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Radiation Laboratory

Contract No. W-7405-eng-48

Summary of the Research Progress Meeting

February 17, 1949

Henry P. Kramer

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Radiation Laboratory
University of California
Berkeley, California

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Summary of the Research Progress Meeting

February 17, 1949

Henry P. Kramer

Excitation Functions from Th Bombardment. W. Meinke.

	225	226	227	228	229	230	231	232	233
U			2m(?)	9m(?) d,K	58m α,K	21d α	4d K	70y α	
Pa		1.9m(?) α,K	38m α,K	22h α,K	1.5d α,K	17d β^-,K	$3x10^4$y α	1.3d β	27d β
Th								10^{10}y	

Table 1.

Extension of the Isotope Table

The bombardments were made on $Th(NO_3)_4$ which was attached to the jiffy probe and blown in and out of the cyclotron pneumatically. The object of the research was to find the short-lived Pa^{226}. The half-life was found to be 1.9 m. The following isotopes were also discovered recently: 38 min. Pa^{227} from 100 Mev deuteron bombardment in the 184" cyclotron, 22 hr. Pa^{228}, 58 min. U^{229} from α bombardment. The assignments of the 9 min. half-life to U^{228} and the 2 min. activity to U^{227} are doubtful.

It is quite difficult to do chemical analysis on the extremely short half-lives which are expected in this section of the table. In some cases the analysis was performed on the Health Chemistry truck on the way to the chemistry laboratory.

Figures 1, 2, and 3 show the excitation functions of the reactions $Th^{232}(d,7n)Pa^{227}$, $Th^{232}(\alpha,p8n)Pa^{227}$, $Th^{232}(\alpha,7n)U^{229}$.

Development of a Rapid Method to Ascertain the Degree of Exposure to Radiation.

R. Rosenthal.

A reliable method of measuring the resistance of liquids has been applied to

observe the change in the resistance of the blood during clot formation and retraction. The experiment is reproducible to such an extent that a definite correlation has been established between the stages and the extent of clot formation and the resistance of the coagulating blood. It is expected that this method of resistance measurements will be useful in evaluating radiation damage since one of the most pronounced effects of radiation, resulting in a large number of the deaths which are attributable to it, is the abnormal release of heparin into the blood stream with the result that blood clotting is thwarted. Thus, it is hoped that the extent of a decrease in the slope of the resistance-time curve from the normal will furnish a quantitative criterion for judging the release of heparin through radiation.

The apparatus is presented in Figure 4. The position of the electrodes with relation to the blood clot is shown in Figure 5. Resistance curves which were obtained for normal, and polycythemic blood samples are drawn in Figures 6, 7, and 8.

In the course of this research an interesting phenomenon was seen to result from radiation of rats. After the blood clot had been removed the remaining serum exhibited a pearly white opalescence (See Figure 9). The degree of opalescence seemed to be related to the extent of radiation damage since those rats whose blood was the most opalescent died sooner than those whose blood was less affected.

During the discussion which followed the talk it was mentioned that opalescence was observed in blood after a fatty meal and consequently some speculations were made regarding the relation between radiation, the presence of opalescence in the blood, the increase in heparin concentration and the possibility that the opalescence might be due to a suspension of fatty particles in the blood stream.

A more detailed discussion of the material which was presented is contained in "Measurement of the Electric Resistance of Human Blood; Use in Coagulation Studies and Cell Volume Determinations," Robert L. Rosenthal, M. D. and Charles W. Tobias, Ph. D., The Journal of Laboratory and Clinical Medicine, Vol. 33, 9, 1110, September 1948, and UCRL-273 "Opalescence of Serum after Total Body Radiation as a Prognostic Sign of Death," Robert L. Rosenthal, January 14, 1948.

The Synchrotron. E. McMillan.

The intensity of the beam has been increased since the last report. Previously, the unevenness of the pulse sizes was mentioned. This was attributed to time jitters in the injection system. The machine is now operating with high rather than with low peaks. The x-ray output is 200 mr/hr. and the x-ray surge appears about .1 μ sec. after injection and has a "half-width" of .02 μ sec.

Adjustments have been made on the timing of injection. Figure 10 shows the injector pulse in relation to the acceptance voltage which electrons must have in order to be accelerated in a stable orbit during betatron operation. The injector pulse is shaped so that its top has the same slope as the acceptance voltage. The intensity was improved by timing the injection so that the peak of the injector pulse coincided with the band of acceptance voltages.

The intensity has also been improved by adjusting the magnet-end coils.

The magnetic field across the doughnut has been recalibrated with a search coil connected to a 60 cycle supply. It was found that the rate of increase of the magnetic field is quite linear to 12,000 gauss (corresponding to 20 kv) and becomes slower above this value. At present the machine is operating at 16 kv indicated voltage and a repetition rate of 16 discharges per second through the condenser bank to produce 335 Mev electrons. Since it was found that the flux change is linear up to 20 kv. it will be possible to use the entire available voltage interval to achieve an acceleration of electrons to 360 Mev.

