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Unclassified TWX P182206Z May 79

REPORT PROPERLY DECLASSIFIED

By J B Stuart 8-20-79

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SUMMARY OF THE RESEARCH PROGRESS MEETING

May 26, 1949

H. P. Kramer

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SUMMARY OF THE RESEARCH PROGRESS MEETING

May 26, 1949

H. P. Kramer

Isotopes of Americium and Curium. K. Street.

Am^{241} was irradiated in a neutron flux from the 184-inch cyclotron with a view to identifying some new short lived Am and Cm activities.

Assignment of the isotopes is hampered by the difficulty of chemical separation of Am and Cm and of these from the rare earths. The separation of Am from Cm was first achieved by B. B. Cunningham, et al. about two years ago by elution with a citrate solution from an ion exchange column. A high degree of separation requires so much time that the short-lived activities decay below the level of detection before the separation is complete. For purposes of isotope identification it has, however, been found that a compromise with the sharpness of separation was possible and that therefore the time consumed by the chemical analysis could be reduced.

The following section of the table of isotopes has been tentatively filled.

	238	239	240	241	242
Cm	2.5 h. 6.5 Mev α		27 α α,k		150 α 6.2 Mev α
Am	1.2 h. K capture	12 h	50 h	~500y. 5.5 Mev α	17 h ≧ 400y.

The long lived Am^{241} was subjected to a neutron flux from the 184-inch cyclotron. A 17 h. β activity was observed. After separation from the α emitters Am^{241} and Cm^{242}, this activity was assigned to the first known transuranic isomer Am^{242}.

It was decided to re-examine the two K capture Americium activities that were reported by G. T. Seaborg, R. A. James and L. O. Morgan and assigned to mass numbers

238 and 239. These K-capture activities were produced by a 10 Mev deuteron bombardment and it is thought now that they ought to be assigned as shown in the table, the 12 h. activity to 239 and the 50 h. activity to 240. The 238 place is now thought to be occupied by a 1.2 h. K-capture isotope.

The yield from an 80 Mev α bombardment of Cm has tentatively been identified as Cm^{238} (2.5 h. 6.5 Mev α). It is also believed that Cm^{240} (27 d. α K?) and Am^{238} (2 h. K) were found.

A limit of 20 percent has been set on the K-capture branching ratio of Cm^{240} by milking of Am^{240} and finding that this K-capture daughter constituted less than 20 percent of the decay products of Cm^{240}.

Hemoglobin Synthesis in Humans. J. Hennessey.

The uptake of iron in the red blood cells of normal persons and those with polycythemia and leukemia was studied by means of radioactive Fe^{59}. The iron was administered intravenously in small doses. Since it is taken up only in the formation of new red cells, the quantity of radioactive iron present is proportional to the number of red cells formed after administration of Fe^{59}. The rate of formation of red cells is sketched in Fig. 1 for polycythemia, and leukemia patients and normal persons. The graph demonstrates that the nature of these diseases is the production of blood cells at an excessive rate.

By introducing Fe^{59} into the plasma and determining the total volume of plasma in the body by measuring the dilution of Pu^{32} it was possible to observe the rate of depletion of labeled iron and the blood and thus to gain knowledge of the rate of renewal of the red cells. It was found that the half time of disappearance was about 110 min. for normal subjects, 60 to 110 min. for leukemia patients and 15 to 60 min. for polycythemia patients. The iron turnover in the plasma is indicated in Fig. 2.

The assumption that underlies the usefulness of the results is of course that Fe^{59} attaches to the protein molecules in the red cells in the same fashion that

ordinary iron does.

The results are biased by the fact that no patients with polycythemia or leukemia were examined who had not had any previous treatment.

Cerenkov Radiation. R. Mather.

