Response curves obtained from the computer when RPF value is set to Oml/min, i.e. when kidneys are asumed to excrete no radioisotope, give a good agreement with actually measured background (RISA radioactivity) curves on both right and left sides.

From these obsevations it may be concluded as follows: it is possible to analyze background in Renogram by the analog computer, and thereby calculate separately the factors related to renal function and those which are not; thus to a certain extent quantitative interpretation of RI-Renogram is made possible by using the analog computer.

# VIII. Whole Body Counting

## An Interim Report on the Standardization of the Renogram Equipment

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There are many factors that influence on the radio-isotope renogram. The ability of the measuring equipments is one of the most important factors among them. The method how to standardize the mesuring equipment was investigated by using phantoms or by clinical applications.

1) The larger the size of NaI crystal, the more advantageous in sensitivity. The crystal of 2″ × 2″ is about five times as sensitive as that of 1″ × 1″ in the similar geometric conditions.

2) The thickness of the lead shield should be enough to reduce the counts of peak gamma-ray of iodine-131 from outside of the visual field to less than one percent of these from the visual field.

3) The whole kidney should be included within the complete visual field of the collimator, while any part of the opposite kidney and the bladder should be outside of the incomplete visual field.

4) The time constant of a ratemeter is desireble to be within the range of 1—5 sec, with the chart speed of 5—10 mm/min.

## Fundamental Studies on the Whole Body Counter (Report 1)

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A high-dose-level whole body counter has been used for the determination of the RI retention in the patient's body in our hospital. The detector installed in the celling has a 3″ × 2″ NaI crystal and a rectangular lead collimator. Patients are counted from both sides (supine and prone positions) and the RI retentions are measured by the geometric means of two-directional counts with the differential settings. By this method of counting, however, the counting rates vary with the change of RI distribution in the patient's body even when the RI is not excreted. For example, the patient with oral administra-

tion of $^{131}I$ and without urination during first 2 hours, give the counting-rate variations of 5 to 30% within this period. The whole body counts should be the same while the RI dose in the body is same, inspite of the RI distribution in the body. From the fact that the counting rates of the scattered region measured by the differential setting are fairly constant, even if the RI distribution in the body varies, it is suggested that there would be the best method of counting among the differential and integral countings. Five different energy bands of $^{131}I$ gamma-ray spectrum were chosen for the measurements of patients and phantoms. They are (1) photopeak: 314—414 keV, (2) scattered region: 200—300 keV, (3) scattered region: 120—220 keV, (4) scattered region: 30—130 keV, and (5) integral over 3 0keV. In this experiment, the variation of RI distribution in the patient's body is replaced by the thickness variation of the water phantom with $^{131}I$ or the depth variation of the $^{131}I$ point source in the water phantom. The counting rate vs thickness of the water phantom with $^{131}I$ is checked with five counting methods. The curve of the photo-peak measurement is exponential and the differences of the counting rates were the largest, while the scattered-region countings (except for 30—130 keV) and the integral counting gave the smallest differences of counting rates for the thickness variations of the water phantom. The geometric means of two-directional countings of the $^{131}I$ point source in the various depth of water give more constant counts than the arithmetic means in the photo-peak measurement. In case of the scattered-region countings and the integral counting, the arithmetic means are better than the geometric means. The counting methods of scattered region of 120—220 keV and integral are superior to the other three. The same results were obtained with the patients' countings.

## Experiments on the Medium Level Whole Body Counter

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1. The medium level whole body counter, manufactured at the ORINS medical Division, Oak Ridge, Tenn. has four detectors, which consist of four 3″ × 3″ NaI crystals in a trough-like container of 11/4″ thickness. This machine is suitable for the measurement of the radioisotope range of 0.1～100MC in a patient's body, namely is used for the medium level range of sensitivity between high and low level counters.

2) When the $^{131}I$ capsule is given to a patient, at first it shows a point source in the stomach. If the capsule is solved, $^{131}I$ will be absorbed by the gastrointestinal tract and it will circulates in the blood through the body. Then it is taken up gradually by the thyroid gland.

3. The counting was made both at the peak region of $^{131}I$ and at the scatlered region, and the data were compared each other. Better results were obtained when $^{131}I$ was measured at the scattered region.

## On the Conception of Medical Universal Human Counter

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Since a radio-pharmaceutical is administered to a patient in clinical tracer studies except for a measurement of natural $^{40}K$, as for a medical human counter its clinical usefulness is more preferable to its sensitivity.

No one wants to be confined in a steel