amino acids observed. In 5 normal animals the irradiated insulin caused quite a pronounced decrease (Table I). Quantitatively the

TABLE I.
Effects of irradiated insulin on demedullated rabbits.

NORMAL					ADRENO-DEMEDULLATED				
Post-injection values after 1.5 and 3 hr. % initial					Post-injection values after 1.5 and 3 hr. % initial				
Amino N		Blood Sugar		Insulin	Amino N		Blood Sugar		Insulin
1.5	3	1.5	3	used	1.5	3	1.5	3	used
97	89	79	110	Cryst.	99	99	100	101	U- 80
86	75	61	92	"	97	101	96	100	U-100
92	83	69	81	"	101	100	101	101	U-100
87	89	88	98	"	99	100	89	96	Cryst.
78	86	81	98	"	99	99	92	98	"
					98	99	87	93	"

results differ from those obtained by Davis, Luck, and Miller in that no tendency towards hyperglycemia was observed. Indeed, for reasons that are still obscure, we were unable to *totally* destroy the hypoglycemic activity of the insulin, despite substantial increases in irradiation time and intensity. In the adreno-demedullated rabbits the irradiation product was completely inactive, such hypoglycemia as was observed being confined to the normal animals.

The results clearly indicate that the irradiated insulin, though inactive to a large extent wth respect to blood sugar, retains a substantial portion of its activity with respect to blood amino acids. The facts accord with the hypothesis that the irradiation of insulin by soft X-rays does not destroy its ability to stimulate the adrenal medulla.

7966 C

A Comparison of the Resistance of Bacteria and Embryonic Tissue to Germicidal Substances. III. Mercurochrome.

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Lambert and Meyer[1] bathed fragments of rabbit spleen in a suspension of *Staphylococcus aureus* for one minute followed by immersion in graded solutions of mercurochrome for 20 minutes.

[1] Lambert, R. A., and Meyer, J. R., PROC. SOC. EXP. BIOL. AND MED., 1926, **23**, 429.

Tissue cultures were then prepared in hanging drops of homologous plasma, following 2 washings of the tissue in physiological salt solution. A second set of hanging drop cultures was made from non-infected tissues similarly exposed with appropriate controls of untreated tissues. Mercurochrome in a dilution of 1-250 killed *Staphylococcus aureus,* 1-500 killed fragments of spleen tissue.

German[2] bathed skin of chick embryos in solutions of mercurochrome for one and 5 minutes. They were washed in Locke's solution, then embedded in a mixture of plasma and embryonic extract. For the bacterial tests, fragments of muscle and fascia were bathed in a broth culture of *Staphylococcus aureus* followed by immersion in the various dilutions of mercurochrome. After periods of one and 5 minutes the fragments were planted on agar plates. "Efficiency indexes" were determined by multiplying the percent of tissue cultures showing growth by the percent of bacterial cultures showing inhibition at the same concentration. Mercurochrome gave an efficiency index of 0.0132 (perfect germicide = 1.00).

Buchsbaum and Bloom[3] prepared chick tissue cultures in which the various dilutions of mercurochrome were embedded in chick plasma. The test organism, *Staphylococcus aureus,* was added to the embryonic fluid. The cultures were observed for bacterial and tissue growth after 24 and 48 hours' incubation. They stated that an antiseptic killing the bacteria at concentrations that would not harm the cells would have an index of 1.0 or greater (greatest dilution that killed the organisms divided by the greatest concentration in which cells show approximately normal growth). Mercurochrome was given an index of 0.5.

In previous papers in this series[4, 5] comparisons were made of the resistance of *Staphylococcus aureus* and embryonic chick heart tissue to Merthiolate, Metaphen and phenol. Toxicity indices were determined by dividing the highest dilution of germicide showing no growth of the embryonic chick heart fragments in 48 hours by the highest dilution capable of killing *Staphylococcus aureus* in 10 minutes but not in 5. Toxicity indices were as follows: Metaphen 12.7; phenol 12.9, and Merthiolate 35.3. Metaphen showed a *Staphylococcus aureus* phenol coefficient of 92; Merthiolate gave a coefficient

[2] German, W. J., *Arch. Surg.*, 1929, **18**, 1920.

[3] Buchsbaum, R., and Bloom, W., PROC. SOC. EXP. BIOL. AND MED., 1931, **28**, 1060.

[4] Salle, A. J., and Lazarus, A. S., PROC. SOC. EXP. BIOL. AND MED., 1935, **32**, 665.

[5] Salle, A. J., and Lazarus, A. S., PROC. SOC. EXP. BIOL. AND MED., 1935, **32**, 937.

of 71. Theoretically, the smaller the toxicity index the more nearly perfect the germicide.

