remissions in more than two thirds of the cases of advanced forms of cancer of the breast. The department has also created a method of hormonoprophylaxis of relapses and metastases of cancer of the breast during the 1st-3rd stages of the disease. Remote follow-up over a period of 3-5 years have shown the foregoing therapeutic methods to be of promise.

The department has begun research in methods of treatment of mastopathy and in hormonotherapy of cancer of the thyroid.

The **Chemotherapeutic Department** (Head — *A. Astrakhan*, Doctor of Science in Medicine) has 60 beds.

The main tasks of the department include clinical testing of new antitumour agents, elaboration and improvements of the methods of their utilisation, and studying

the possibility of their combined administration and of combination of chemical methods of treatment with those of surgery and radiation. In particular, the department is studying a number of new compounds of the series of alkylating metabolites, ethyleneimines and antitumour antibiotics, as well as some drugs of plant origin. The clinic receives the agents after thorough experimental studies of their antitumour activity and pharmacological properties. In connection with this the chemotherapeutic department maintains close contact with the experimental departments of the Institute and other scientific institutions.

## Department of Roentgenradiology
(Head — Prof. *I. Tager*)

The department engages in diagnostic examinations by means of X-rays and in radiotherapy.

The following specialised cabinets have been opened: radiodiagnosis of diseases of the respiratory organs, radiodiagnosis of diseases of the gastrointestinal tract, skeletal examinations, sectional radiography (planigraphy), angiography, complex contrast methods (bronchography, cinefluorography, etc.).

The diagnostic branch of the department is engaged mainly in elaborating specific methods of radiological examination of tumours of the skeleton, lungs, and the gastrointestinal tract. Special attention is devoted to determining the effectiveness of the various methods of treatment (chemotherapy, radiotherapy) of tumours of the skeleton and lungs, as well as to early detection of relapses after operations on the stomach (for the purpose of repeated surgical intervention).

The radiotherapeutic branch of the department has cabinets of stable radiotherapy, rotation and proximofocal therapy; a rotation gammatron and a linear accelerator are being installed.

The department staff is working out methods of combined treatment of tumours, mainly the method of surgical and radiation, chemical and radiation, hormonal and radiation treatments of the female genitalia, skeleton, intestinal tract, etc.

**Laboratory of Anaesthesiology** (Chief -- *V. Smolnikov*, Master of Science in Medicine)

The main problem studied by the laboratory is the change in metabolism produced by anaesthetics and relaxants at different levels of anaesthesia. The particular

Fig. 6. In the Laboratory of Anaesthesiology

problems elaborated by the laboratory include the changes in the electrolytic balance of patients under the influence of anaesthesia, hormonal changes, and the functions of external and internal respiration of pulmonary patients. The peculiarities of the course of anaesthesia in patients with adrenal cortical insufficiency are being studied

The mechanism of prolonging thiopental sleep with the Schein and Ammen mixture, 3-per-cent ether, cyclopropane and other anaesthetics is being tested experimentally.

**Department of Pathomorphology** (Head—Prof *N. Krayevsky*, Member of the USSR Academy of Medical Sciences)

The department comprises two laboratories: of pathomorphology (Chief—*I. Avdeyeva*, Master of Science in Medicine) and cytology (Chief—*B. Nikitin*, Doctor of Science in Medicine)

The work of the laboratory of pathomorphology consists of two parts.

1. Routine pathological (prosecting) work which includes: a) differential diagnosis of malignant tumours on biopsy and surgical material; b) scientific control of the correctness of the diagnostic and therapeutic work by autopsies of the deceased who died in the Institute's clinic, elucidation of the causes of their death, comparison of the clinical and post mortem diagnoses, joint discussion and comparison at clinical and anatomical conferences of the case histories and data furnished by the autopsies.

2. Research, its main trends being: a) study of the character and dynamics of the morphological changes in human malignant tumours regressing under the action of chemo-, hormono- or biotherapy, as well as combined methods of treatment; b) establishment of pathomorphological criteria for selecting patients for various forms of chemotherapy and for determining their effectiveness; c) study of the pathomorphological and histochemical signs of transition of precancerous affections to cancer (in man and experimental animals); d) study of the morphological and histochemical changes in the endocrine organs of women affected with cancer of the breast.

The subjects of research conducted by the department of pathomorphology correspond to the main trends of the general plan of research conducted by the Institute as a whole, the research being carried on in association with other laboratories and clinics of the Institute.

The working plan of the laboratory also includes mastering and improvement of new histochemical methods of examination and their introduction into the routine practice not only of scientific work, but also of examining biopsy, surgical and section materials.

The cytological laboratory serves the clinic and polyclinic by examining the specimens obtained by puncture of tumours, the sputum, urine, ascitic and pleural fluids. The laboratory is connected with some medical institutions of the city; it acts as consultant to them and examines vaginal smears obtained during examination of large groups of women with the purpose of detecting early forms of cancer.