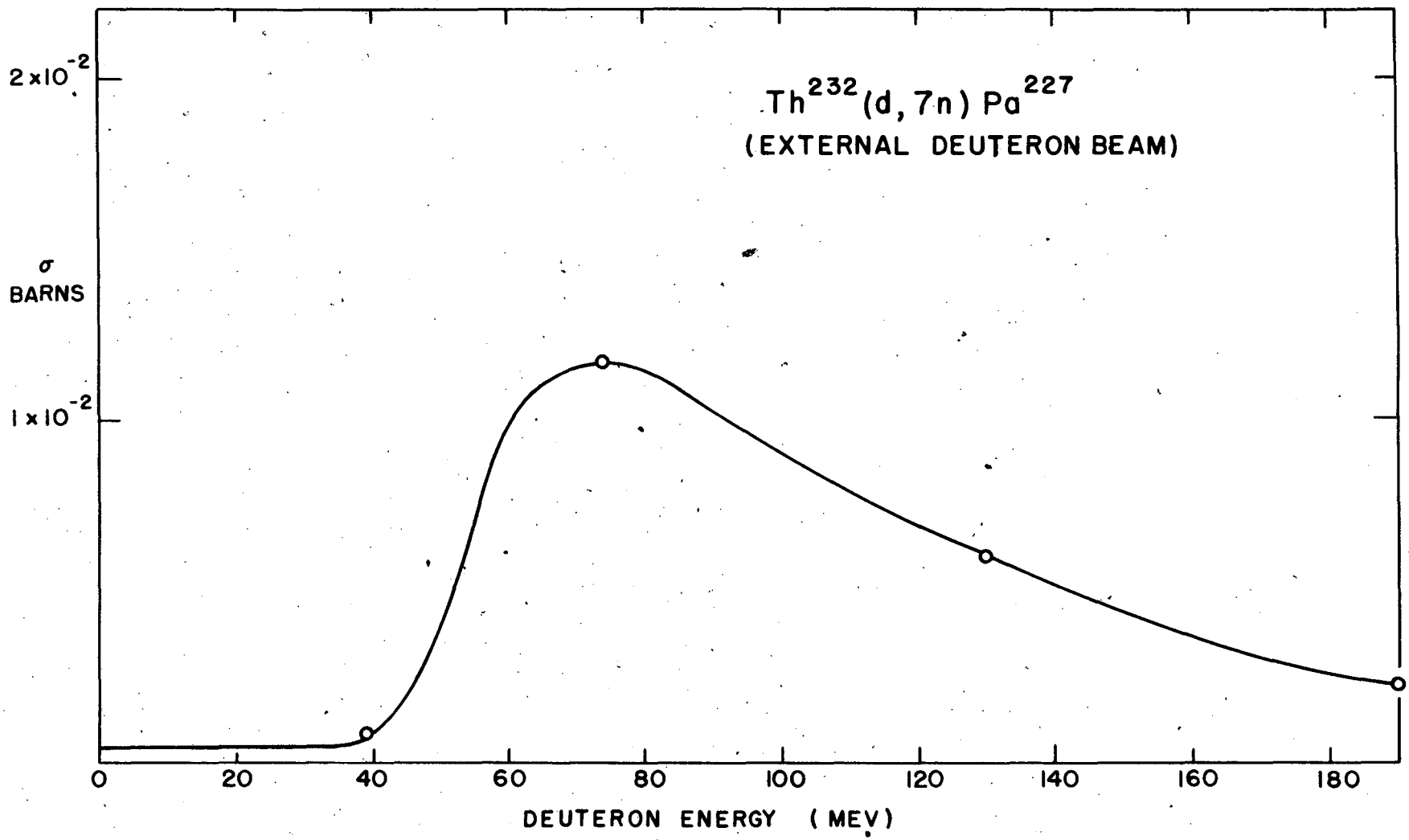

$Th^{232}(d, 7n)\ Pa^{227}$
(EXTERNAL DEUTERON BEAM)
2×10^{-2}
1×10^{-2}
σ
BARNS
0
20
40
60
80
100
120
140
160
180
DEUTERON ENERGY (MEV)

