A BIOMETRIC STUDY OF THE RED BLOOD CORPUSCLES OF THE COMMON TADPOLE (*RANA TEMPORARIA*), FROM THE MEASUREMENTS OF ERNEST WARREN, D.Sc.

By KARL PEARSON, F.R.S.

(1) On leaving for Natal in 1902 to take up his duties at the Government Museum, Pietermaritzburg, Dr Warren placed in my hands a quantity of material, the reductions of which will be published with many other data in a forthcoming memoir on homotyposis. Among this material were measurements on the red blood corpuscles of 71 tadpoles from a pond at Hendon. These measurements were, for several reasons, of peculiar interest to me. I had been working at the blood corpuscles of frogs, and had met with several difficulties in the investigation. One group of these difficulties turned on the problem of the "small sample," and the second set on the doubt which arose in my own mind as to whether the size of the cell in the individual of any species can be considered as independent of the bulk or age of the individual.

An interdependence of the two appeared to me not improbable on the basis of statistical material, a part only of which has been published. It is clear that any correlation of the kind indicated will influence to a greater or less extent the determination of homotyposis in the case of such cells. From a careful examination of the data themselves I was unable to detect signs of differentiation* in the *sizes* of the red blood corpuscles of any individual; nor were my biological friends able to give me evidence that such *size* differentiation actually existed for the tadpole, or indeed, if it existed at all, that it affected any *large* percentage of the red blood corpuscles of the frog or any other species. Differentiation was based in most cases on other than size characters.

In the absence of Dr Warren from England I do not feel justified, however, in making him responsible for any conclusions I may draw from his measurements.

* A large amount of algebraical work was undertaken in the endeavour to break up the frequency distributions of the blood corpuscles into components, but no definite evidence of size heterogeneity could be obtained. The apparent bimodal nature of the characters in Tables A, D and F (pp. 412, 415, 417) emphasised in the homotyposis tables failed to allow of algebraic resolution, and is, I think, solely a result of the paucity of the sample.

The whole of the labour of measurement is due to him, and this is, perhaps, the most important part of the work. I have to thank my late colleague and assistant, Dr Alice Lee, and my present assistant, Miss Julia Bell, for most of the arithmetical work. My own task has been that of suggesting the nature of the statistical reductions to be made, and drawing from them possibly disputable conclusions. Foremost among these I take to be the point raised by Dr Warren himself in 1903, that in many cases an intimate relation exists between the size of the body and the size of the cell*. In the case of *Daphnia magna* the cell was a constituent part of the body length; in the present case we have to deal with a related but detached cell. I cannot avoid making the suggestion that the field for inquiry here is not only very wide, but exceedingly important.

The second difficulty that arises in the homotyposis of cellular characters is the practical difficulty of obtaining and measuring a sufficiently large sample of a cell population. The whole theory of "small" samples is only at present owing to the labours of von Bortkewitsch†, "Student"‡ and others, in course of development. But it is easy to see that the general effect of "small" sampling is to increase the apparent variability of the means of the sub-populations by terms depending on the error of random sampling and thus to make the variability of an array larger, and consequently the correlation, or in the special case the homotyposis, smaller than it should be as a result of "large" sampling. It is needful accordingly to bear in mind the double possibility (*a*) that cell size is correlated with the growth of the individual, and (*b*) that "small" sampling has considerable influence on these intercellular correlations.

(2) Dr Warren's material was collected at Hendon. The total length from tip of tail to head, and the body length from head to anus were measured. The end of the tail being removed, the maximum length and breadth of 25 corpuscles from a drop of blood from the wound were measured with an ocular micrometer. In the present paper, if the characters of rather more than 25 corpuscles were determined in a few cases by Dr Warren, I have dealt only with the first 25.

In the first place I shall consider the relation of cell length to body length, choosing this instead of total length as the length of the tail is much influenced by the changing state of development. Table A (see p. 412) gives the actual measurement of 25 blood corpuscles of 71 tadpoles, cell length against body length. In Diagram I. I have represented the same result graphically, taking the means of the lengths from the table below.

The correlation coefficient between cell and body length is $r = -\cdot 25$, and the correlation ratio—not very widely removed from it in value, and thus indicating approximately linear regression—is $\eta = \cdot 28$, with a probable error of about ·02. Thus there can be no doubt from this result that the size of the blood corpuscle of

* *Biometrika*, Vol. II. p. 255.

