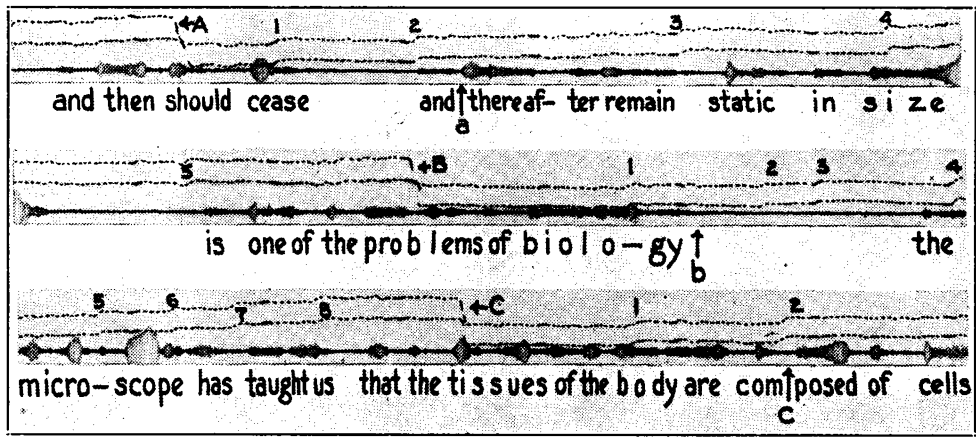

FIG. 1.

related to reading ability. It remains for a series of studies now under way to determine the relationship between this variable and other measurable aspects of reading ability.

This note is published at this time because others interested in eye-movement photography may wish to expand the possibilities of the supplementary voice record.

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SPECIAL ARTICLES

THE WEIGHT OF THE NEGRO BRAIN[1]

BURIED in the older literature of medicine and anthropology, and in the main forgotten, is to be found a great wealth of quantitative material on variation in man, in respect of various anatomical and physiological characteristics. In many cases these data are quite as accurate, critically taken and recorded as those being gathered at the present time. All that they need to be made useful for present-day purposes is to be analyzed biometrically. Furthermore, such forgotten observations often have a special interest for comparative purposes, in that they date from a substantial period of time back of the present, and therefore present the opportunity of judging what degree of secular change, if any, has occurred in the character observed. As new methodologies are discovered and perfected in any branch of science it is often profitable to reexamine and reanalyze old data by the new methods, provided, of course, that the old data are intrinsically sound and critically collected. Nowhere is this more true than in physical anthropology, where the collection of data is at best an extremely expensive and laborious process.[2]

It is an accepted view that the skull capacity and the brain weight of the Negro, whether pure or mixed with white races, tends on the average to be smaller than the same dimensions in whites. The amount of precise data upon which this opinion rests is, however, meager. In 1849 Morton[3] published a series of observations on the cranial capacity of various races, using the method described in his "Crania Americana," which substituted "leaden shot" one eighth inch in diameter for the conventional mustard or millet seed. He gives no distributions, but tables (in cubic inches) the minimum and maximum observations and the means for some 20 racial groups, of which four are negroid. Seventy-four skulls of "Native African family" and "American-born Negroes" (62 of the former and 12 of the latter) gave a combined mean cranial capacity of 1,360.1 cc,[4] as compared with a mean capacity for 18 German, 5 English and 7 Anglo-American skulls averaged together of 1,489.6 cc. The mean capacity of the Negro skulls was thus 91.3 per cent. of that of the Caucasian group with the largest average capacity. Morton's conclusions and his table were republished elsewhere a year after their original appearance,[5] but without additional data.

[1] From the Department of Biology of the School of Hygiene and Public Health, Johns Hopkins University.

[2] Pearson's laboratory has furnished numerous examples of the value of studying old data by modern methods, notably in a series of papers analyzing Galton's anthropometric data (*cf. Ann. of Eugenics, passim*). Greenwood's (*Biometrika*, III, 63–83, 1904; IX, 473–485, 1913) analysis of autopsy records is another case in point.