FIG. 1

OZ 369

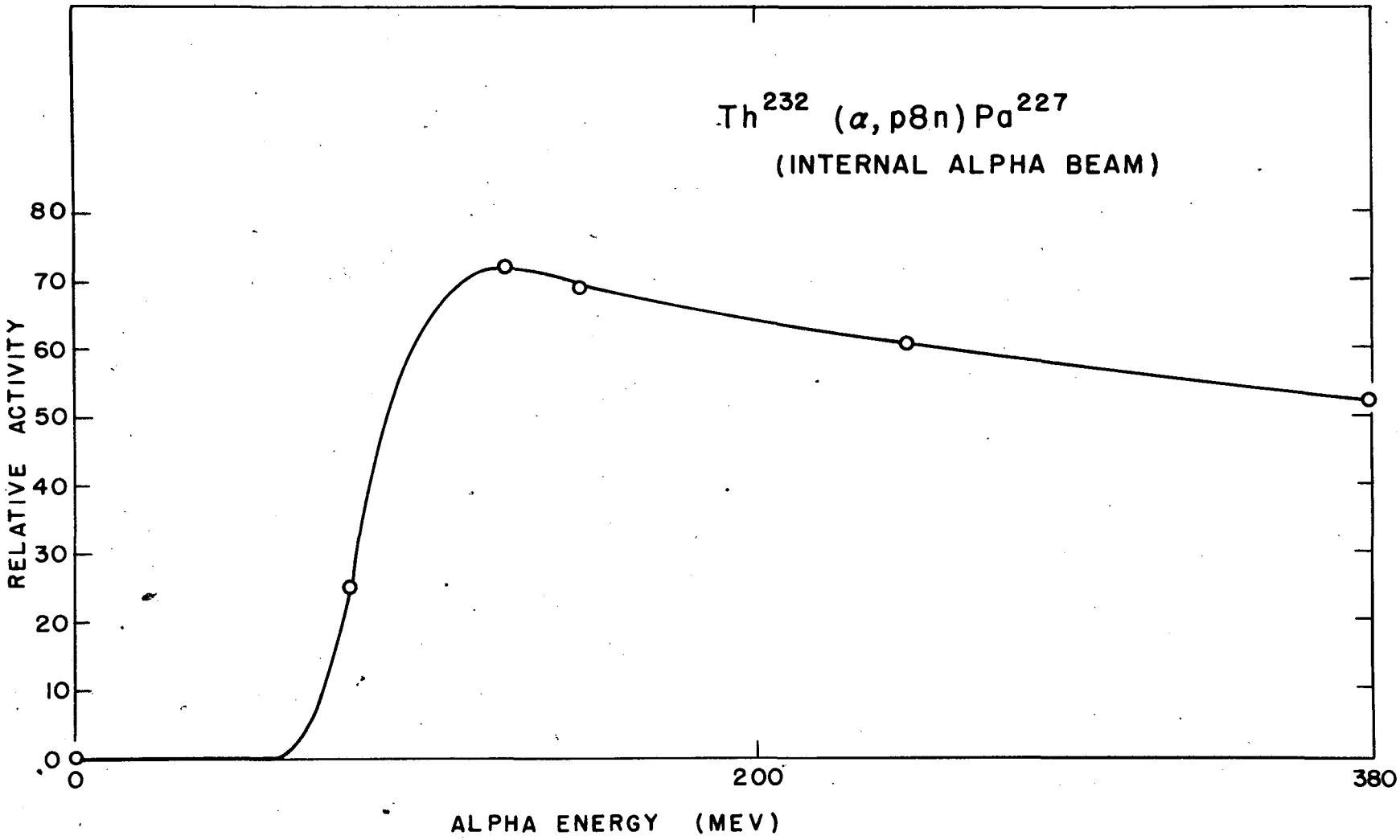

Th^{232} $(\alpha, p8n)$ Pa^{227}
(INTERNAL ALPHA BEAM)
RELATIVE ACTIVITY
80
70
60
50
40
30
20
10
0
0
200
380
ALPHA ENERGY (MEV)