† *Das Gesetz der kleinen Zahlen*, Leipzig, 1898.

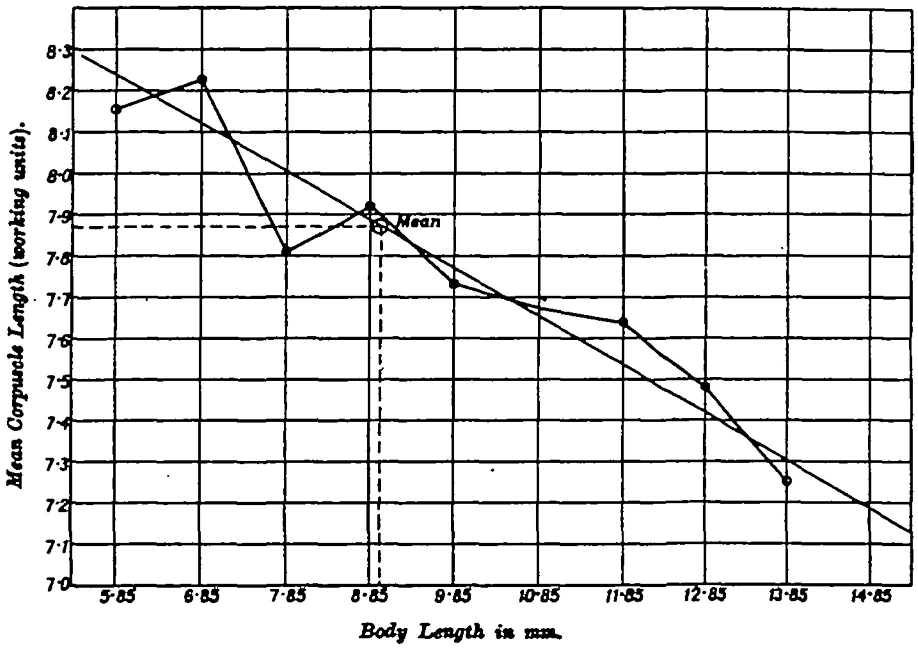
‡ *Biometrika*, Vol. VI. p. 1, and Vol. VI. p. 302

TABLE I.

Mean Cell Length for each Body Length.

Body Lengths Millimetres	Mean Cell Length Working units	Mean Cell Length Millimetres
5·35— 6·35	8·15	·0218
6·35— 7·35	8·22	·0220
7·35— 8·35	7·81	·0209
8·35— 9·35	7·91	·0212
9·35—10·35	7·73	·0207
10·35—11·35	7·67	·0206
11·35—12·35	7·64	·0205
12·35—13·35	7·48	·0200
13·35—14·35	7·25	·0194
All body Lengths	7·86	·0211

DIAGRAM I. Regression Line of Length of Blood Corpuscle on Body Length. *R. temporaria.*



the tadpole diminishes as it develops. It appears to me that this point wants testing in other species; it may well be that we are here dealing with a peculiar cellular change consequent on the development of the tadpoles, the larger of which were beginning to develop hind- and in a few cases fore-limbs. At the same time the decrease in size of blood corpuscles appears to have started with tadpoles so small that they showed no sign of limb development. The correlation $-·25$ is in excellent agreement for the result obtained for tadpoles of *B. vulgaris*, namely $-·28$; see Table IV. below. It will be obvious that if absolute lengths of the corpuscles were taken in either case, we should screen the true homotyposis owing to this change of corpuscle size with growth.

We can still further illustrate this point by finding the correlation between *total* length, that is 'body' + 'tail,' and the length of the corpuscle. We have $r = -\cdot 23$, showing a somewhat less, but still quite sensible, negative correlation, or the size of the corpuscle decreases with increasing total body length. I now proceeded to correlate the total length with the body length, and found $r = \cdot 93$. Now it is a noteworthy result of these numbers that $\cdot 93 \times -\cdot 25 = -\cdot 23$, or well within the limits of random sampling, we have:

Correlation of body length and cell length × correlation of total length and body length = correlation of total length and cell length.