The methods followed were the same as those given in the first paper.[4] A *Staphylococcus aureus* phenol coefficient was first determined by the method of Reddish, followed by the addition of graded amounts of mercurochrome to embryonic chick heart tissue embedded in plasma and contained in Carrel flasks.

The highest dilution of phenol required to kill *Staphylococcus aureus* in 10 minutes but not in 5 was 1-65. For mercurochrome it was 1-40. This gave mercurochrome a *Staphylococcus aureus* phenol coefficient of 0.6.

Young, White and Swartz[6] found that mercurochrome in a concentration of 1-1,000 in urine killed *Staphylococcus aureus* in 1 minute; a 1-5,000 concentration in 5 minutes. Lancaster, Burnett and Gaus[7] reported that a 1-1,000 concentration of the germicide in Ringer's solution showed no growth of *Staphylococcus aureus* in 6-10 minutes. In the presence of serum, however, the activity was greatly decreased, a 1-100 solution required one hour to kill the organism. Scott and Hill[8] stated that a 1-60 dilution of mercurochrome in alcohol-acetone-water killed *Staphylococcus aureus* in one minute. Birkhaug[9] reported a *Staphylococcus aureus* phenol coefficient of 1.7. On the other hand Simmons[10, 11] stated that a 1-50 dilution of the germicide failed to kill the above organism in 10 minutes.

The tissue culture results are summarized in Table I.

TABLE I.

Germicide	Highest Dilution Showing no Tissue Growth = A	Highest Dilution Showing no Growth of *Staphylococcus aureus* = B	Toxicity Index = A/B	*Staphylococcus aureus* Phenol coefficient
Phenol	1-840	1-65	12.9	
Mercurochrome	1-10,500	1-40	262.0	0.6

It is seen that mercurochrome possesses considerable toxicity when tested by the tissue culture method. The germicides so far

[6] Young, H. H., White, E. C., and Swartz, E. O., *J. Am. Med. Assn.*, 1919, **73**, 1483.

[7] Lancaster, W. B., Burnett, F. L., and Gaus, L. H., *J. Am. Med. Assn.*, 1920, **75**, 721.

[8] Scott, W. W., and Hill, J. H., *J. Urol.*, 1925, **14**, 135.

[9] Birkhaug, K. E., *J. Am. Med. Assn.*, 1930, **95**, 917.

[10] Simmons, J. S., *J. Inf. Dis.*, 1926, **39**, 273.

[11] Simmons, J. S., *J. Am. Med. Assn.*, 1928, **91**, 704.

studied may be placed in the following order on the basis of their toxicity indices: Metaphen 12.7; phenol 12.9; Merthiolate 35.3; and mercurochrome 262.0.

Scott and Hill[8] stated that a 1-50 dilution of mercurochrome in alcohol-acetone-water "has a relatively low toxicity as shown by the vigorous way that tissue cultures and transplants have grown after its use." von Oettingen, Calhoun, Badertscher and Pickett[12] reported that the tissue toxicity of mercurochrome was relatively low, but a 5% aqueous solution was distinctly injurious as judged by excised ciliated mucous membranes.

On the basis of the above results it is concluded that mercurochrome is relatively toxic and rated considerably poorer than any of the germicides so far studied when tested by the tissue culture technique.

7967 P

Effect of 1-2-4 Dinitrophenol on Oxygen Uptake of Rat Tissue.

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Since Cutting and Tainter[1] and Magne, Mayer and Plantefol[2] have observed that small quantities of dinitrophenol cause a marked acceleration of the metabolism of animals, it seemed desirable to determine whether this drug accelerates the oxygen uptake of excised tissue.

The experiments here reported are a continuation of those given in a previous preliminary report.[3] The preparation of the rat tissue slices and the measurement of the oxygen uptake was done as previously described,[4] the tissue being suspended in glucose phosphate (pH 7.4) Ringer's solution. Four Warburg vessels were employed in each instance, 2 serving for the control observations. The fol-

[12] von Oettingen, W. F., Calhoun, O. V., Badertscher, V. A., and Pickett, R. E., *J. Am. Med. Assn.*, 1932, **99**, 127.

[1] Cutting, W. C., and Tainter, M. L., PROC. SOC. EXP. BIOL. AND MED., 1932, **29**, 1268.

[2] Magne, H., Mayer, A., and Plantefol, L., *Ann. Physiol. Physicochem. Biol.*, 1932, **8**, 1.

[3] Muntwyler, E., PROC. SOC. EXP. BIOL. AND MED., 1934, **31**, 621.

[4] Muntwyler, E., and Binns, D., *Am. J. Physiol.*, 1934, **108**, 80.