strains and human cases of poliomyelitis to white mice and cotton rats, using autolyzed brain diluent, are now in progress.

Summary. Autolyzed brain tissue diluent shortens the incubation period and facilitates the transfer of poliomyelitis virus to CFW Swiss mice, hamsters, and rhesus monkeys. The Leon monkey-passage strain of poliomyelitis virus was successfully adapted to CFW Swiss mice by means of this technic.

Since this manuscript was submitted we have isolated several strains of poliomyelitis virus from infected human feces and spinal cord in CFW Swiss mice by means of this technic.

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Semiquantitative Determination of Traces of Uranium: A Fluorophotometric Method for Field Use

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The method described below was devised in an attempt to meet a need for a lightweight portable apparatus for determining traces of uranium. Restrictions of portability were such as to eliminate most chemical and physical methods from consideration. The procedure adopted is an adaptation of that employed by Hernegger and Karlik (*1*) and by Hoffmann (*2*), who succeeded in determining quantities of uranium of the order of 1×10^{-4} μg.

The method used by the above-mentioned workers involves spectrophotometric measurement of the brightness of the fluorescence of a sodium fluoride bead containing traces of uranium, presumed to be in solid solution. A successful adaptation of this technique for use in a portable field kit was achieved by substituting a cast disc of more fusible material for the sodium fluoride bead and by employing a simple visual comparator. Certain features of two fluorophotometers constructed and a brief summary of the results obtained appear to be of sufficient interest to warrant publication.

The first fluorophotometer was constructed for laboratory use as follows: A General Electric AH-8 mercury lamp, powered by a constant-voltage transformer, was employed as a source of near-ultraviolet radiation. An aspheric condensing lens of optical glass was used to focus an enlarged image of the lamp on the fluorescent object. Next to the lens were placed glass filters to isolate the 365-mμ line. Corning Glass Works filters Nos. 585 and 986 were found to be satisfactory by spectrographic tests. Light of lower wave length (254 mμ) was found to excite fluorescence other than that due to the uranium-alkali-fluoride system and would also require use of optical materials other than glass. The fluorescent disc, a blank, and a reference disc of canary glass were held in a sliding carriage oriented at 45° to the axis of the illuminating system so as to permit fluorescent and reflected light to enter a Weston Photronic cell oriented at right angles to the illuminating beam. The carriage was constructed of blackened aluminum and served to mask the sometimes irregular edges of the discs. Between the carriage and the cell were placed two filters, which isolated the green fluorescence and prevented ultraviolet and blue light from entering the cell. Corning Glass Works filters Nos. 351 and 428 were employed. The output of the cell was taken through an Ayrton shunt to a sensitive galvanometer (0.001 μA/mm./M). The entire instrument, exclusive of the galvanometer and shunt, was contained in a hardwood box provided with light-tight ventilators. The integral lamp unit was lined with sheet aluminum.

TABLE 1

Relative Fluorescence of NaF-NaCl Discs* Containing Uranium

Added element	Relative fluorescence	Remarks
None	1.0	
Al	0.9	
As	0.9	Disc fragile
B	1.0	
Ba	1.0	
Be	0.9	
Bi	—	Disc fragile and discolored
Br	1.0	
Ca	1.0	
Cb	1.0 (+?)	
Cd	—	Disc adheres to platinum
Ce	0.5	Disc yellowish
Co	0.4	Disc gray
Cr	0.2	Disc pronounced yellow
Cu	0.9	Disc slightly gray
Fe	0.5	Disc yellowish
Hg	0.9	
I	1.0	
Mg	1.0	
Mn	—	Disc blue-green and adheres to Pt
Mo	1.0	
Ni	1.0	
Pb	0.3	Disc fragile and yellowish
Sb	0.3	
Si	1.0	
Sn	1.0	
Sr	1.0	
Ta	1.0	
Th	1.0	
Ti	1.0	
Tl	1.0 (+?)	
V	0.9	
W	0.9	
Zn	0.6	
Zr	1.0	

* The discs contained 35–100 μg. uranium/gram flux and, initially, a threefold excess by weight of added element. Discs were fused 10 minutes at bright red heat and weighed 1.9 grams.

This instrument was used for preliminary studies on the effect of temperature of fusion, composition, and thickness of the alkali fluoride discs, and for subsequent studies on interfering substances. It was found that a mixture of 5.75 parts

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[2] The authors wish to express their thanks to Metal Hydrides, Inc., of Beverly, Massachusetts, for financial assistance which made this work possible.

sodium fluoride with 1.00 part sodium chloride was satisfactory in all respects. The mixture fused easily at about 900° C. in a platinum crucible cover over a Bunsen or Mekker burner and, on rapid cooling in contact with a cold metal block, formed a fine-grain disc, easily separable from the platinum and sufficiently durable to withstand ordinary handling. A disc weighing 2 grams and 30 mm. in diameter was found satisfactory. The crucible covers used were shaped on a hardwood die and cleaned prior to each use by repeated fusions with the flux. The fluorescence of uranium-containing discs was increased by heating at bright red heat for 7 minutes, but decreased on more prolonged heating. Interference by several of the substances listed in Table 1 was reduced by heating, maximum fluorescence being attained in most cases in from 7 to 10 minutes.