That is to say, the partial correlation coefficient of total length on cell length for a constant body length is zero. We may therefore infer that the length of the tail has little or no influence on the length of the corpuscles, which are affected only by the growth of the body.

In Dr Warren's measurements, one ocular unit for the length or breadth of the corpuscle = ·00268 mm., and the mean length of 1775 blood corpuscles of tadpoles was 7·8554 working units = ·0211 mm. The late Professor Weldon measured for me, in 1901, 50 red blood corpuscles from each of 20 frogs. The method of procedure was somewhat different to that of Dr Warren, the frog being killed with chloroform and the blood taken from the heart; the frogs were from the neighbourhood of Oxford, whereas the tadpoles came from Hendon. Professor Weldon also drew the corpuscles, using a *camera lucida*. The mean cell length of these 1000 blood corpuscles of the adult frog was ·0256 mm. Comparing this value with that found for the tadpole at various stages as well as the mean value, it would seem highly probable that notwithstanding change of local race, the data point to the increase of size of the blood corpuscle of the frog with or after metamorphosis. Dr Warren also measured the length of the blood corpuscle in 25 corpuscles taken from each of 29 "toadpolls,"* or tadpoles of *Bufo vulgaris* taken from Kew lake. The mean value found was ·0212, which is in very close agreement with the mean result for the tadpoles from *R. temporaria*.

The following table sums up our results on corpuscle length.

TABLE II.

Length of Red Blood Corpuscles in mm.

Species	Number	Mean	Standard Deviation	Coefficient of Variation
R. temporaria (adult)	1000	·02560 ± ·00004	·00192 ± ·00003	7·50 ± ·11
R. temporaria (tadpole)	1775	·02105 ± ·00004	·00246 ± ·00003	11·69 ± ·13
B. vulgaris (toadpoll)	725	·02118 ± ·00006	·00251 ± ·00004	11·85 ± ·21

* I should like to reintroduce the original of tadpole, i.e. toad-poll, as a convenient popular term for the tadpole of *B. vulgaris*; tadpole being reserved for *R. temporaria*.

We see that the two sets of tadpoles are again in close agreement as to variability, but whether we judge absolutely or relatively their corpuscles are in length more variable than those of the adult frog. It is possible that some amount of this difference of variability may be due to difference of treatment, Dr Warren taking his corpuscles from the truncated tail and Professor Weldon from the heart, but the bulk of the loss of variability is probably due to the fact that the tadpoles were at a variety of stages of growth, and the corpuscles, as we have seen, are also changing with this growth. Tables A, B and C (pp. 412—414) give respectively the correlation tables of body length and cell length, of total length and cell length, and of body length and total length for tadpoles of *R. temporaria*. The body and total lengths are in *mm.*, but the cell lengths in working units, each of which = ·00268 mm.

Table III. gives the biometric constants of the total and body lengths in mm. We see that notwithstanding the small numbers, the relative variabilities are in strikingly close agreement.

TABLE III.

Body and Total Lengths of R. temporaria and B. vulgaris Tadpoles.

Length		Number	Mean	Standard Deviation	Coefficient of Variation
Frog	Body	71	9·058	1·9443	21·46
	Total	69	26·125	5·5326	21·18
Toad	Body	29	8·966	1·7662	19·70
	Total	29	20·415	4·3103	21·11

The great range of variability here exhibited is due to the fact that we are dealing with different stages of growth, all clubbed together. One point, however, comes out from regarding the relative variabilities in Tables II. and III., i.e. that the influence of growth on variability of the body is nearly twice as great as it is on the variability of the cells.

(3) I now pass to the subject of breadth of the corpuscle. Correlating body length with the breadth of the corpuscle, we find from the data in Table D (p. 415):

$$r = -\cdot016 \pm \cdot016,$$

This, as in the case of length of corpuscle, is negative, but it is insensible, having regard to the probable error. This direct correlation is so small that it does not look as if it were solely due indirectly to the correlation between length and breadth of the corpuscle. The latter correlation, found from Table E (p. 416), is ·306, and if we find the partial correlation of breadth and body length for a constant corpuscle length, we have: $r = +\cdot062$, again very slight, but possibly significant, or for a constant length of body, the breadth of corpuscle would increase with size of body.