**Clinicohaematological Laboratory** (Chief — *B. Dobrov*, Master of Science in Medicine)

The laboratory is conducting extensive dynamic studies of the changes in certain indices of the peripheral blood and the composition of cell elements in various forms of malignant neoplasms. These data are examined in patients during the preoperative and postoperative periods, as well as during systematic administration of various chemotherapeutic agents and radiotherapy. Moreover, the laboratory extensively practises thorough and repeated examinations of the cellular composition of the bone marrow of cancer patients for diagnostic purposes and for controlling the chemotherapy administered to certain groups of patients.

**Laboratory of Bacteriology** (Chief—*O. Vyazova*, Master of Science in Medicine)

The laboratory makes the following analyses:

1. Determination of the bacterial flora in the different materials obtained from the patients.
2. Determination of sensitivity of the pathogenic microflora isolated from the patients for the purpose of rational administration of antibiotics.

The research plan of the laboratory includes study of the microflora of tumours in patients with different localisation of the tumour process.

### Serological Laboratory (Chief—*L. Sarycheva*, Master of Science in Medicine)

The laboratory is conducting the following studies for the clinic:

1. Determination of the Rh factor (accelerated method with gelatin).
2. Detection of Rh antibodies (accelerated method with gelatin, test tube method and Coombs method).
3. Detection of antibodies in haemolytic anaemia (direct Coombs test).
4. Serologic tests in various infectious diseases.

The laboratory studies and ascertains the serologic tests proposed for diagnosing cancer (Black's test, Hakim's test, Ravkina's test).

### Organisation and Cancer Control Department with a medical archive (Head — *Ye. Kudimova*)

This department was organised two years ago. The main task of the department is to study the remote results of treatment of the former patients of the clinical departments of the Institute (since 1952). This work is particularly important in connection with the use of new methods of treatment and new drugs. The department takes part in elaborating methods of organising prophylaxis, diagnosing malignant neoplasms and treating patients; it also participates in organising symposiums, conferences and the forthcoming congress. The scientific work of the department is aimed at improving the methods of keeping records of oncological patients who died of malignant tumours.

### Polyclinic of the Institute (Chief—*V. Nagoryanskaya*, Master of Science in Medicine)

In the polyclinic the patients are examined by surgeons, gynaecologists, urologists, endocrinologists and

chemotherapeutists. The polyclinic has an operating room and a radiodiagnostic cabinet. Each patient admitted to the Institute hospital is infallibly given a complete medical examination in the polyclinic and consultation by the leading specialists of the Institute. Moreover, the physicians and consultants of the polyclinic examine the patients referred to the Institute for consultation by the country's various medical institutions.

The Institute clinic has a **pharmacy** with an office elaborating medicinal forms of preparations.

The Institute **library** with a book stock of Russian and foreign literature in excess of 20,000 volumes caters to the workers of the experimental and clinical departments.

* * *

The laboratories and clinical departments of the Institute are carrying on extensive work in training specialists in oncology; twenty-seven persons completed their postgraduate work and internship, while many physicians specialised at their places of work (28 in 1961). The heads of the departments, as a rule, act as consultans for the physicians from the different Union Republics submitting theses.

All the clinical departments of the Institute, as well as the radiological and pathomorphological departments and the laboratory of anaesthesiology, conduct extensive consultation work in the therapeutic and research institutions in Moscow and other cities of the Soviet Union.

## MONOGRAPHS

**of the Institute of Experimental and Clinical Oncology, U. S. S. R. Academy of Medical Sciences**

1. N. N. Blokhin — Plastic Surgery of the Skin. Moscow, Medgiz, 1955
2. Volume of Papers Dedicated to the 75th Birthday and the 45th Anniversary of the Scientific, Pedagogical and Social Activities of Professor A. D. Timofeyevsky. Ed. N. N. Blokhin and Ye. E. Pogosyants, Moscow, U. S. S. R. Academy of Medical Sciences, 1957.
3. A. E. Uspensky — Lymphogranulomatosis. Moscow, Medgiz, 1958.
4. Models and Methods of Experimental Oncology (practical guidebook). Ed. A. D. Timofeyevsky, Moscow, Medgiz, 1960.
5. Problems of Chemotherapy of Malignant Tumours. Ed. N. N. Blokhin and L. F. Larionov, Moscow, Medgiz, 1960.
6. L. S. Yevseyenko -Changes in the Urinary Excretion System in Cancer of the Uterine Cervix. Moscow, Medgiz, 1961.
7. Yu. M. Vasilyev — Connective Tissue and Tumour Growth in Experiment. Moscow, Medgiz, 1961.
8. A. D. Timofeyevsky — Role of Viruses in the Production of Tumours. Moscow, Medgiz, 1961.
9. N. I. Perevodchikova — Chemotherapeutic Methods of Cancer Treatment. Moscow, Medgiz, 1961.
10. M. M. Mayevskya oth. — Antitumour Antibiotics. Moscow, Medgiz, 1962.
11. L. F. Larionov — Chemotherapy of Malignant Neoplasms. Moscow, Medgiz, 1962

* All the monographs have been published in Russian.