TABLE 1

REARING OF BODY LICE ON CLOTH IMPREGNATED WITH DDT

	Test 1		Test 2	
	0.1% DDT	Con-trol	0.1% DDT	Con-trol
Total newly hatched lice at beginning of test	153	58	189	54
Percentage surviving to adult stage, 15 days at 80°–90° F	34	67	36	83
Percentage eggs hatching	$\frac{270}{383} = 70$	$\frac{430}{541} = 79$	$\frac{250}{376} = 66$	$\frac{271}{367} = 74$

the month of May, the fifth month of routine application, over 34,000 lbs of 10% DDT powder were used. The percentage of infestation by weeks for the month of May as determined by a random check of about 3% of the men was 35.5, 49.2, 51.0, and 42.4, respectively.

To determine whether more frequent application would give better results, a segregated group of 40 infested men was treated every third day for 15 days. Another group of 40 men, 20 of whom were infested and 20 apparently uninfested, were treated similarly and housed together in a separate tent. On the fifteenth day 35 were still infested in the first group and only 5 remained uninfested in the second group.

Impregnation of clothing and blankets by immersion in a 2% DDT-xylene emulsion was somewhat more effective, but not sufficiently so to merit adoption as a control measure. In a segregated group of 84 men whose effects were so treated, daily counts showed that the percentage of infested individuals dropped from 68% before treatment to 17% on the eighth day after treatment, then increased to 38% by the fourteenth day. Observations were discontinued at this point because it was not practicable to keep the group segregated for a longer period.

In laboratory tests 3 samples of 10% DDT louse powder applied to cloth at the rate of 0.021 g/sq in. gave mortalities for adult lice which ranged from 33 to 65% in 24 hr, with 27–45% remaining normal. Nine such tests were performed, using 20 lice per test. A fourth sample containing 5% DDT powder in Pyrax, kindly furnished by W. V. King, U. S. Department of Agriculture, Orlando, Fla., and known to be of acceptable potency against a standard laboratory strain of body lice, was tested in a similar manner. Ten tests, using 20 lice each, gave an average mortality of 46%, with 34% remaining normal after 24 hr exposure. When lice were confined within treated sleeves, which could be worn, thus permitting normal feeding, there were 41.5% normal test lice and 48% normal controls at the end of 48 hr in one test, and 60.5 and 61.7%, respectively, in a second. Under similar test conditions a powder containing 0.25% DDT gives 100% mortality in a standard laboratory strain of lice (*2*). The second test utilized the sample of proved potency previously mentioned. Four hundred lice and 10 subjects were employed in each test.

Lice were reared through their complete life cycle and produced a large number of viable eggs on cloth impregnated with 0.1% DDT solution in acetone (Table 1).

Cloth impregnated with a .05% solution is lethal to a standard laboratory strain (*3*). The solution of DDT used to impregnate the cloth was tested against the fourth instar larvae of *Anopheles sinensis,* a highly sensitive insect, and in two trials gave 83 and 90% mortality, respectively, in 24 hr, in a concentration of 1 part in 10 million. This DDT had been in storage as a 10% powder in talc for 5 years. Chemical analysis gave the DDT content as 10.4% by weight.

Since 1947 DDT resistance in houseflies has been reported from numerous localities where DDT has been in use. Laboratory experiments have demonstrated that resistant strains can be developed by selective breeding (*4*), and this has been interpreted as indicating that such a process occurs in nature. It seems probable that an analogous condition exists in the body louse. Hitherto, great dependence has been placed on DDT for the control of typhus. It now appears to be of uncertain value, being unsuitable for this purpose in some localities.

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Transition Energy Determination for Orbital Capture

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An element decaying by orbital electron capture to the ground state of the daughter element has x-rays of the daughter element as its principal detectable emission. There are, however, undetectable neutrinos and a weak but detectable γ-ray continuum (*1*). This spectrum is analogous to the continuous γ-ray, generally called "internal bremsstrahlung," accompanying β-ray transitions (*2, 3*). The spectrum of the γ-rays accompanying the β-transitions extends up to the maximum energy of the β-rays, and in the K-capture transitions the spectrum extends to the transition energy plus the energy obtained from the K-electron captured by the nucleus. The energy from the K-electron is the rest energy of an electron (0.511 mev) less the K-orbit binding energy.