Let us next investigate how the volume of the corpuscle changes with increasing body length. A rough measure of this volume may be taken as $\gamma = b^2 l$, where b is the breadth and l the length of the corpuscle. If L equal the body length then very closely:

$$r_{\gamma L} = \frac{2v_b r_{bL} + v_l r_{lL}}{\sqrt{4v_b^2 + v_l^2 + 4v_b v_l r_{bl}}}.$$

Now the constants of the breadth frequency are

Mean = ·01530 mm. Standard Deviation = ·00208 mm.

Coefficient of Variation = v_b = 13·575.

Hence remembering that $v_l = 11·69$, $r_{bL} = -·016$, $r_{lL} = -·245$ and $r_{bl} = ·306$, we deduce:

$$r_{\gamma L} = -·101.$$

We therefore conclude that the corpuscular volume decreases very slightly with the growth of the tadpole, but the more significant change is the negative correlation of corpuscular length, or the reduction of the corpuscular length with growth.

For comparison we have only the relatively few toadpolls, whose corpuscles were measured by Dr Warren. These give us the results below:

TABLE IV.

Comparison of Breadth in Corpuscles from Tadpoles of Toad and Frog.

	Number	Mean	Standard Deviation	v_b	r_{bl}	r_{bL}	r_{lL}
B. vulgaris ...	725	·01581	·00186	11·74	·520	− ·196	− ·277
R. temporaria...	1775	·01530	·00208	13·58	·306	− ·016	− ·245

It will be noted that the breadth is a more variable character than the length of the corpuscle in tadpoles. For toadpolls the variation is almost equal for length and breadth, but all the correlations are higher. In particular $r_{\gamma L} = -·252$, being more than double the tadpole value. The smallness of the sample does not allow of our placing much stress on these differences, but in the essential feature that the blood corpuscle becomes smaller as the organism develops the toadpoll confirms the tadpole results completely.

For our present purposes it is desirable to follow out further the effect of increasing length on the breadth of the tadpole corpuscle. The value of the correlation ratio, η, was calculated from the length-breadth table (Table E, p. 416), and we found that while:

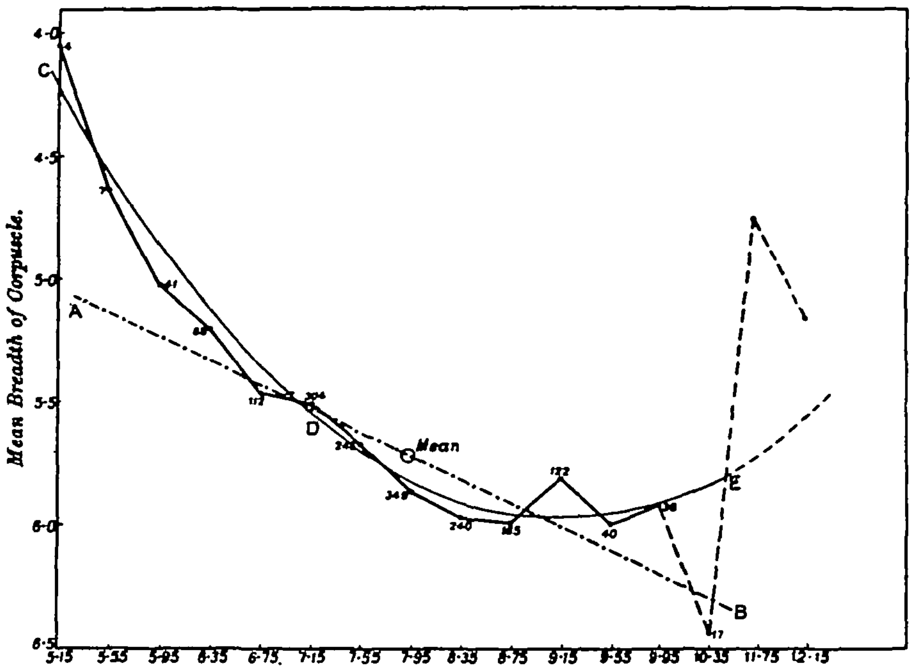
$$r = ·306 \pm ·015,$$

$$\eta = ·350.$$

There appeared thus to be a significant difference and on drawing the regression line, it was at once seen to be curved: see Diagram II.

