A PHYSIOLOGICAL BASIS FOR THE DIFFERENTIAL RESISTANCE OF THE TWO RACES OF RED SCALE TO HCN[1]

There has been considerable interest in the two physiological races of red scale, *Aonidiella aurantii* (Mask.), since their discovery by Quayle.[2] This particular study has to do with the physiological basis of the resistance or non-resistance to HCN fumigation. Two pure strains were very kindly furnished by Dr. D. L. Lindgren[3] of Riverside. The last instar females were carefully removed from the host, either squash or grapefruit, prior to fertilization and placed in a closed chamber under the microscope and the spiracles carefully observed while several dilutions of HCN were admitted to the chamber. In all, 46 females of the resistant race and 17 females of the non-resistant race have been studied. There is no observable difference in the structure of the spiracles of the two races. There are two apparent positions of the inner structure of the spiracles. Testing with oil has shown that in one position the spiracle is closed and in the other it is open. The opening and closing are concurrent with a pulsation of the tracheal trunk. In the normal insect the tracheal trunk pulsates from the open to a partly closed position about 60 times a minute. On admitting HCN to the chamber the behavior of the spiracles of the two races is markedly different. In each race the spiracles close within three to five minutes after the cyanide reaches them. In the resistant race the spiracles remain closed as long as HCN is present for at least 30 minutes. In the non-resistant race the spiracles remain closed for only about one minute and then open and death follows in a short time if the cyanide concentration is lethal. The resistant scale can survive a lethal concentration of cyanide for at least 30 minutes. The closure of the spiracle was tested in each doubtful case by placing a drop of oil upon the insect. The oil penetrated readily if the spiracles were in the open position but did not penetrate when they were in the closed position. The five resistant individuals which failed to maintain closure of the spiracles during fumigation were known to have been injured during removal from the host. There seems no doubt but that the relative ability to maintain closure of the spiracles is sufficient to explain the difference in resistance to HCN of the two races. This study and others now in progress to determine the possible existence of a difference in the cyanide insensitive respiration and also the effect of other substances on spiracular closure will be reported in full elsewhere. A material which would cause failure of closure would be of the utmost practical importance.

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[2] H. J. Quayle, *Jour. Econ. Ent.*, 15: 400–404, 1922.

[3] D. L. Lindgren, *Hilgardia,* 11: 5, 213–225, 1938.

PALM PATTERNS AND HANDEDNESS[1]

Investigation of the handedness and palmar dermatoglyphics of the members of twenty-six families reveals an association within families between pattern D in the fourth interdigital area and functional handedness. Within fifteen of these families variations occur in respect to both traits. The following combinations of the two traits appear within the 348 paired sibs.

Concordant in handedness and pattern D	145 pairs
Concordant in handedness, discordant in D	64 pairs
Discordant in handedness, concordant in D	68 pairs
Discordant in handedness and D	71 pairs

Analysis of these data in a 2×2 table gives a Chi square value of 14.8, a highly significant figure. Thus sibs are much more likely to be alike or unlike in respect to both traits than they are to be alike in one and unlike in the other.

In the general population pattern D occurs with equal frequency in both right and left handers. In the twenty-six families studied, no significant relationship exists between handedness and sex or pattern D and sex. These findings would seem to eliminate pleiotropy and sex-linkage as the agencies responsible for the association. Autosomal linkage between factors responsible for handedness and the formation of pattern D appears to be the most likely cause of the association. The investigation will be continued with a large number of additional famiiles.

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THE EARLY USE OF IMPLANTED ELECTRODES FOR STIMULATION OF THE CORTEX CEREBRI

After we had made more than one report on the results of cortical stimulation with implanted electrodes[1] with a method that was evolved from those of Loucks,[2] and Chaffee and Light,[3] and Mussen,[4] there came to my attention the "Method of Ewald"[5] as used

[1] This investigation was made possible by a grant from the National Research Council.

[1] J. W. Ward and S. L. Clark, *Arch. Neur. and Psychiat.*, 38: 927, 1937.

[2] R. B. Loucks, *Jour. Comp. Psychol.*, 16: 439, 1933.

[3] E. L. Chaffee and R. U. Light, Science, 79: 2048, 299, 1934.

[4] A. T. Mussen, *Arch. Neurol. and Psychiat.*, 31: 110, 1934.