FIG. 2

OZ 371

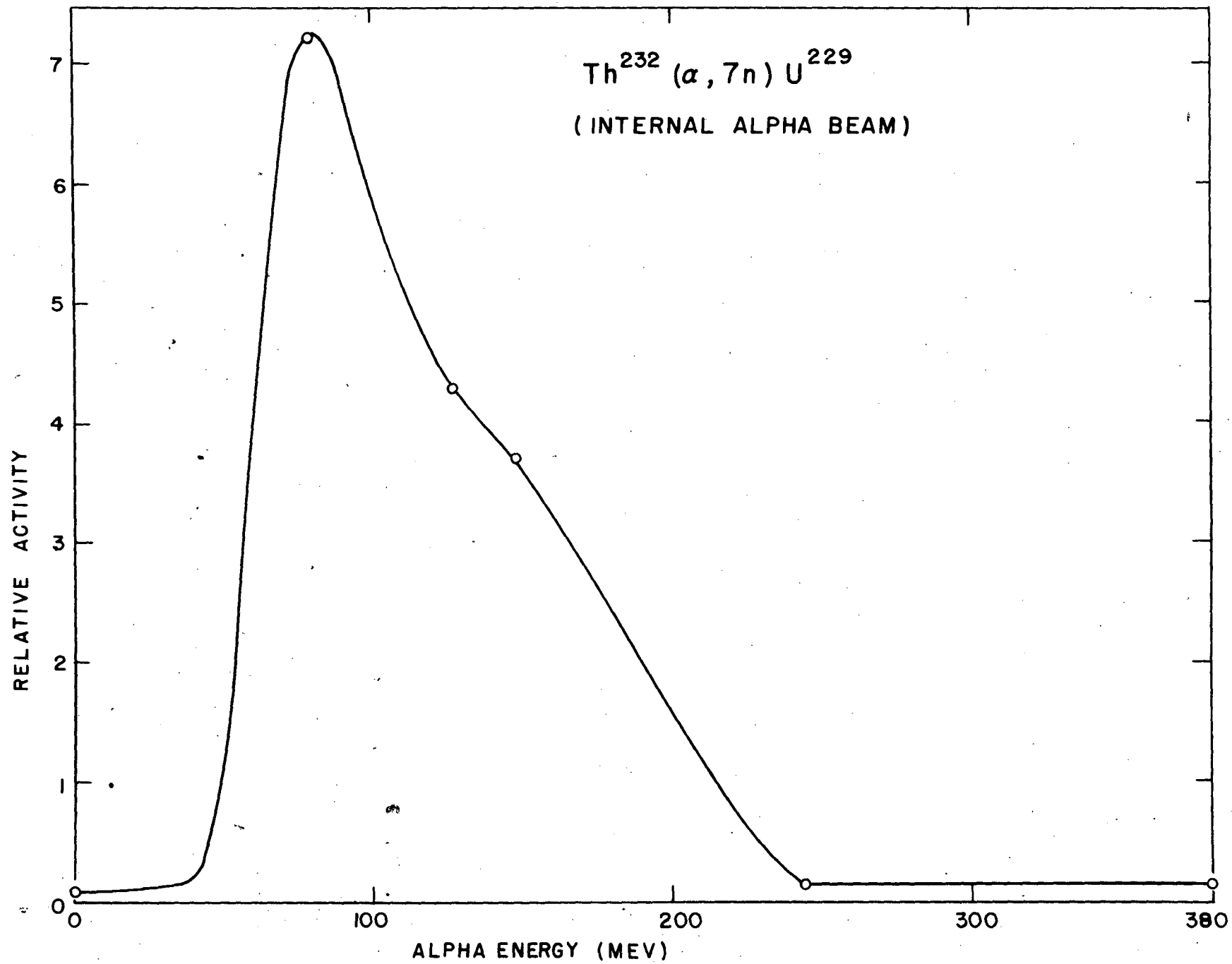

$Th^{232}(\alpha, 7n)U^{229}$
(INTERNAL ALPHA BEAM)
RELATIVE ACTIVITY
0
1
2
3
4
5
6
7
0
100
200
300
380
ALPHA ENERGY (MEV)