The facts that the length of the corpuscle decreases with the growth of the tadpole, and further that the correlation between length and breadth is not very marked and is not linear, render it hard to obtain any character of the blood corpuscle free from growth changes.

DIAGRAM II. *R. temporaria* Tadpoles. Regression of Breadth on Length of Corpuscle.



The diagram shows the badness of fit of the regression line AB, and the improvement of fit when we adopt the regression parabola CDE*, or:

$$\frac{y-\bar{y}}{\sigma_y}=r\frac{x-\bar{x}}{\sigma_x}\pm\sqrt{\frac{\eta^2-r^2}{\beta_2-\beta_1-1}}\left\{\left(\frac{x-\bar{x}}{\sigma_x}\right)^2-\sqrt{\beta_1}\frac{x-\bar{x}}{\sigma_x}-1\right\},$$

where β_1, β_2 are the usual biometric functions of the moments, σ_x and σ_y the standard deviations, $\bar{x}$, $\bar{y}$ the means of the lengths and breadths of the corpuscles.

In the present case the equation to this parabola referred to the mean as origin is:

$$Y=\cdot 270X-\cdot 109X^2+\cdot 094.$$

In judging of the fitness of the parabola no weight can be given to the means of the first and last few arrays, which contain very small numbers of corpuscles;

* Pearson: "On the General Theory of Skew Correlation," *Drapers' Research Memoirs* (Dulau & Co.), p. 29.

the observed frequency is placed alongside each point. It may be doubted whether the ultimate decrease of breadth with increasing length is real and not solely due to the two abnormally narrow corpuscles of maximum length. Still there is some sign of a tendency to reduced breadth before these are reached.

(4) I had much hoped that the index of the blood corpuscle would be a character free from growth changes, but the previous section shows that in this respect it is not available. A direct investigation of the correlation of the body length of the tadpole and the index of its blood corpuscles (Table F) gives for the coefficient of correlation,

$$r = +\cdot 179 \pm \cdot 016.$$

Thus the index alters with the growth of the tadpole quite significantly, but not so intimately as in the case of the length of the corpuscle. The change is of course in the opposite direction since the index = breadth/length, and the small decrease in breadth is more than compensated by the greater decrease in length. The corpuscle tends to become rounder with the growth of the tadpole.

For comparative purposes, we find:

TABLE V.

Comparison of Corpuscle Indices for Tadpoles of Toad and Frog.

	Number	Mean	Standard Deviation	v_i	r_{iL}
B. vulgaris ...	725	·751	·0810	10·77	+·081
R. temporaria ...	1775	·732	·1047	14·31	+·179

It would thus appear that the corpuscle in the toadpoll is somewhat more brachycalic than in the tadpole, sensibly less variable and less modified by growth.

On plotting the means of the index arrays to the successive body lengths for tadpoles, the resultant regression line was a very irregular polygon, but showed distinct signs of a non-linear regression. Accordingly the correlation ratio η was found for the indices and body length, and gave the value $\eta = \cdot 348$, thus demonstrating that the index does not increase uniformly with the body length. It rises in fact quickly with body lengths from 5·6 to 7·8, and then remains nearly constant. I may remark that for a somewhat different series of tadpoles, the correlation ratio between index and *total* length, *not* body length, was found to be somewhat higher, i.e. $\eta = \cdot 405$. There is thus more relation between index of corpuscle and growth of the tadpole than is indicated by the correlation coefficient 179. In the case of toadpoll's corpuscles, the regression is again not linear and the correlation ratio, η, is equal to ·273. To get rid of the lumpiness due to taking only 25 corpuscles from 71 tadpoles and 29 toadpolls, we need probably 50 to 100 corpuscles from four or five hundred individuals.