[3] S. G. Morton, *Proc. Acad. Nat. Sci. Philadelphia*, Vol. 4, pp. 221–224, 1849.

[4] The original figures are in cubic inches. I have here and elsewhere in the paper when necessary translated dimensions in English units to metric units for the sake of uniformity.

[5] S. G. Morton, *Trans. Amer. Med. Assoc.*, Vol. 3, pp. 56–58, 1850.

Peacock (*loc. cit. infra,* p. 523) measured the cranial capacity of all the skulls of "ascertained race" in the museum of St. Thomas's Hospital, by the millet seed technique. For 9 Negro skulls the mean capacity was 1,295 cc, as compared with 1,465 cc for 16 skulls of "Europeans," all being males in both cases. The Negro mean is 88.4 per cent. of the "European."

Duckworth[6] gives (p. 472) the cranial capacity of his racial Group II (African) as 1,388 cc, while for his racial Group IV (Eurasian—distributed over the continents of "Europe, Asia, and a large part of America") the cranial capacity is (p. 475) about 1,500 cc, the former capacity being thus 92.5 per cent. of the latter. This is in substantial agreement with the percentage from Morton's data.

In 1865 Peacock[7] published two papers (the second an appendix to the first) on the actual weight of the brain of the Negro instead of its inferred size from the cranial capacity. He actually weighed 5 brains, and copied from John Reid's tables the weights of two others. Of the five males three died of phthisis and were greatly emaciated. The mean weight of the entire encephalon for these five was, by my computation, 1,256.8 gm. Peacock was able to cite from the literature at the time he wrote, but four other actually observed Negro brain weights, one made by Tiedemann (*Phil. Trans.,* 1836) two by Soemmering and one by Sir Astley Cooper.

Waldeyer[8] in 1894 gave as the mean weight of 12 male native African Negro brains, weighed fresh in 11 of the 12 cases, 1,148 gm. But this low mean is probably partly to be accounted for by the facts that; (a) 2 individuals were only 15 years old, (at which age the growth of the brain can hardly be complete), and (b) several of the individuals had died of wasting diseases and were greatly emaciated. Waldeyer quotes (p. 1220) from the 1885 edition of Topinard's *Anthropologie générale* a mean weight of 1,234 gm for 29 male Negro brain weights collected from the literature, and based upon a very heterogeneous lot of individuals.

Bean[9] in 1927 reported the brain weight of Negro males as smaller than that of white males, the difference being larger relatively than in respect of either liver, kidneys, spleen, heart, appendix or pancreas. His conclusions were derived from 117 autopsies.

Vint[10] gives the most recent figures on Negro brain weights. He finds (p. 217): "In a series of 389 apparently normal adult male native [Kenya natives chiefly of Bantu and Nilotic stocks] brains, the average weight was 1,276 gm or 45 oz., the extremes being 1,006 gm and 1,644 gm." He figures the average skull capacity to be 1,230 cc. These figures agree reasonably well with Peacock's quoted above. Vint, on the basis of a not too sound general European white mean brain weight, finds that the native African brain is 10.6 per cent. lighter.

Next to Vint's the longest series of Negro brain weights apparently ever recorded was collected in a series of over 400 autopsies made during the Civil War by Surgeon Ira Russell, of the 11th Massachusetts Volunteers. His data were discussed by Hunt,[11] in a report to the U. S. Sanitary Commission, that was reprinted in the *Journal of the Anthropological Society of London,* where I first came upon them. The report, in spite of containing some unimportant and easily detectable slips in addition (probably due to bad proofreading)[12] has the great merit of providing frequency distributions for the different groups treated. The class units are somewhat broader than might be desired, but still there are distributions. Hunt's (Russell's) averages are occasionally quoted in anthropological literature, but the data have never been subjected to modern biometrical treatment. It is the purpose of this paper to present the results of such treatment.