FIG. 3

OZ-370

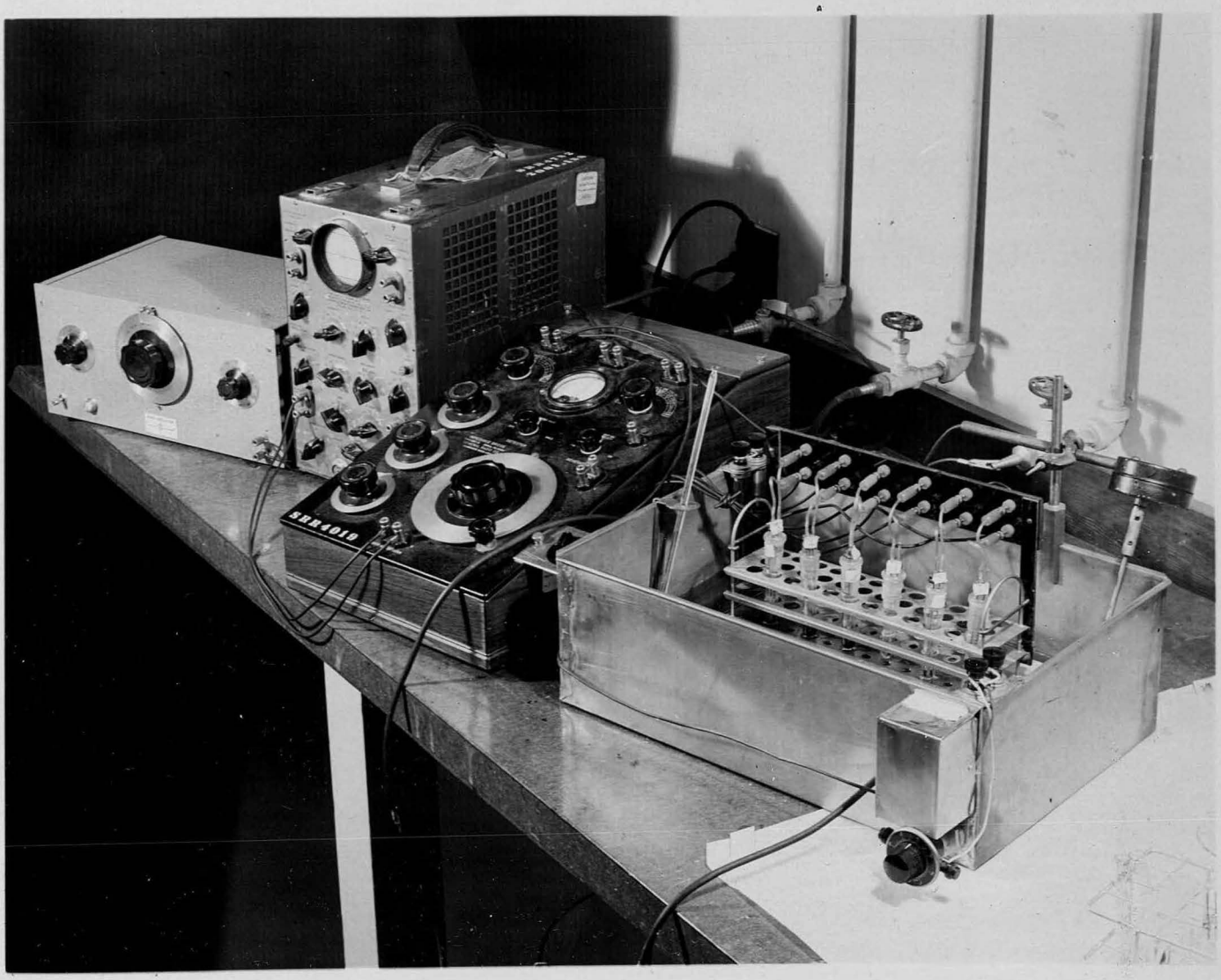


FIG. 4

OZ 366

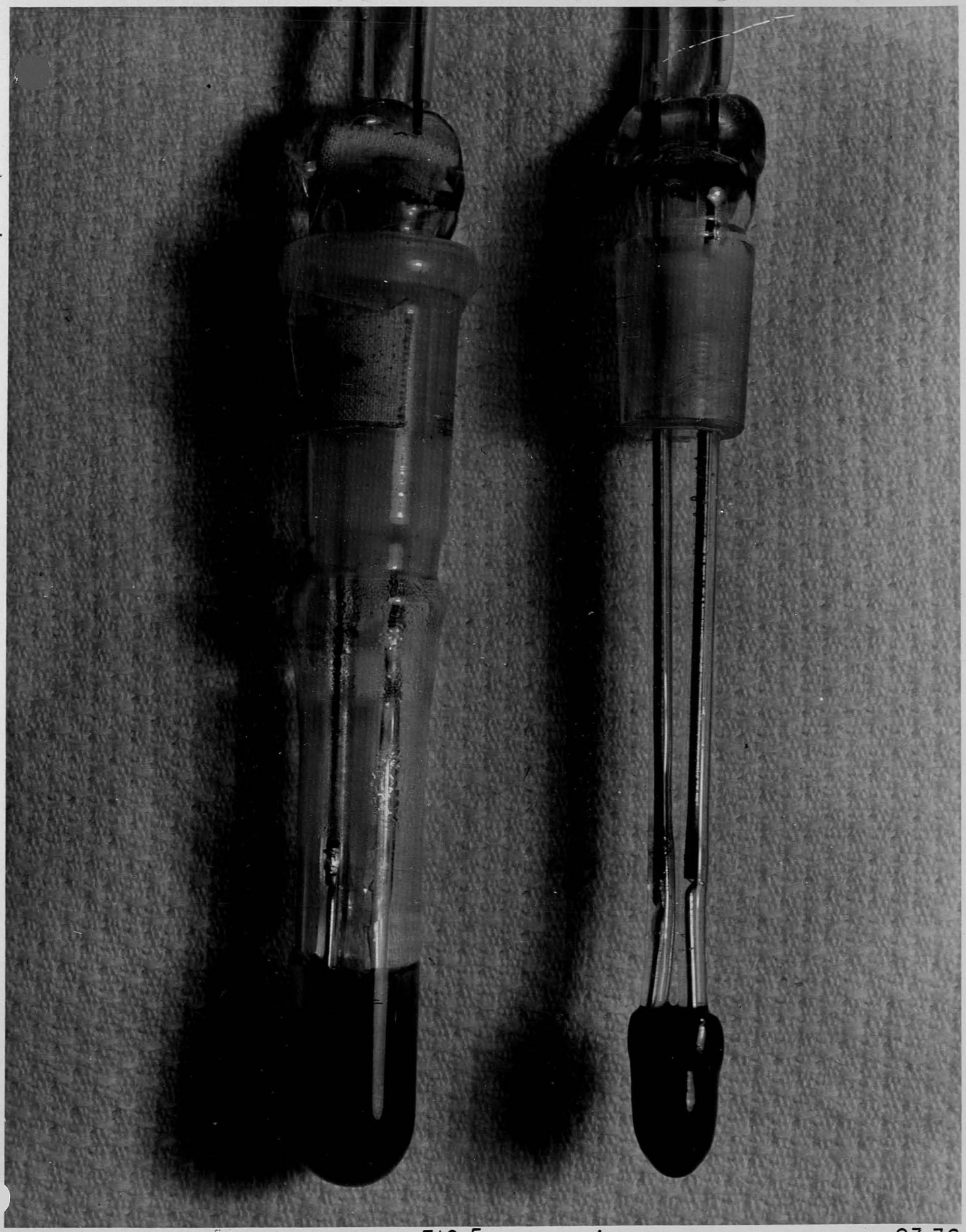


FIG. 5

OZ 365

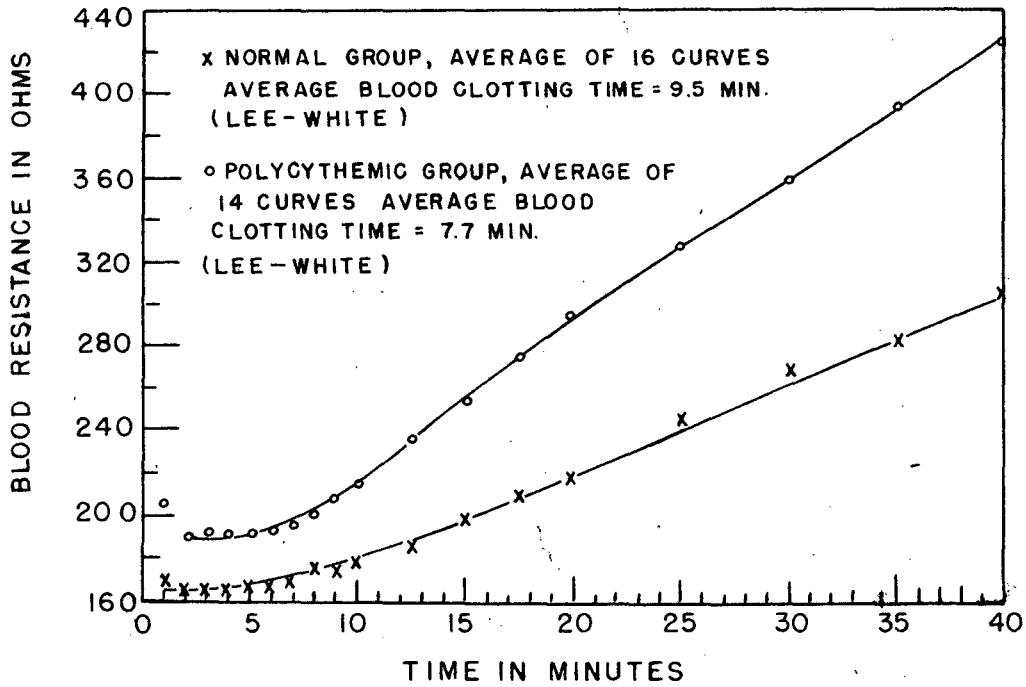


FIG. 6