Under the conditions cited, the fluorescence of the discs, as measured by the galvanometer deflections, showed a nearly linear relation to the uranium content over the range 0.2–50.0 μg. uranium/gram flux. At higher concentrations of uranium, up to 300 μg./gram flux, a smooth curve was obtained. (The maximum reported by Nichols and Slattery (*3*) is found at much higher concentrations.) The curves were used directly as working curves, by standardizing the instrument with a uranium glass disc at frequent intervals and making the occasional slight correction required by the blank. This type of instrument is capable of very great sensitivity, although the accuracy might be considerably improved by substitution of a phototube balanced circuit for the single barrier-layer cell.

It was required that the second fluorophotometer be portable, light, and able to withstand rough handling. Since great accuracy was not essential, an exceedingly simple type of visual comparator was used. This consisted of a comparator wheel on which were mounted standard alkali fluoride discs and a holder for the disc to be examined. The concentration of uranium in the standard discs varied geometrically from 0.1 to 200 μg./gram flux. The source of ultraviolet was a General Electric 4-watt RP-12 lamp, which may be operated from a 24-volt battery through a variable 25-ohm resistance. This lamp radiates principally in the vicinity of 365 mμ and is far more effective than the common 110-volt argon glow lamp. A Corning Glass Works filter No. 584 was used to eliminate practically all visible light. The instrument, including batteries, was housed in a specially designed plywood case measuring 6 x 7 x 10 inches (Fig. 1). The weight was only 4.8 pounds. The method of preparing discs for use in the portable comparator is similar to that mentioned above, except that, in field use, a gasoline blowtorch is used, and necessary weighings are accomplished with a portable balance. Sampling is more time consuming than the actual analysis, which requires 20 minutes at the most.

Because of the requirements imposed, standard techniques for the chemical separation of uranium from samples were not considered feasible. Under ordinary conditions, the method of Hoffmann (*2*) is satisfactory but tedious. A semiquantitative study of the effect of relatively large amounts of impurities was undertaken and is recorded in Table 1. Of the substances studied, antimony, bismuth, cadmium, cerium, cobalt, chromium, iron, lead, manganese, and zinc were found to interfere seriously, because they quench the fluorescence due to uranium, obscure it by coloring the flux, or render the disc brittle. Northup (*4*), in a recent article, gives a more extended discussion of substances which interfere qualitatively with the fluorescence of sodium fluoride beads, together with a study of the effect of columbium, the one element which shows fluorescence similar to that due to uranium.

Several possible procedures for inactivating or volatilizing the above-mentioned impurities were tried. It might be expected that many of these elements could be volatilized as the halide by heating with ammonium chloride, hydrofluoric acid, etc. This procedure was fairly successful with iron, but in all cases significant amounts of uranium were lost. Attempts to volatilize chromium as chromyl chloride were unsuccessful for the same reason. Dilution of the sample with flux did not greatly alter the extent of interference, except that fragility was decreased.

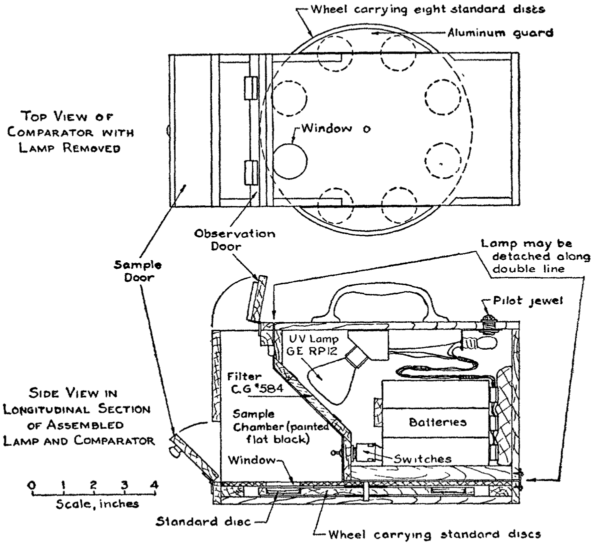

FIG. 1

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A Simple Resistance Thermometer for Blood-Temperature Measurements[1]

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In connection with an instrumentation program for the Medical Research Laboratory, Edgewood Arsenal, a compact field instrument has been developed for the intravenous meas-

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[1] This work was carried out under contract with the Medical Division of the Chemical Warfare Service and was under the direction of A. H. Pfund. The authors wish to thank Capt. Lawrence Hobson (MC), AUS, for whom the instrument was constructed, for his suggestions, enthusiastic use of the instrument, and patience. We are indebted to Mr. C. B. Green, of the Bell Telephone Laboratories, for supplying the thermistor elements and pertinent information.

[2] Now with Leeds and Northrup Company, Philadelphia, Pennsylvania.