The subjects upon whom the autopsies were made, and from which the brain weight data were obtained, were enlisted soldiers. While no specific statement as to age is made, the presumption is that they were young adults, probably mostly in the twenties. Regarding the causes of death the following is quoted by Hunt from Dr. Russell's report on colored hospitals (p. 47):

> From the records of five hundred autopsies[13] (four hundred and seventy-two of which were colored men) made at Benton Barracks, Mo.; Wilson Hospital, Nashville, Tenn.; and L'Ouverture Hospital, Alexandria, Va., it appears that pneumonia and pleuro-pneumonia were found to exist, and were usually the cause of death, in four hundred and six out of the four hundred and seventy-two cases. Tuberculosis existed in thirty-seven cases only. All other diseases eight cases. [Something is plainly wrong with the adding or subtracting here, but

[6] W. L. H. Duckworth, "Morphology and Anthropology." *Cambridge* (Univ. Press), 1904. Pp. xxviii + 564.

[7] T. B. Peacock, *Mem. Anthrop. Soc. London,* Vol. 1, pp. 65–71, 1865 (read Feb. 16, 1864); *ibid.,* pp. 520–524, 1865.

[8] W. Waldeyer, *Sitzungsber. d. k. Preuss. Akad. d. Wiss. Berlin,* Jahrg. 1894, pp. 1213–1221.

[9] R. B. Bean, *Anat. Rec.,* Vol. 11, Jan., 1917.

[10] F. W. Vint, *Jour. of Anat.,* Vol. 48, pp. 216–223, Pl. I–III, 1934.

[11] S. B. Hunt, *Jour. Anthrop. Soc. London,* Vol. 7, pp. 40–54, 1869.

[12] These slips were promptly pointed out by J. Barnard Davis (*Jour. Anthrop. Soc. London,* Vol. 7, pp. 190–192, 1869), who also with justice criticized points in Hunt's somewhat exuberant deductions about the Negro generally.

[13] Hunt specifically states (pp. 51–52) that the brain weight data came from this particular series of autopsies.

TABLE I

BIOMETRIC CONSTANTS FOR BRAIN WEIGHT, COMPUTED FROM DATA GIVEN BY HUNT

Race	N	Mean (grams)	Median (grams)	Standard deviation (grams)	Coefficient of variation (per cent.)	Minimum observation (grams)	Maximum observation (grams)	Range (grams)
White	24	1470.6 ± 16.2	1469.0 ± 20.1	118.0 ± 11.6	8.02 ± .79	1254.5	1814.4	559.9
3/4 White	25	1409.0 ± 14.5	1399.8 ± 18.1	106.4 ± 10.2	7.56 ± .73	1134.0	1729.3	595.3
1/2 White	47	1355.7 ± 11.6	1354.1 ± 14.5	118.6 ± 8.2	8.75 ± .61	1070.2	1615.9	545.7
1/4 White	51	1321.6 ± 12.8	1330.5 ± 15.9	136.3 ± 9.1	10.31 ± .70	1091.5	1672.6	581.1
1/8 White	95	1315.3 ± 7.9	1328.2 ± 9.9	116.7 ± 5.7	8.88 ± .44	978.1	1615.9	637.8
1/16 White	22	1307.9 ± 12.8	1304.1 ± 15.8	88.3 ± 9.1	6.75 ± .69	1134.0	1431.7	297.7
All mixtures together	240	1333.6 ± 5.4	1338.4 ± 6.8	122.1 ± 3.7	9.15 ± .28	978.1	1729.3	751.2
Black	139	1354.8 ± 6.8	1354.9 ± 8.5	120.2 ± 4.8	8.87 ± .36	1013.5	1587.6	574.1

it appears tolerably clear that the great majority of the colored men died of pneumonia.]

The biometric constants are given in Table I. The differentiation of the mixed bloods, as given in the table, was presumably based solely upon casual judgment from skin color and not from either genealogies (as in the work of Herskovitz[14]) or measurement of pigmentation. But it is important to note that in any event, these are *American* Negroes, not native Africans, and even by the time of the Civil War there had been a very considerable amount of intercrossing, so that absolute purity of Negro ancestry could be asserted in any particular case (regardless of depth of skin color) only with a certain reserve and caution.

From Table I the following points may be noted.