If the velocity of a charged particle passing through a medium is greater than the velocity at which the electric and magnetic fields associated with it are propagated in the medium, that is, when $v > c/n$ where v is the velocity of the particle and n is the index of refraction in the medium, then visible radiation is emitted in a cone whose axis coincides with the line of motion of the particle and whose apex is away from the direction of motion. The diagram of Fig. 3 illustrates that the half aperture θ of this cone is given by

$$\cos \theta = \frac{c/n \, \Delta t}{v \, \Delta t} = 1/n\beta.$$

The number of quanta within the frequency band $d\nu$ that are emitted in a length of path ℓ has been calculated to be

$$dN = 2\pi/137 \sin^2\theta \, (\ell/c \, d\nu).$$

According to this formula, one expects to observe 500 visible quanta/cm. in the deflected proton beam of the 184-inch cyclotron.

This type of radiation was first produced in 1937 by Cerenkov with an electron beam. It is believed that it has now been produced with particles other than electrons, namely cyclotron accelerated protons.

The geometry of the experiment is sketched in Fig. 4. The proton beam passes through a semi-cylinder of heavy flint glass. Any light that is emitted is focussed by a hemispherical mirror situated below the flint onto a photographic plate held horizontally above the radiator. The apparatus was exposed to radiation for 30 min. and when the photographic plate was examined, a spot of light was observed at a position corresponding to a semi-aperture of $\theta = 41.6°$. For the type of flint glass that was used, $n = 1.925$. And thus, by the formula above, $\beta = .6947$, and from this

one calculates that the energy of the proton beam is 366 ± 40 Mev.

Since fluorescent light that is produced by radiation is emitted isotropically, it was felt by the experimenter that the absence of a complete circle of light on the photographic plate and the presence of a pronounced spot of focused light at approximately the correct angle with the direction of the beam was satisfactory evidence that the phenomenon was produced by Cerenkov radiation.

Some members of the audience, however, expressed uneasiness over the fact that the flat surface of the cylinder perpendicular to the direction at which the observed light was emitted might favor light of whatever origin to such an extent that the presence of a spot on the plate might not be considered perfectly irrefutable evidence for Cerenkov radiation.