(5) Lastly an attempt was made to ascertain to what extent the blood corpuscles of an individual are characteristic of that individual. The difficulties here are undoubtedly considerable. At the outset of the investigation it was not anticipated that the red blood corpuscles would change in size with the growth of the individual, and it might well have been expected that if this should prove to be the case, the index would still be practically free from the growth factor. In the next place a good deal more inquiry is needed as to the influence of the locus of withdrawal and the treatment of the blood corpuscles, before very definite conclusions are drawn. 50 blood corpuscles drawn from the heart after obliterating the central nervous system in the case of Frog No. 3, when examined without any reagents, gave a value of the mean length = ·0262 mm. A second series of 50 blood corpuscles from the heart mixed with normal salt solution and exposed to vapour of chloroform for 20 to 30 seconds before measurement, gave mean length ·0260 mm. The mean length of 1000 corpuscles of adult frogs

$$= \cdot 0256 \pm \cdot 00004.$$

The error of a random sample of 50 would be about ·0002. It cannot therefore be asserted that the difference of the two samples of the same blood is due to treatment; it is just what might be expected in two random samples. Further the two sample means appear to be significantly different from the mean of the general population of corpuscles. Samples of at least 50 to 100 (and better the latter) ought to be taken, and uniformity observed in time of measurement after extraction and in actual treatment. The immense amount of labour involved is, however, a very serious consideration in such large sampling.

The problem of possible heterogeneity must also be borne in mind, but I think we may definitely assert that the blood corpuscles here dealt with certainly did not belong to any *two* well-marked classes, they failed to give real solutions in all attempts at analysis. It is of course conceivable, in fact not improbable, that the red corpuscles as a population are in various stages of growth, and till more is known as to the place and manner of production of these corpuscles it would be profitless to hazard any guess as to how this may affect the variability and individuality of the population. This may account in part for the relatively low values found for homotyposis in these free cells as compared with my unpublished data for homotyposis in fixed cells.

Emphasising these preliminary points, I will put together the results so far reached for the homotyposis or degree of resemblance of blood corpuscles in the same individual.

The probable errors are based on the number of corpuscles, not on the number of individuals or of pairs dealt with.

It will be obvious from this table that there is a sensible degree of individuality in the corpuscles of the same individual, the raw values of the coefficients are sufficient to demonstrate this. Further, by correcting for change in the blood

TABLE VI.

Homotyposis in the Red Blood Corpuscles of Frog and Toad.

	Character	Number of Individuals	Number of Pairs	Raw Value	Corrected Value	Table
R. temporaria, Adult ...	Length	20	49,000	·153 ± ·021	?*	G, p. 417
R. temporaria, Tadpoles	Index	71	42,600	·333 ± ·014	·405	H, p. 418
" "	Length	61	36,600	·186 ± ·017	·206	I, p. 418
B. vulgaris, Toadpolls...	Index	29	17,400	·121 ± ·025	·134	J, p. 419

corpuscle with growth, we get somewhat higher values. If r be the raw correlation coefficient, η the correlation ratio between the character and stage of growth, R the corrected correlation and m the number of homotypes used, then I have shown that†:

$$R = \frac{r}{1-\eta^2} + \frac{\eta^2}{(m-1)(1-\eta^2)}.$$

From this formula are found the "corrected" values given in the last column of the table. It will be seen that while the changes are in the right direction, they do not raise the homotyposis to the value we might have anticipated from other published and unpublished homotypic results. We therefore conclude that while there is undoubtedly individuality of a homotypic character in the blood corpuscles of the species dealt with, there are very probably differentiating factors, not yet studied, which have not been allowed for when we merely correct the correlations on the basis of body growth. The suggestion that naturally arises is that the cell undergoes changes not only in relation to bodily growth, but probably in relation to its own life.

(6) *Conclusions.*

The object of the present paper will be fulfilled if it shows that:

(i) the size and form of the blood corpuscle is related to the life history of the organism to which it belongs;

(ii) there is a quite sensible individuality in the blood corpuscles of the same individual, if it be not so intense as the mean value which has been found for the homotyposis of purely homologous organs;

(iii) there is a wide field here for biometric inquiry, but it needs much labour and persistence, if the sample is to be 50—100 corpuscles in each of 400 to 500 individuals.

* No body measurement was taken on these frogs, which were described merely as adult; thus no correction for size can be made.

† "On Homotyposis in Homologous, but differentiated Organs." *Proc. R. S.* Vol. 71, pp. 303—4 and footnote.

APPENDIX.

TABLE A.

R. temporaria, Tadpoles. Body Length and Length of Blood Corpuscles.

Body Length.