[5] J. R. Ewald, *Vereins-Beilage,* 25: 180, 1898.

by Lewandowsky,[6] in a few experiments on the cerebellum. Though a search was made of the literature the work of Talbert[7] with this method escaped me as it seems to have escaped most others working on cortical physiology. Talbert working in Munk's laboratory made excellent use of small bipolar electrodes made of two wires set in ivory and screwed into the skulls of dogs which were allowed to live to be stimulated on successive days. Without having been aware of his results we have confirmed Talbert's findings completely.

With Ewald's method Talbert produced movements from stimuli applied to various portions of the cortex, even outside the motor area, and produced epileptic seizures with strong stimuli. He observed that the result of stimulation of a point "remained quite the same, day after day, and experiment after experiment, with no variations save the necessity of stronger currents . . . because of the formation of the cicatrix." He observed that successively stronger stimuli applied to a single point brought in movements of more and more of the animal's body. He noted that stimuli were less effective when the limbs involved were being used at the time of application of the stimulus, and that a stimulus would interfere with some normal motions, as drinking, but not others as eating. He saw the possibility that position of the animal would affect the response to stimulus, thus predicting Ward's demonstration that cortical stimulation in the intact animal is concerned with a "final position" of the responding part.[8] Had Talbert's work been fully appreciated at the time it was reported, much of the doubt about the constancy of response of cortical points could have been avoided. Though late, I would like to record Talbert's priority in the use of the method of implanted electrodes and express my appreciation of the keenness of his observations which we have had the pleasure of observing independently.

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SCIENTIFIC BOOKS

MATHEMATICAL TABLES

Mathematical Tables. Vol. IX. Table of Powers Giving Integral Powers of Integers. BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. xii + 131 pp. Cambridge: At the University Press; New York: The Macmillan Company. $4.25.

THIS table was initiated by J. W. L. Glaisher and extended by W. G. Bickley, C. E. Gwyther, J. C. P. Miller and E. J. Ternouth.

Around the end of the last century Dr. J. W. L. Glaisher computed and prepared to print a table giving the first twelve powers of the first thousand numbers. At least one proof copy was run off, but the table was never published and all copies of it disappeared from view. In recent years, Dr. L. J. Comrie made a determined search for a copy and in 1935 finally found a lone proof copy in the possession of Mr. H. J. Woodall, who generously donated it for use in the formation of the present table.

The present table gives an extension of Glaisher's table in two directions. The first twelve powers of the numbers from 1001 to 1099 are added and also higher powers of numbers less than 300. These additions are not inconsiderable, but Glaisher's original table is the source of over 60 per cent. of the entries of the present table.

In checking Glaisher's table, the computers had a great piece of luck. In the WPA project for the computation of mathematical tables, a table of the first ten powers of the first thousand numbers had just been prepared. Dr. A. N. Lowan presented a manuscript of the WPA table to the computers of the present table. It should be said in credit to both Dr. Glaisher and the WPA computers that no errors were found in the WPA table and only one error (an obvious missing digit) in Glaisher's.

Glaisher's eleventh and twelfth powers were checked by differencing, which is particularly suitable for checking a table of integral powers of integers.

The powers not in Glaisher's table were checked by adding up powers of consecutive integers and checking the sums by a separate computation of $\Sigma_{x=1}^{X-1} x^n$ from the formula. The coefficients of this formula for $n = 1, 2, \cdots, 50$ are included in a short table at the end of the table of powers. The ten errors brought to light in this way were tracked down by use of remainders modulo 101.

All the checks mentioned were applied to the proof sheets rather than to the original computations. As a further check, page proof was compared with the original computations or with Glaisher's proof. Numerous minor checks were constantly employed throughout the preparation of the table.

As indicated earlier, the present table contains the first twelve powers of the integers from 1 to 1099 inclusive. Higher powers of numbers less than 300 appear as follows:

Integers from 1–299; first 20 powers.
Integers from 1–120; first 27 powers.

[6] M. Lewandowsky, *Archiv. für Physiologie,* 129, 1903.

[7] G. A. Talbert, *Archiv. für Physiologie,* 195, 1900, *Philadelphia Medical Journal,* 4: 1024, 1899.

[8] J. W. Ward, *Jour. of Neurophysiology,* 1: 463, 1938.