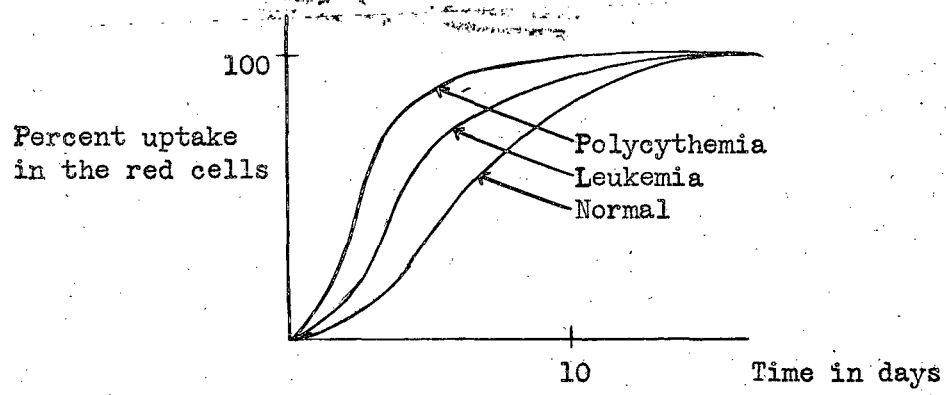

Fig. 1

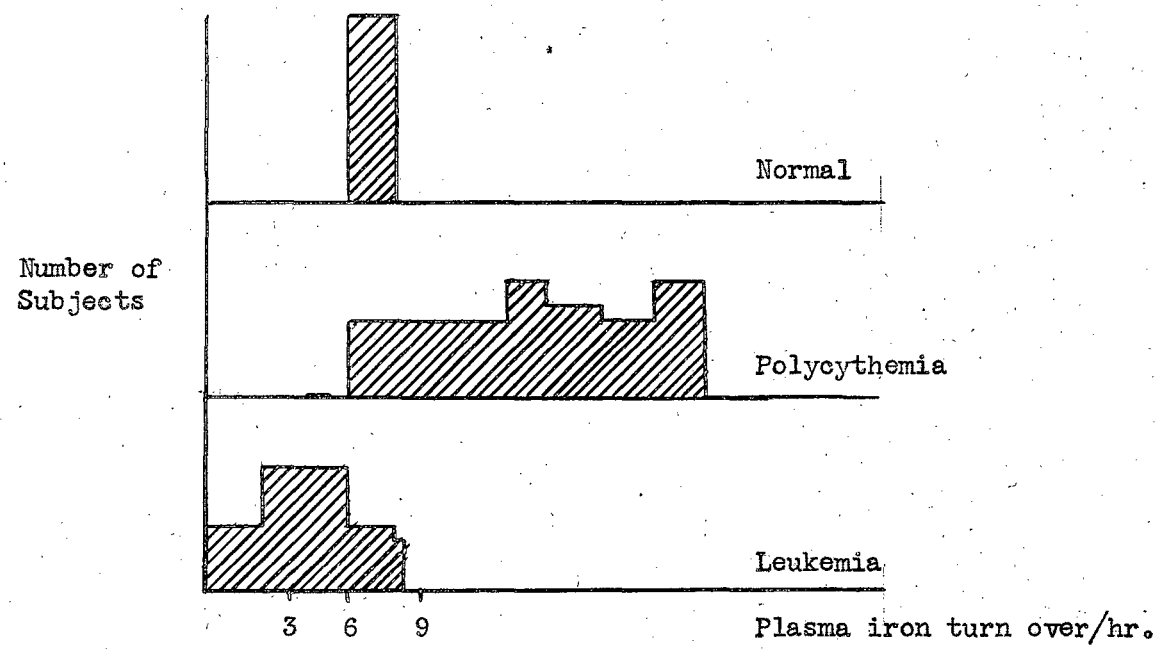

Fig. 2

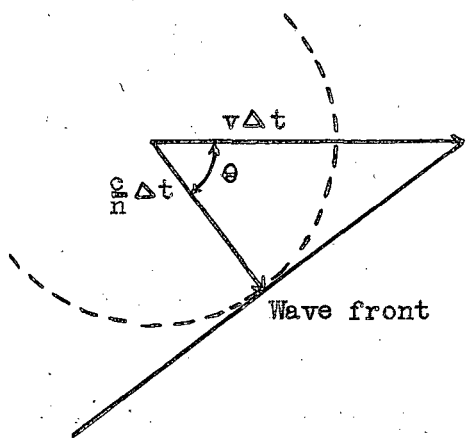

Fig. 3

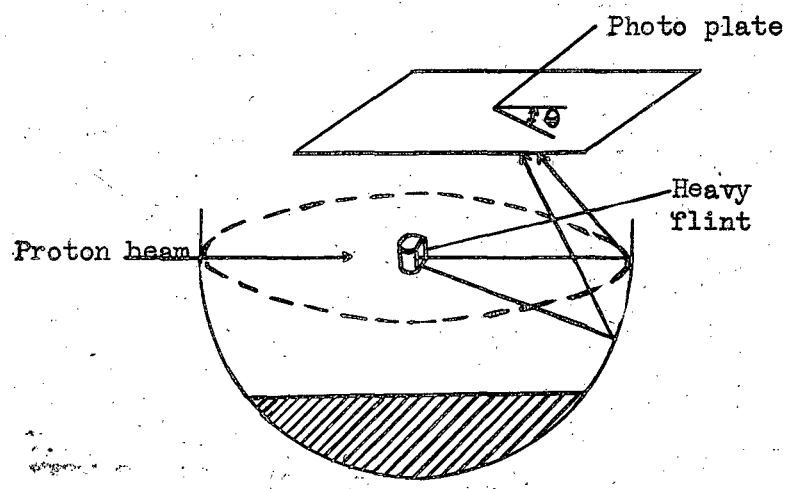

Fig. 4

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