If x_2 , x_1 and x_0 denote the positions of the means of the (AA), (Aa) and (aa) rows we find

$$x_2 - x_1 = \frac{m+1}{m+3} \text{ and } x_1 - x_0 = \frac{2}{m+3}.$$

The above value of r will be reasonably accurate only as long as these two expressions do not greatly differ, i.e. in the neighbourhood of $m=1$. Actual values of the expressions are:

m	0	.5	1	2	10	∞
$x_2 - x_1$	.33	.43	.50	.60	.85	1.0
$x_1 - x_0$	.67	.57	.50	.40	.15	0

Thus, except when m is very close to unity, the expressions differ considerably, and the above formula for r cannot be taken as giving a true value of the correlation for such a table. If we approximate by taking the mean of the values of $x_2 - x_1$ and $x_1 - x_0$ weighted according to the frequency on which each is based, we reach results which in the present case are not far different from the values given by Dr Brownlee's formula. In another case, however, which we have worked out the difference is greater. If we do not weight, the difference may be very great.

We have by no means exhausted the possible criticisms of Dr Brownlee's work. Sufficient has been done, however, to show that his results must be interpreted with very great caution. Finally, in all cases of the determination of correlation, we would emphasize the necessity for a clear understanding of the nature of the distributions dealt with.

III. A Mendelian View of racial Heredity.

By H. J. LASKI, New College, Oxford.

THE application of Mendelian principles to the problems of inter-racial heredity has not thus far met with any very conspicuous success. The work of Davenport on the mulatto is quite inconclusive in character. The incomplete pedigrees of Mudge merely defeat the end which doubtless they were intended to serve. It is not, indeed, too much to say that the endeavour to make man a complex of sharply-defined unit characters has failed, and failed completely. Even the researches of Hurst, which were received with an almost lyrical enthusiasm by the adherents of Mendelism, are not above suspicion; for post-mortem microscopic examination has revealed the presence of anterior pigment in eyes or parts of eyes which, after most careful examination, were judged free from it in life. Undeterred, however, by previous failures Dr Redcliffe Salaman* has endeavoured to prove the applicability of Mendelian theory to the problems of Jewish heredity. His paper is so characteristic an example of much recent Mendelian work that it is not entirely purposeless to examine it in some detail.

Its conclusions may, at the outset, be briefly summarised. Dr Redcliffe Salaman investigated the transmission of a Jewish facial characteristic which, somewhat mysteriously, he calls Jewishness. His method was to collect cases of intermarriage between Jew and Gentile, and thus to discover whether the resulting offspring were Jewish, non-Jewish, or intermediate in appearance. He was assisted throughout by Jewish observers who, he states, seemed desirous whenever possible of claiming the child as Jewish†. This is, perhaps, a little curious in the light of our knowledge of the Jewish aversion for intermarriage and their known desire to dissociate its consequences from anything Jewish. It is remarkable that the bias of the observers influenced their judgment so little if the personal equation is so high as Dr Salaman

* *Journal of Genetics*, Vol. I. pp. 273-290.

† *Loc. cit.* p. 280.

believes. The data, it should be said, relate entirely to the Jews of Northern and Central Europe and the Gentile is either English or North European. This limitation is noteworthy because there does not seem to be a specifically Jewish type among the Sephardim, or Jews of Eastern Europe and Africa. They are rarely to be distinguished from the natives of the country to which they belong, and to distinguish between the Jew and the Armenian is almost impossible.

Dr Salaman provides the following table:

Number of families	Father	Mother	Children's appearance		
			Gentile	Jewish	Intermediate
50	Gentile	Jewish	88	15	4
86	Jewish	Gentile	240	11	4
Total 136	—	—	328	26	8

His conclusion may be briefly summarised as follows:

(1) The Gentile features, or rather, facial expression act as practically a complete dominant to the Jewish.

(2) In the matings of the hybrids the following results were reached:

(a) Where the Jew is father and the mother the hybrid: in nine families there were "thirteen children undoubtedly Gentile and twelve unequivocally Jewish";

(b) Where the mother is Jewish and the father is the hybrid: in four families there are seven children of whom two are Gentile and five are Jewish. Dr Salaman adds (a) and (b) together and obtains a very close approximation to the Mendelian expectation of equality.

(3) He has five cases where the hybrid married a Gentile and in all of these the resulting eight children are Gentile in appearance. This is not perhaps unexpected on any theory of heredity, since three-quarters of the offsprings' blood would be Gentile and the difference between the results of (3) and (2) (b) is not a little curious.

(4) When the Jew who lacks the characteristically "Jewish" expression marries the markedly "Jewish" type the latter is dominant. Pedigree 6 is quoted by Dr Salaman in support of this important result.

