

pared with those in air for the honey cone type. The isoresponse curves were not traced up to the low response regions of less than 10%.

Multifocusing collimator was designed of a 36-channel focusing collimator with three foci. The thirty-six tapered channels in the gamma-absorbing shield are arranged in three groups, each with a separate focus; the first at 10, the second at 15 and the third at 20cm from the front of the collimator. The multifocusing collimator, however, showed apparently one focus like the honey cone type and far from our expectation.

The degree of collimation or resolution was given by the reciprocal of the width of the scan-curve at half height.

This resolution curves showed the honey cone type was better than the multifocus type. Response profiles obtained by the counting a  $^{131}\text{I}$  point source moved per-

pendicularly to the axes of focusing collimators of similar "width of response at half-maximum" in plane of each optical focus.

The relative sensitivities at the focal points of honey cone collimators,  $f=10, 15\text{cm}$  and multifocusing collimator were 1.5, 1.0, 1.2 respectively.

The slit type collimator was designed to provide as uniform a sensitivity in the transverse direction as possible and also to make the cutoff between the inside and outside of the plane in the longitudinal direction as sharp as possible.

The transverse and longitudinal isoresponse curves in air with 1.0cm slit width were shown.

The 3 inch flat-field collimator showed a greater sensitivity than any other from its isoresponse curve.

These data are the informations essential for using MUHC.

## Body Potassium by $^{40}\text{K}$ Measurements in Patients with Duchenne Muscular Dystrophy

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The present investigation is a method to determine the role of potassium in neuromuscular diseases.

Total body potassium (gm.) and body potassium concentration (gm. per kg) have been determined in 17 male patients aged 7 to 16 years with Duchenne muscular dystrophy by means of  $^{40}\text{K}$  measurements in a JNIRS plastic scintillator type whole body counter. Each patient was counted on two occasion one month apart. The results have been compared with values in 36 normal male subjects of comparable age.

The counter has been calibrated by the comparative use of  $^{40}\text{K}$  and  $^{42}\text{K}$  in humans and human-shaped water phantoms of selected size. All data analysis were performed on a Burroughs-220 electronic computer.

Serum creatine phosphokinase concentrations were determined in accordance with the

method described by Ebashi and Sugita.

Remarkably decreased potassium levels were observed in patients and the levels seemed to be correlated with advancing age. When the data were expressed as a ratio to values in normal subjects of comparable age, the ratio was significantly correlated with the time elapsed after the attack of the disease, but less well correlated with their state of functional disability classified by Rusk and Deaver. In a few patients classified the state six a lesser degree of decreased potassium was noted. This discrepancy between the potassium level and the functional disability seemed to be attributed to the inadequateness of patient care.

The method reported here seems to be worthy of further study as a practical method of evaluating the pathological process and genetic role in neuromuscular diseases.

Works are now in progress in further attempts to study  $^{40}\text{K}$  contents in patients with various neuromuscular diseases and their non-dystrophic relatives; parents and sib-

ings of patients, probable gen carriers, and definite gen carriers with or without abnormal serum enzyme levels.

## Clinical Studies on $^{22}\text{Na}$ Metabolism with the Use of Whole Body Counters

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With the use of a whole body counter which is composed of plastic scintillators, a long-term study on sodium metabolism was done in human subjects after a single ingestion of  $10\ \mu\text{C}$  of  $^{22}\text{Na}$ .

Before the long term study, a tracer dose of  $^{24}\text{Na}$  was administered orally to three normal subjects to establish the distribution of radioactive sodium in the body. The profile scanning was repeated until an equilibration of  $^{24}\text{Na}$  in the bodies was found, using another type of whole body counter with  $8'' \times 4''$  NaI crystal.

Three normal females and 10 patients with hypertension, with and without chronic nephritis, carcinoma of uterus and subacute thyroiditis were studied. During the course of the study, they took a diet containing ten grams of NaCl per day. In some case, 25-30g of NaCl or 50-75mg of hydrochlorothiazide per day were given orally, after a period of a week of the normal diet.

Ten  $\mu\text{C}$  of  $^{22}\text{NaCl}$  diluted with distilled water was administered orally to the subject in the fasting state. The total body counting was carried out 5 minutes, 2 hours after the ingestion of  $^{22}\text{Na}$ , and then at an interval of 24 hours for a period of 2 months or more.

The concentration of stable Na and  $^{22}\text{Na}$  in the serum were measured by a flame photometer and by a coincidence type low background  $\beta$ -spectrometer respectively. The  $^{22}\text{Na}$  in the urine was determined by a well

type scintillation counter.

The results are summarized as follows:

(1) The use of whole body counters for the study of a long-term sodium metabolism was superior to the usual balance techniques. It was difficult to estimate the extrarenal excretion of  $^{22}\text{Na}$  by the latter method.

(2) The distribution of  $^{24}\text{Na}$  in normal subjects was found to be equilibrated between 1 to 2 hours after a single ingestion of  $^{24}\text{Na}$ .

(3) In 4 normal female subjects, the biological half life (B.H.L.) of  $^{22}\text{Na}$  was approximately 12 days and the exchangeable sodium ( $\text{Na}_e$ ) was 2100 meq in average under the condition of a daily intake of NaCl in a dosis of 10g.

(4) In the patients with hypertension, a tendency was found that the B.H.L. was prolonged.

(5) In the patients with hypertension, the B.H.L. of  $^{22}\text{Na}$  decreased after the administration of hydrochlorothiazide. The effect of the drug on the B.H.L. was most significant within a few days, and then diminished gradually, even when the same dose of the drug was continued. Stopping the administration of the drug, the B.H.L. of  $^{22}\text{Na}$  became slower than that of the initial stage of the experiment.

(6) The high intake of NaCl resulted in a decreased B.H.L. and an increased  $\text{Na}_e$ .