(1) The mean for the black group is about 207 gm greater than Waldeyer's figure for native African Negroes, but only 78.8 gm greater than Vint's. I have already given reasons for thinking Waldeyer's mean abnormally low. Considering that in all probability there was some white blood in Hunt's "black" group, and allowing for other racial and environmental differences certainly existing as between the two samples, the agreement of the present mean with Vint's seems quite a reasonable one.

(2) The accuracy and general reliability of Russell's brain weighings is attested by the following pertinent facts: (a) in no instance is there a significant difference between mean and median in his data, indicating the absence of significant skewness in the distributions. It has been shown[15] that brain weight distributions from the most reliable data are characteristically symmetrical. (b) The coefficients of variation in the present series have values not far from 8 per cent. This has again been shown (Pearl, *loc. cit.*) to be the characteristic figure for brain weight variability in large and accurately weighed samples.

(3) The mean brain weight for the black series is 92.1 per cent. of that for the white series. The approximate agreement of this with Morton's, Peacock's, Duckworth's and Vint's results is clear, and may reasonably be taken to lead to the conclusion that the Negro brain is, on the average, from 8 to 10 per cent. lighter than the fairly comparable white brain.

(4) The brain weights for the Negro-white mixtures are extremely interesting in the smooth decline of the means with a putative increase in Negro blood in the mixture (based presumably, however, solely on casual judgment of skin color). The smoothness of the figures has enticed me into struggling to rationalize them genetically, but I have had no success, finding myself in this respect in precisely the same position as Herskovitz (*loc. cit.*) and his student Barnes when confronted with a similar problem. Perhaps some ingenious reader can do better. It will be noted that mean brain weights for the whites (0 per cent.), ¾ whites (25 per cent.) and ½ whites (50 per cent. Negro blood) lie, if plotted, very close indeed to a straight line. So also do the means for the ¼, ⅛ and 1/16 whites. But the line fitting the latter three groups has a different (less marked) slope downwards than the former. And finally the mean for the black group (putatively pure Negroes) is almost identical with that for the ½ whites. Reasons have already been given for believing the actual weighings to be substantially accurate.

(5) The mean brain weight of the "All mixtures together" group is lower than that for the "black" group, and necessarily still farther below that for the whites. The mid-point between the white and "black" means is 1,412.7 gm. The mean for no single mixed

[14] M. J. Herskovitz, "The Anthropometry of the American Negro." New York, (Columbia Univ. Press) 1930. Pp. xvi + 283.

[15] R. Pearl, *Biometrika*, Vol. 4, pp. 13–104, 1905.

group is as great as this figure, the nearest being the "$\frac{3}{4}$ white" mean.

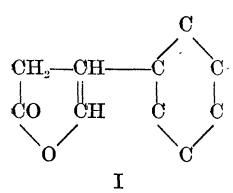
(6) The relative variability of the Negro brain weight (as measured by the coefficient of variation) appears to be slightly greater than that in the whites, though the difference can not be asserted to be significantly greater than might arise from fluctuations of random sampling, so far as concerns any of the comparisons that can be instituted on the basis of the present material.

RAYMOND PEARL

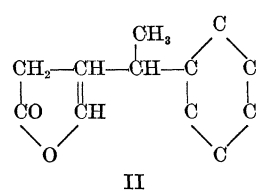
THE DIGITALIS GLUCOSIDES. VIII. THE DEGRADATION OF THE LACTONE SIDE CHAIN OF DIGITOXIGENIN

DEGRADATION studies with a number of derivatives of strophanthidin and of the digitalis aglucones have been in progress since the reports of our earlier work.[1] Because of the possible significance of recent results which we have obtained, in particular in degradation experiments with the digitalis aglucones, we wish to present a preliminary report of this phase of the work before its completed presentation can be made elsewhere.