The shape of the γ-ray spectrum to be expected

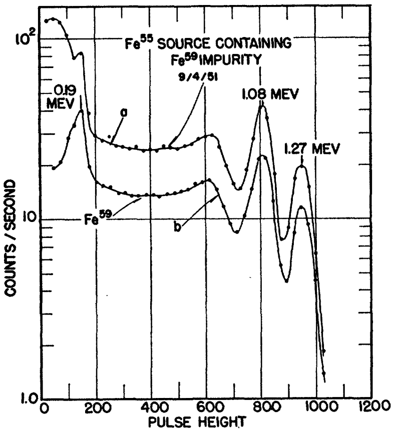

FIG. 1. Pulse height spectrum of Fe^{55} and Fe^{59} γ-rays.

from an allowed transition has been calculated by Morrison and Schiff (*1*) and by Jauch (*4*) and is given by the relation

$$N(\omega)d\omega = C(\omega)\,\frac{\alpha}{\pi m_o^2 c^4}\,\frac{\omega}{W_o^2}\,(W_o-\omega)^2 d\omega, \qquad (1)$$

where $N(\omega)$ is the number of photons lying in the energy interval $d\omega$ at energy ω. W_o is the maximum photon energy which is related to the energy of transition E_o by Eq (2):

$$W_o = E_o + m_o c^2 - E_k, \qquad (2)$$

where $m_o c^2$ is the self-energy of an electron and E the K-shell binding energy. The factor $C(\omega)$ is a complicated function that is slowly varying except at very low energies. The inner bremsstrahlung spectrum is quite weak; the total number of photons goes as W_o^2 (*4*) and is about 3×10^{-5}/disintegration for Fe^{55}. The inner bremsstrahlung have been detected from Fe^{55} by Bradt *et al.* (*5*), and their average energy estimated as 70 kev, yielding a transition energy of 150 kev.

We have measured a sample of Fe^{55} (containing a small amount of Fe^{59}) with a scintillation spectrometer (*6–7*), using a N_aI-Tl phosphor. Fig. 1 (*a*) shows the pulse spectrum obtained. Fig. 1 (*b*) is the pulse spectrum of a small sample of Fe^{59}. The low energy end of 1 (*a*) shows the continuous γ-ray inner

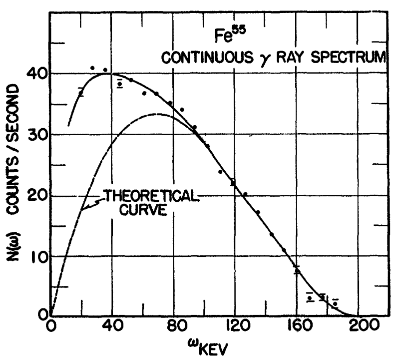

FIG. 2. γ-ray spectrum obtained by subtracting the Fe^{59} curve from the spectrum of impure Fe^{55}. The theoretical curve was obtained from the straight line in Fig. 3.

bremsstrahlung spectrum. The strong peak at 190 ± 5 kev in both curves is the missing crossover γ-ray of Fe^{59} not previously reported. Other runs of these two samples were made at higher gain, and the Fe^{59} contribution was subtracted to obtain the Fe^{55} radiations. Such a spectrum is shown in Fig. 2.

An inspection of Eq (1) shows its similarity to the relation for the β-ray distribution given by the Fermi theory. If the experimental $N(\omega)$ is treated in the same way as done for β-rays by Kurie, Richardson, and Paxton (*8*), we obtain

$$\frac{N(\omega)\,\mathrm{exptl}}{C(\omega)\,\omega} = K(W_o-\omega), \qquad (3)$$

where K is a constant. Since $C(\omega)$ is slowly varying, we may to a first approximation consider it constant. Fig. 3 shows the plot resulting from the data of

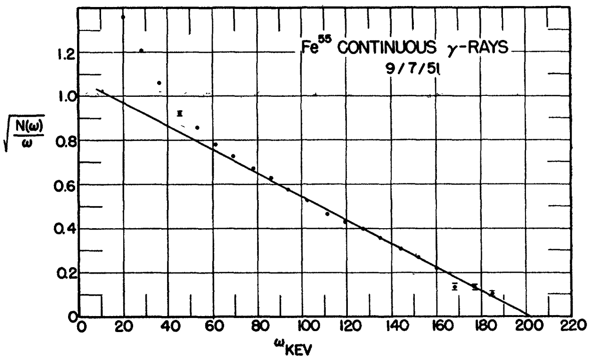

FIG. 3. Linearized plot of continuous γ-ray spectrum.

Fig. 2. It is approximately linear, showing that the transition is allowed, and intercepts the energy axis at $W_o = 206\pm20$ kev.

This value for the transition energy including the K-electron energy must be considered approximate, since correction has not been made for resolution and efficiency. Fortunately the efficiency of the crystal (2.5 cm thick) is very nearly unity for this energy range. The Mn x-rays have been absorbed out by the crystal container and a lucite absorber inserted to stop the Fe^{59} electrons.

The energy of this transition can be obtained from the Q value for the $Mn^{55}(p,n)Fe^{55}$ reaction. Using the value of $Q = 1.006$ mev reported by Stelson and Preston (*9*), the value obtained is $W_o = 217\pm10$ kev, with which our value is in good agreement.

This new method for K-capture transition energies is now being extended to other isotopes.

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