(5) Finally, "The conclusion to which these results inevitably lead is that the Jewish facial type, whether it be considered to rest on a gross anatomical basis, or whether it be regarded as the reflection in the facial musculature of a peculiar psychical state is a character which is subject to the Mendelian law of Heredity*."

These results seem open in the very highest degree to criticism. Objection must, in the first place, be made to the categories used. I do not think it is possible to understand the nature of the character of which the transmission and behaviour were investigated. One would, I think not unfairly, expect Dr Salaman to provide us with a definition or at least a more or less exact description of the character with which he deals. It is surely a lamentable lack of scientific precision not to do so. Dr Salaman himself is not at all certain what is meant by this "Jewishness." In the earlier part of his paper he is at some pains to demonstrate the fact that the Jews cannot be considered racially pure. He quotes, indeed, with approval the statement of Weissenberg† "the Jew in an anthropological sense forms no specific type, but the facial expression is absolutely characteristic"; but immediately above the opinion of Ripley‡ who favours the existence of a Jewish type is quoted as bringing comfort to the observer. But

* *Loc. cit.* p. 285.

† *Archiv f. Anthropol.* Bd. xxiii. S. 347—423 and 531—579.

‡ Ripley, *Races of Europe*, pp. 393—400.

Dr Salaman's conclusion (5) makes it a matter of indifference whether we accept the opinion (it is hardly more) of Ripley or of Weissenberg. We have nothing definite or tangible upon which to seize. The Jewish nose has a prominent place in the essay, but as to its value as a possible index of racial character Dr Salaman is perfectly agnostic. We are told of a face with "rounded features, long sloping jaw, fairly developed chin which is round and not square, a good sized forehead devoid of that angularity in the temples not uncommon among Teutonic peoples," but these highly complex anatomical peculiarities, each of which from its mere description seems to demand quantitative expression, do not constitute "Jewishness" but merely accompany it. For Dr Salaman, in fact, the "Jew is a Jew because he looks like one." This, indeed, seems to be his most characteristic argument. He deals with a character which does not admit even of qualitative expression. While it is necessarily a function of the various organs of the face, and therefore an allelomorph so highly compound as to be scarcely resolvable into its component parts, it does not admit of expression in terms of them. Now, if the facial features are each one and separately a Mendelian unit, is *each* unit in the Jewish face recessive to the corresponding unit in the Gentile face so that the whole Jewish face is recessive to the Gentile? A blend would be produced even if some units were dominant over others in the general appreciation of Jewishness; but if Dr Salaman's view be justified, then every Jewish unit must be recessive to every other Gentile unit; but since this has not been tested it is purely arbitrary to assume its truth. It is not easy to see why the shape of a Gentile nose should be dominant to the shape of a Jewish nose in precisely the same way as a Jewish chin should be recessive to a Gentile one. When we ask what "Jewishness" is, we are told that it is the quality of looking Jewish, and to the question of what it means to look Jewish Dr Salaman would doubtless reply that it is to possess the quality of Jewishness. So vicious a circle of reasoning seems, scientifically, almost ludicrous, and it can hardly have value from the standpoint of anthropology. Dr Salaman appears in some degree troubled by this. "In determining the nature of so complex a character," he writes*, "the personal equation of the observer must play an important part. I have in some cases found that observers not specially acquainted with the subject, although agreeing that a given individual of the first generation is of Gentile appearance have yet felt that there was somewhere lurking in the face an expression which suggested 'Jewishness,' and there is very little doubt that such an opinion may be well founded. I have myself come across a few cases where without doubt the recessive Jewish facial expression has come to the surface as the individual grew older." Stated in other words, the first sentence would seem to imply that individuals classed as dominant may in reality constitute a blend. This has some importance in view of the suggestion made above that not all the Jewish characters may be recessive to the Gentile, and, if this be once conceded, what becomes of the correlated inheritance which is necessary for the establishment of Mendelian theory? The second sentence indicates a very real absence of gametic purity. These facts as stated by Dr Salaman throw the gravest doubt on the value of the categories used. When a definition of the character investigated is lacking because, seemingly, it can only be "felt" by the observer; when his observers are classifying as Gentile offspring with a tinge of Jewishness—surely nothing more than a Mendelian gloss for an intermediate; when Dr Salaman observes the appearance of the supposed recessive with increase of age; the nature of Gentile dominance is very far indeed from being so satisfactory as his table would seem to show. Professor Pearson tells me of a typical case of intermarriage where the Gentile relatives say the children are Jewish, the Jewish relatives Gentile, in appearance. Here we have the dominance of Jewish features when judged by a Gentile, of Gentile when judged by a Jew. Dr Salaman's observers, as he himself tacitly admits, do not feel that his categories are sufficiently precise. The personal equation plays, I think, an even more important part than Dr Salaman imagines. In Weissenberg's experiment the Jew and the Gentile differed in their estimate by 20 per cent. and to the Jew 30 per cent. and to the Gentile 50 per cent. did not seem Jewish,—a highly

