

below to well above normal, female skin consistently produces feathers of a higher grade than male skin at the same concentrations. Even at the extremes reached in these experiments, only an approximation to sex reversal (1+ and 3+) was attained. This indicates that in these species of pheasants the genetic factor is an important one in the determination of sex differences in plumage, and the results afford no support for the theory of equipotentiality as originally formulated.

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Chilling as an Effective Means of Delousing.

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Louse-borne relapsing fever and typhus fever are prevalent in North China where they often assume epidemic proportions. Since these infections are transmitted by body-lice, delousing will always remain one of the most effective means of controlling them. In China's northern provinces the natural temperature during the months from November to February is stated to fluctuate between -16°C . and -40°C . The problem is to devise an effective, practical, and cheap means of delousing the clothing and other belongings of large numbers of people, especially troops, who are exposed to relapsing fever and typhus fever and live under conditions in which on account of economic and other difficulties, the usual type of delousing by means of moist or dry heat is not available. Hence, a series of experiments has been conducted to test the resistance of body-lice and their eggs to chilling, a natural means which is always available without cost during winter in cold regions.

Altogether 2,922 male and female body-lice varying from 4 days to 32 days old divided into 40 lots, and 2,370 eggs in 9 lots were subjected to chilling at temperatures ranging from -1°C . to -25°C . for various periods of time. Many thousands of lice and their eggs were also subjected to temperatures varying from 5°C . to 8°C . for many days. In most instances the chilling was accomplished by placing the different lots of lice and eggs contained in different cages in a special refrigerator which is adjustable to give any desired temperature from 0°C . to -25°C . In a few instances the lice subjected to chilling were kept in a small test-tube which was closely

wrapped with a thick layer of cotton-wool in all directions. The thickness of this cotton-wool coat measured 3 cm. when uncom-pressed but measured only 0.5 cm. when compressed. In some instances the chilling was done by merely exposing the lice contained in cages to the outdoor winter temperature and the minimum and maximum temperatures to which the insects were subjected for a given time were recorded with a suitable thermometer.

Death of lice was confirmed by the fact that recovery never took place when these chilled insects were brought back to temperatures between 25°C. and 37°C. In many instances the chilled lice still showed slow and sluggish rhythmic contractions of their stomachs, but they were neither able to move nor ever recovered, and hence can be safely regarded as dead. The results of these experiments may be summarized as follows:

1. Chilling out-of-doors, at a temperature fluctuating between -10°C. and -14°C. for 9 hours, or between -10°C. and -12°C. for 13 hours is lethal to body-lice. This is not in agreement with the observations of Kisskalt and Friedmann¹ and Zabel as cited by Halberkann² who stated that chilling at -12°C. overnight or at -15°C. for several days was not lethal to body-lice.
2. Chilling in a special refrigerator at a temperature of -17°C. for 2 hours, or at a temperature of -25°C. for one hour is lethal to body-lice.
3. It requires chilling for 3 hours at a temperature of -17°C. or for 2½ hours at a temperature of -25°C. to kill body-lice when they are protected by a compressed layer of cotton wool 0.5 cm. thick.
4. When fed once daily many body-lice survive a temperature fluctuating from 5°C. to 8°C. for 6 to 8 weeks.
5. Chilling at temperatures between -6°C. and -8°C. for 36 hours or between -10°C. and -11°C. for 10 hours does not kill body-lice. This is in keeping with the observations of Heymann³ and Hase⁴ who found that chilling overnight at -8°C. or -10°C. was not lethal to body lice.
6. Chilling at 5°C. for 7 days or more prevents most of the eggs of body-lice from hatching, but chilling at -17° or at -25°C. for 2 hours effectively prevents all eggs of lice from hatching. This is

¹ Kisskalt, K., and Friedmann, A., *Deut. med. Woch.*, 1915, **41**, 397.

² Halberkann, J., *Arch. f. Schiffs- u. Tropenhyg.*, 1916, **20**, 5.

³ Heymann, B., *Z. f. Hyg.*, 1915, **80**, 298.

⁴ Hase, A., *Die Biologie der Kleiderlaus*. Original article not available; cited by Da Rocha-Lima and Sikora in ref. 5.

in harmony with the observations of Sikora⁵ but does not agree with the findings of Widmann⁶ and Kisskalt,⁷ who stated that chilling overnight at -5°C . or at -10°C . did not prevent eggs of lice from hatching.

Conclusion. Chilling for a sufficient period is an effective means of destroying both body-lice and their eggs. Where refrigerators having a temperature lower than -12°C . are available, the delousing of valuable furs and other delicate garments which would be damaged by moist or dry heat, can be safely and effectively achieved by this means.

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Photodynamic Action of Various Dyes on Bacteria.

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In the presence of ordinary visible light from an electric bulb, methylene blue was found to exert a rapid bactericidal action on certain bacteria which survived the same dye even in higher concentration in the absence of lamplight.¹ At the same time, gram negative bacilli were found to be highly resistant to this action of methylene blue. In continuation of a systematic study of photodynamic action of dyes on bacteria, various other common dyes have been chosen, and tests with representative gram positive and gram negative organisms repeated. The result of such a study is hereby presented.

Saline solutions of eosin, mercurochrome, acid fuchsin, basic fuchsin, and fluorescein, and a commercial 2% solution of trypaflavine were used. Bacteria were grown on either blood- or plain meat-infusion agar for 24 hours and were then suspended in saline. Except in the case of trypaflavine, which was diluted with the suspension to the desired concentrations, suspensions were added to equal parts of dyes in the different dilutions recorded in Table I.

In order to facilitate the study of a large number of specimens at the same time, the procedure previously employed was slightly

⁵ Da Rocha-Lima, H., und Sikora, H. *Handbuch der Biologischen Arbeitsmethoden*, 1925, **12**, 769.

⁶ Widmann, E., *Z. f. Hyg. u. Infek.*, 1915, **80**, 289.

⁷ Kisskalt, K., *Deut. med. Woch.*, 1915, **41**, 154.

¹ T'ung, T., *PROC. SOC. EXP. BIOL. AND MED.*, 1935, **33**, 328.