Our previous observations have suggested that the unsaturated lactone side chain of the cardiac aglucones may be attached directly on the β-carbon atom to a six-membered ring as in formula I, or by an intermediate carbon atom as in formula II.[2] The latter



I



II

possibility, however, would be excluded if the presence of the sterol ring system as indicated by the formation of methyl cyclopentanophenanthrene on dehydrogenation of strophanthidin[3] could be substantiated by other means. For further information we have attempted the graded degradation of the lactone side chain in a number of selected substances. The present preliminary report deals with the experience with a previously described digitoxigenin derivative, γ-digitoxanoldiacid.[4] On oxidation of its secondary hydroxyl group with chromic acid this was converted into the keto acid, *digitoxanondiacid,* $C_{23}H_{34}O_5$. On reduction by the Clemmensen method, *digitoxandiacid,* $C_{23}H_{36}O_4$, resulted. The *dimethyl ester* was converted with Grignard reagent into the bis-diphenyl carbinol which on oxidation with chromic acid was degraded with the loss of three of the original carbon atoms of the lactone side chain to the *monobasic acid,* $C_{20}H_{32}O_2$.

At this point the striking property of this acid of forming very sparingly soluble salts which made manipulation somewhat difficult recalled a similar experience reported by Wieland, Schlichting and Jacobi[5] in the case of aetiocholanic acid of the same formula. On further study other resemblances appeared. Our acid melted at 219–219.5°. The melting point given for aetiocholanic acid is 219°. The methyl ester of our acid melted at 97–98°. Wieland, Schlichting and Jacobi reported 98–99° for aetiocholanic methyl ester. The ethyl ester of our acid melted at 76.5–77.5°. Aetiocholanic ethyl ester melts at 78–79°.

The striking similarity of the two series of substances thus suggests the possible identity of our degradation product from digitoxigenin with aetiocholanic acid. Final check of such identity, however, must await the results of a direct comparison of physical constants, mixed melting points, etc. We are attempting to procure the material for such comparison.

Should the identity of these substances be verified, the conclusions are obvious which can be drawn in regard to the structure of the cardiac aglucones.

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[1] W. A. Jacobs and R. C. Elderfield, *Jour. Biol. Chem.*, 102: 237, 1933.

[2] W. A. Jacobs and R. C. Elderfield, *Jour. Biol. Chem.*, 100: 676, 1933; R. C. Elderfield and A. Rothen, *Jour. Biol. Chem.*, 106: 71, 1934.

[3] R. C. Elderfield and W. A. Jacobs, SCIENCE, 79: 279, 1934.

[4] W. A. Jacobs and E. L. Gustus, *Jour. Biol. Chem.*, 86: 211, 1930.

[5] *Zeits. physiol. Chem.*, 161: 102, 1926.

BOOKS RECEIVED

CHAPMAN, F. SPENCER. *Northern Lights.* Pp. xiv + 264. Oxford University Press. $2.50.

FALKHAGEN, HANS. *Electrolytes.* Translated by R. P. Bell. Pp. xiii + 346. 105 figures. Oxford University Press. $9.50.

HARDY, G. H., J. E. LITTLEWOOD and G. POLYA. *Inequalities.* Pp. xii + 314. Cambridge University Press, Macmillan $4.75.

HERRICK, FRANCIS H. *The American Eagle.* Pp. xx + 267. 94 figures. Appleton-Century. $3.50.

HOUSE, HOMER D. *Wild Flowers.* Pp. 362. 364 plates in color. Macmillan. $7.50.

HOUSTON, WILLIAM V. *Principles of Mathematical Physics.* Pp. xi + 265. McGraw-Hill. $3.50.

JEANS, SIR JAMES. *The Universe Around Us.* Third edition, revised. Pp. x + 380. 29 plates, 23 figures. $4.00. *The New Background of Science.* Second edition. Pp. viii + 312. $2.50. Macmillan.

MOHR, OTTO. *Heredity and Disease.* Pp. xiv + 253. 58 figures. Norton. $3.50.

MORSE, MARSTON. *The Calculus of Variations in the Large.* Pp. ix + 369. American Mathematical Society.

RICKETTS, PALMER C. *The History of the Rensselaer Polytechnic Institute.* Third edition. Pp. xx + 293. Illustrated. Wiley. $3.50.

TREWARTHA, GLENN T. *A Reconnaissance Geography of Japan.* Pp. 283. 54 figures. 49 plates. University of Wisconsin Studies.