* *Loc. cit.* p. 282.

significant series and entirely unfavourable to Dr Salaman's view. It seems to show that the Jewish conception of "Jewishness" and that of the Gentile are something very different indeed, and that an independent classification of Dr Salaman's data by a Gentile observer would not lead to the same result. The fact is,—and in research of this kind it is an absolutely fatal objection to such loose and worthless categories,—the Jew catches the Gentile, and the Gentile the Jewish, features in what is probably a blend, and is guided in his judgment by the degree in which he perceives them. It is not until the nose, the eyes, pigmentation and other Gentile-Jewish differentia are reduced to measured features that any real solution of the problem can be reached.

I think therefore, that Dr Salaman's categories are open to grave and even fatal objection. Let us turn now to the results of the investigation itself. Dr Salaman has himself admitted throughout his paper the existence of a large number of Jews who do not possess the character "Jewishness." We do not find that he has given us any facts as to the appearance of those Jews who married Gentiles and whose offspring form Table I. To the ordinary observer it would appear obvious that when a Gentile marries a Jew whose features do not possess "Jewishness" the resulting offspring would be Gentile in appearance. We require a fairly large sample of the Jewish population showing the distribution of its component elements before Dr Salaman's conclusions can be accepted. Now in Weissenberg's* experiment a proportion of his samples consisting either of 30 or 50 per cent. of his population, according to the personal equation of the observer did not appear distinguishably Jewish. It seems therefore reasonable to assume that the non-Jewish looking Jew forms a fairly large proportion of the population, larger, as I shall show, than it is possible for Dr Salaman to admit. Again, it must surely have struck him that the distribution of types in his Table I is not without significance. In the first case, ♂ Gentile × ♀ Jewish, the distribution is 88 Gentile, 15 Jewish and 4 intermediate, i.e. in the sample, classing Jewish and intermediate as Jewish, 18 per cent. were Jewish in appearance. In the second case, ♀ Gentile × ♂ Jewish, gave 240 Gentile, 11 Jewish, and 4 intermediate, i.e. with the same classification as before, 5 per cent. are Jewish. This is surely very anomalous, since on Mendelian theory there is no distinction between the two cases. Dr Salaman ascribes the appearance of the recessive Jewish types and the intermediates to (1) the Jewish bias in the observers and (2) a Jewish permeation of the English people in particular districts. In reference to (1) it is only necessary to say that the bias in favour of distinguishing the offspring as Jewish must be very great when the observer makes an incorrect distinction between two types which Dr Salaman tells us cannot be mistaken. His inconsistency here is destructive of his entire position. If this incorrectness be once admitted, it is sufficient to cast doubt upon the entire investigation. In (2) Dr Salaman, I take it, means that there is a Jewish ancestry even among the Gentile inhabitants. The Gentile inhabitant would therefore be an imperfect dominant on this theory; but if there be this ancestry it is difficult to see why a Jewish looking Jew should always be dominant over a non-Jewish looking Jew, who would be often only a Jew in name and not a gametic Jew. The complete data should, I think, be tabulated before this exceedingly hypothetical explanation can be accepted as satisfactory. The mating of the hybrids with pure types seems to Dr Salaman entirely Mendelian in result, the approximate equality being the Mendelian expectation. I think the evidence I shall now adduce in criticism of this conclusion is sufficient to render it untenable.

When the father is a Jew and the mother the hybrid and conversely, the distribution of types in the resulting offspring is 15 Gentile to 17 Jewish, the Mendelian expectation being, as we have said, equality. But Dr Salaman's analysis is very far from sufficient. What was the appearance of the hybrid parent? This, the really crucial point, is left a mystery. The following scheme indicates the possibilities which might have occurred.

* *Globus*, Vol. xcvi. 6, 9, 10, 1910.

Hybrid Jewish in appearance $\times$ Jew Jewish in appearance,

" " " $\times$ Jew intermediate in appearance,

" " " $\times$ Jew non-Jewish in appearance.

Hybrid intermediate in appearance $\times$ Jew Jewish in appearance,

" " " $\times$ Jew intermediate in appearance,

" " " $\times$ Jew non-Jewish in appearance.

Hybrid Gentile in appearance $\times$ Jew Jewish in appearance,

" " " $\times$ Jew intermediate in appearance,

" " " $\times$ Jew non-Jewish in appearance.