CURVES OF THE AVERAGE BLOOD RESISTANCE DURING CLOTTING FOR SIXTEEN NORMAL AND FOURTEEN POLYCYTHEMIC SUBJECTS.

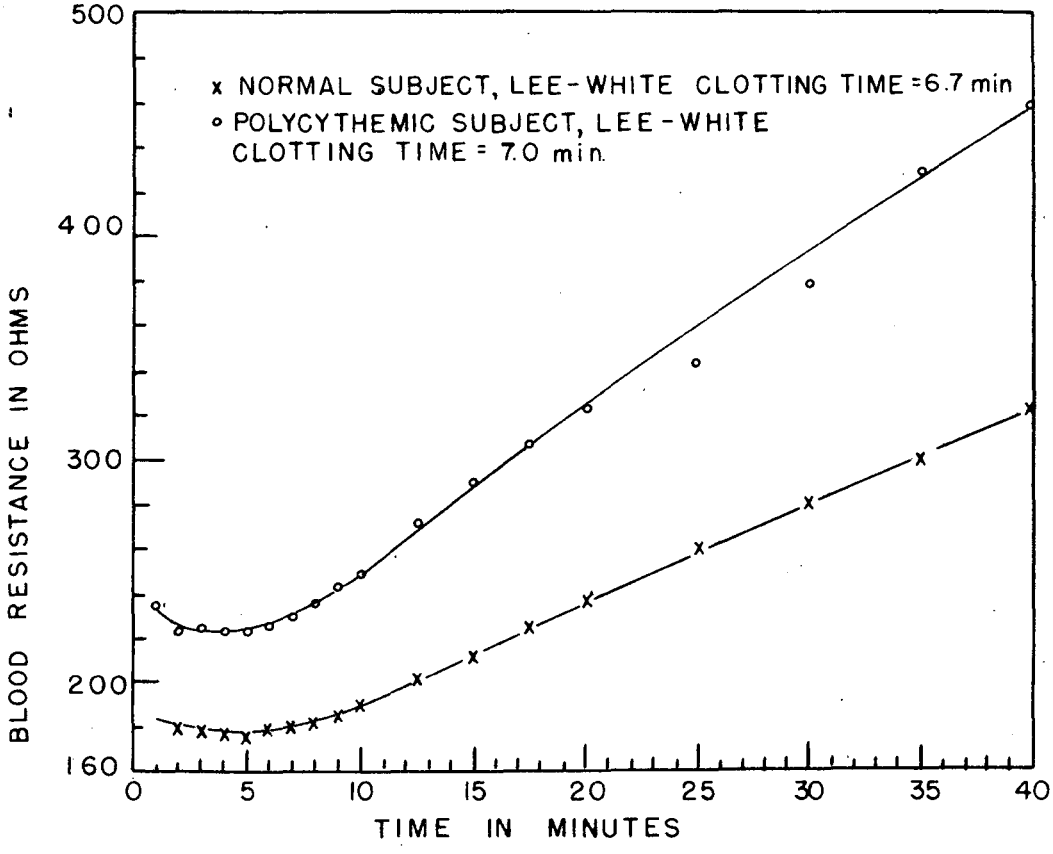


FIG. 7

BLOOD RESISTANCE CURVES DURING CLOTTING FOR A NORMAL AND A POLYCYTHEMIC SUBJECT.