It is evident from this scheme that the problem is immensely more complex than is indicated by Dr Salaman. His belief that the Jew who appears recessive carries an inhibiting factor which prevents the appearance of "Jewishness" works in any case against his view, for when crossed with pure Gentile the offspring could not possibly be Jewish on any theory. But we can go further than this. Is the non-Jewish type so markedly recessive to the Jewish type? While I thoroughly distrust any such vague category as "Jewishness," I have yet endeavoured to the best of my ability to apply it to certain data of my own and see in how far the results are consonant with Dr Salaman's. The pedigrees here given refer in every case to families where intermarriage has not, within knowledge, occurred.

Fig. I.

These pedigrees indicate, I think, a dominance of the non-Jewish type. I give the results of the marriage of some of the above offspring on the opposite page.

These show absolute divergence from Dr Salaman's conclusions. In every case the cross between the distinctly non-Jewish type and the distinctly Jewish type gives dominance to the former. In the case of the intermediate type no definite conclusion seems possible. The result indeed is what the biometrician is beginning almost to expect in Mendelian work on man, that while one pedigree may admit of a Mendelian interpretation others no less certainly contradict it. If we use Dr Salaman's classification, it is obvious that the non-Jewish looking Jew cannot possibly be regarded as a recessive. If it be regarded as *DR*, then in the crosses *DR* $\times$ *DR* the absence of *RR* is inexplicable. Now it does not seem to me that this divergence disproves the applicability of Mendelism to the facial expression in man, but it does demonstrate that it is purely idle to use vague categories of this kind, and then claim that any theory can be

Fig. II.

demonstrated by such use. I have in my possession several pedigrees illustrating the result of crossing pure Jew with pure Gentile. These give

⊙ = Distinctly Jewish.
 ⊖ = Pure Gentile birth.
 ⊕ = Intermediate appearance.

Fig. III.

In each case the cross of a distinctly Jewish type with a no less distinctly Gentile type produces offspring either of Jewish or of intermediate appearance. It is, in fact, characteristic of the application of Mendelism to problems such as these, that imperfect categories and incomplete analysis should superficially render soluble a problem which, on a more intimate dissection, does not yield its secret to the Mendelian enthusiast.

In fact, this problem, as every genetic problem, is to be solved only by the method of quantitative analysis, that is, by the methods of biometry. We must know the numerical distribution of the various types of Jew in a population sufficiently random in character to

represent the general Jewish population. We must actually measure the "Jewishness" by analysing it into its component factors and measuring them by accepted and specially devised anthropometric methods—such as the nasal index, the cephalic index, the profile angle, etc., together with any number of new facial measurements which it would be quite easy to devise, and also pigmentation determinations. Where, as in man, we cannot be certain of the gametic constitution of an individual, we can only guess at it by an inquiry as to purity of the ancestry and the somatic characters both in Gentile and Jew. This, especially in regard to non-Jewish looking Jews, has been wholly omitted by Dr Salaman in each individual case. From such knowledge we can, by well-known biometric methods, calculate the probable character of the offspring. The result of such an investigation may be to confirm Mendelian theory—as to that I make no assertion. But we stand now, and until this fact has penetrated into the Mendelian consciousness we shall continue to stand, in the position indicated by Weldon ten years ago—"the fundamental mistake which vitiates all work based on Mendel's method is the neglect of ancestry and the attempt to regard the whole effect upon the offspring produced by a particular parent as due to the existence in the parents of particular structural characters; while the contradictory results obtained...show clearly enough that not only the offspring themselves but their race, that is, their ancestry, must be taken into account before the result of pairing them can be predicted."

IV. On "Cancer Houses," from the Data of the late Th. Law Webb, M.D.

By KARL PEARSON, F.R.S.

THE data dealt with in the present paper contain a record of the house distribution of 377 cases of cancer occurring between 1837 and 1910 in the Madeley registration subdistrict. They include both cases of sarcoma and carcinoma. It has not been possible to separate the two, for in many cases the entry is merely cancer. The data include the exact position of the house, its water supply; the age, occupation, and date of death of subject, and the organ affected by the growth. The data consist, besides the record of cases, of large scale maps of the district upon which every inhabited house is marked in with blue wash and every house in which a case of cancer followed by death has occurred in the given period with red wash. A red cross marks existing cases of cancer in the living. The collection was formed by Th. Law Webb, Esq., M.D.

The deaths from cancer are as follows:

1831—1840: [20?]*	1841—1850: 14	1851—1860: 20
1861—1870: 48	1871—1880: 41	1881—1890: 77
1891—1900: 81	1901—1910: 89.	

The number of cancer deaths has thus increased very considerably, but the population has increased† and its average age has no doubt very considerably increased, so that it is not possible to say whether this increase of cancer deaths marks an actual increase of cancer.

* Based on four years of the decade only.

† Not very markedly, and lately it has fallen again.