13616-1

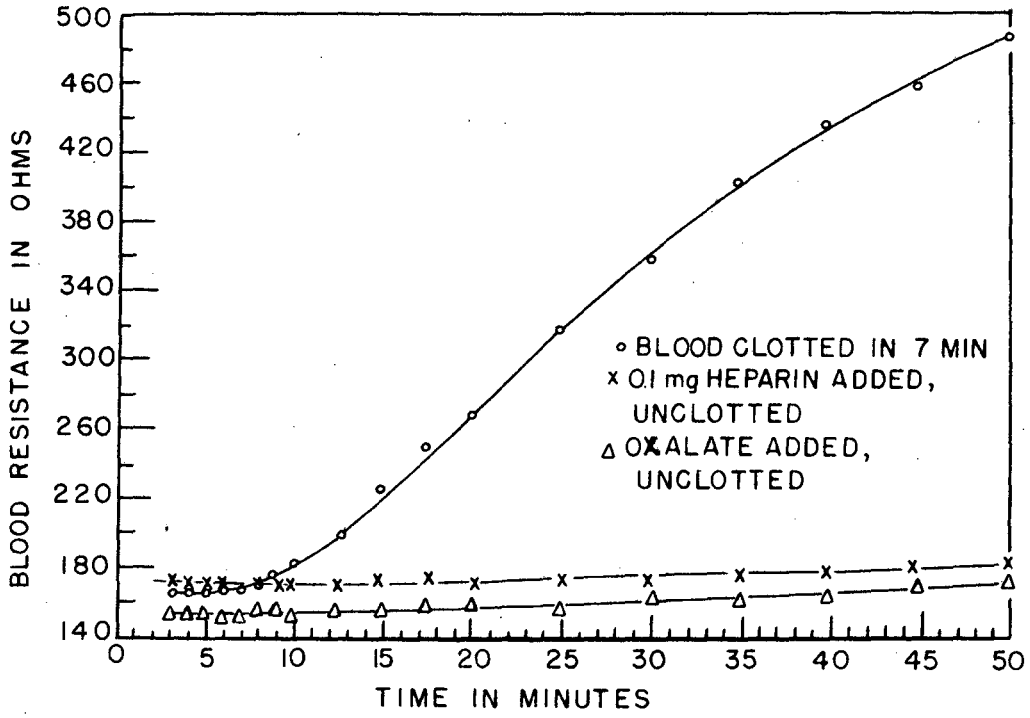


FIG. 8

RESISTANCE MEASUREMENTS SHOWING THE EFFECT OF RENDERING BLOOD INCOAGULABLE BY THE ADDITION OF ANTICOAGULANTS SUCH AS HEPARIN AND OXALATE. THE CHANGES DURING CLOTTING FOR THE BLOOD OF THE SAME SUBJECT ARE SHOWN FOR COMPARISON.

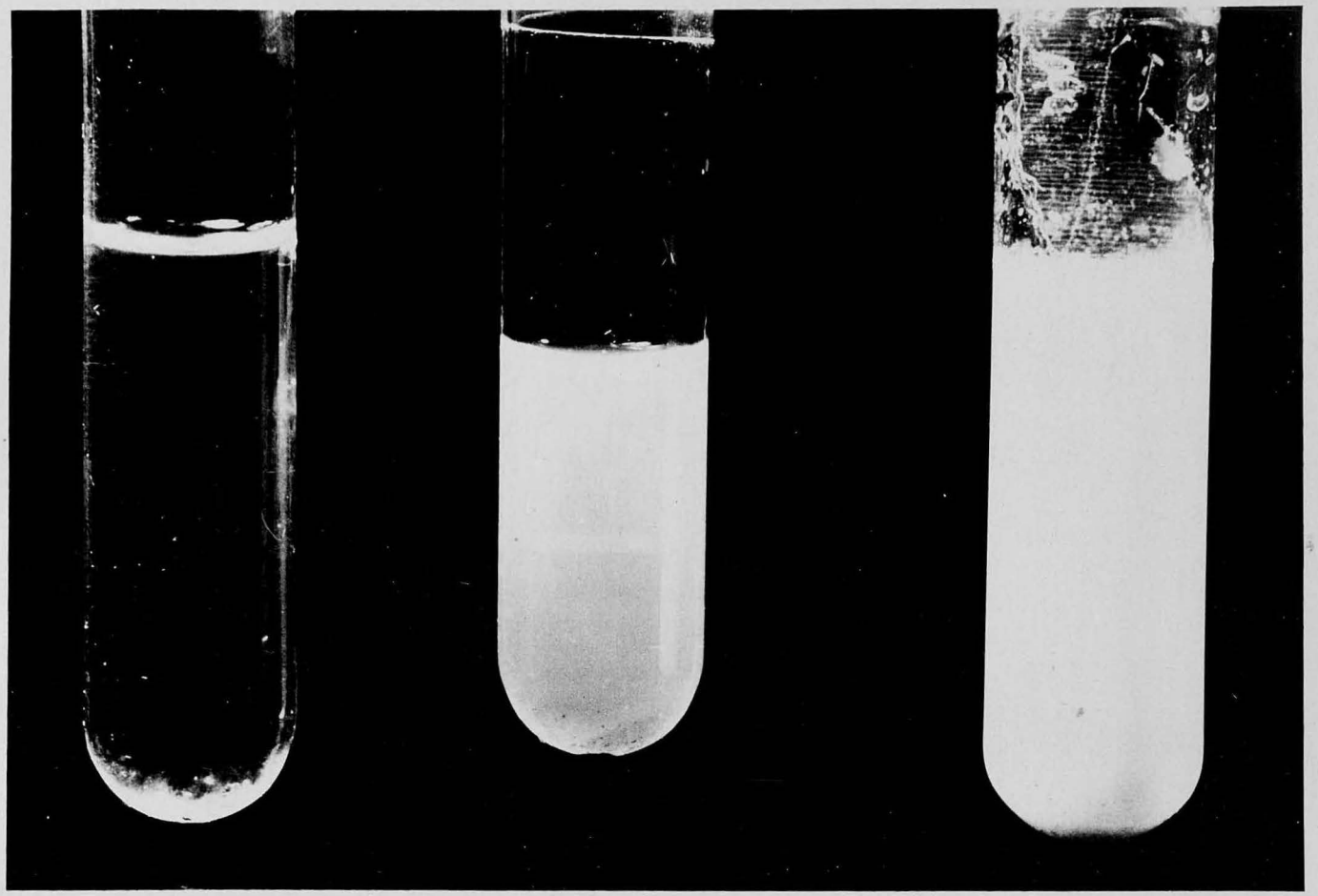
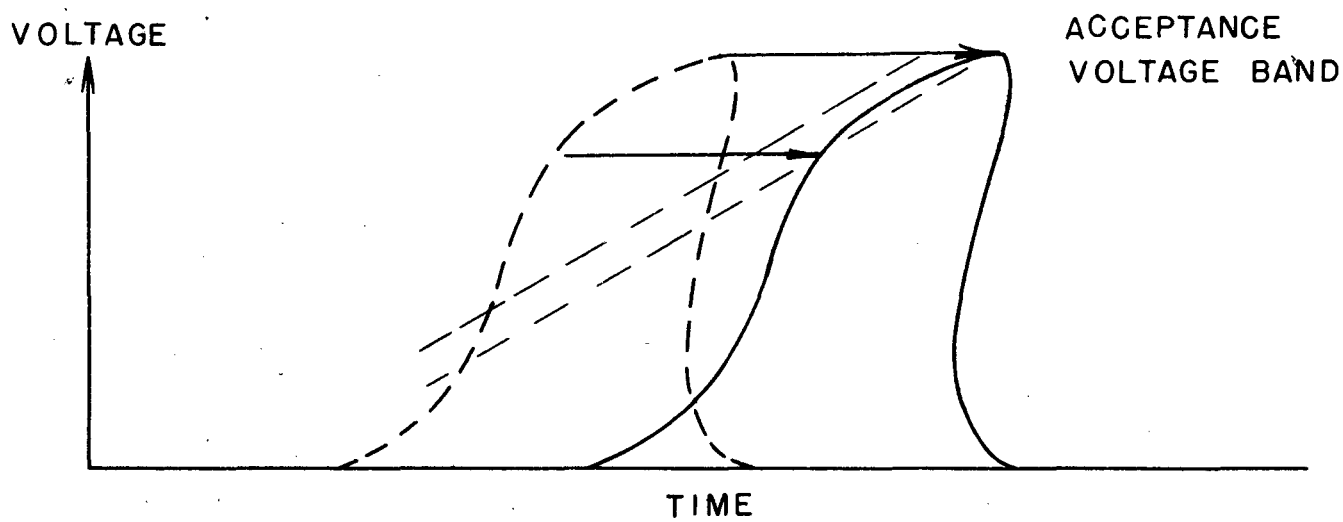


Fig. 9. Tube at left shows clear serum as found before irradiation of rabbit. Center tube shows moderately opalescent serum (rabbit #16, 24 hours after irradiation; animal sacrificed 34 days after irradiation). Tube at right shows markedly opalescent serum (rabbit #15, 24 hours after irradiation; died a a few hours later).



RELATION BETWEEN INJECTION PULSE AND ACCEPTANCE VOLTAGE.

FIG. 10

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