Length of Blood Corpuscles	5·35—5·85	5·85—6·35	6·35—6·85	6·85—7·35	7·35—7·85	7·85—8·35	8·35—8·85	8·85—9·35	9·35—9·85	9·85—10·35	10·35—10·85	10·85—11·35	11·35—11·85	11·85—12·35	12·35—12·85	12·85—13·35	13·35—13·85	13·85—14·35	Totals
4·95— 5·15	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	1
5·15— 5·35	—	—	1	—	1	—	—	—	—	—	1	—	—	—	—	—	—	—	3
5·35— 5·55	—	—	—	—	1	—	—	—	—	—	—	—	1	—	—	—	—	—	2
5·55— 5·75	—	—	—	—	1	—	—	—	—	—	2	—	—	—	1	—	1	—	5
5·75— 5·95	—	—	—	—	3	—	1	1	2	—	4	—	—	—	—	—	—	—	11
5·95— 6·15	—	—	2	—	1	1	1	1	2	5	10	2	2	—	1	—	2	—	30
6·15— 6·35	—	1	1	1	2	1	2	7	2	4	4	2	2	1	3	—	1	2	36
6·35— 6·55	—	—	1	2	3	4	4	5	2	4	16	3	1	1	4	—	2	—	52
6·55— 6·75	2	—	3	1	2	1	4	9	3	3	—	1	2	1	3	—	—	1	36
6·75— 6·95	—	1	2	2	3	7	9	2	7	10	12	3	4	2	4	—	4	4	76
6·95— 7·15	1	4	7	8	8	9	14	9	11	9	17	13	2	1	3	—	3	3	122
7·15— 7·35	6	3	9	11	7	18	20	15	16	12	19	11	4	3	16	—	7	5	182
7·35— 7·55	4	3	7	17	10	11	15	10	8	9	15	9	8	1	5	—	1	1	134
7·55— 7·75	—	9	5	6	6	5	27	15	11	3	9	5	3	4	3	—	1	2	114
7·75— 7·95	5	10	13	20	10	18	22	12	21	10	11	11	3	3	10	—	1	2	182
7·95— 8·15	13	10	8	17	5	12	24	15	8	9	18	11	5	5	5	—	1	1	167
8·15— 8·35	5	5	10	21	10	11	17	18	12	10	16	10	1	2	13	—	—	1	162
8·35— 8·55	3	6	6	10	2	6	12	7	14	1	4	5	1	—	1	—	—	—	78
8·55— 8·75	3	5	6	6	5	4	5	3	6	4	12	5	2	—	—	—	—	—	66
8·75— 8·95	4	7	9	20	4	5	12	8	11	3	8	2	3	—	1	—	1	1	99
8·95— 9·15	—	3	11	12	10	3	9	2	4	3	5	2	2	1	1	—	—	1	69
9·15— 9·35	2	4	7	9	1	2	7	6	4	—	5	2	4	—	—	—	—	—	53
9·35— 9·55	1	1	6	1	2	2	5	—	1	1	3	—	—	—	—	—	—	—	23
9·55— 9·75	—	1	3	3	—	2	2	1	1	—	2	2	—	—	—	—	—	—	17
9·75— 9·95	—	2	3	7	—	1	3	2	1	—	3	—	—	—	—	—	—	—	22
9·95—10·15	1	—	2	1	2	2	2	1	—	—	2	—	—	—	—	—	—	1	14
10·15—10·35	—	—	1	—	1	—	5	—	3	—	1	—	—	—	1	—	—	—	12
10·35—10·55	—	—	1	—	—	—	3	1	—	—	—	—	—	—	—	—	—	—	5
10·55—10·75	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
10·75—10·95	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0
10·95—11·15	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	1
Totals	50	75	125	175	100	125	225	150	150	100	200	100	50	25	75	0	25	25	1775

TABLE B.

R. temporaria, Tadpoles. Total Length (with tail) and Length of Corpuscles.

Body Length (with tail).

Length of Corpuscles.	16·35—17·35	17·35—18·35	18·35—19·35	19·35—20·35	20·35—21·35	21·35—22·35	22·35—23·35	23·35—24·35	24·35—25·35	25·35—26·35	26·35—27·35	27·35—28·35	28·35—29·35	29·35—30·35	30·35—31·35	31·35—32·35	32·35—33·35	33·35—34·35	34·35—35·35	35·35—36·35	36·35—37·35	37·35—38·35	38·35—39·35	39·35—40·35	40·35—41·35	41·35—42·35	42·35—43·35	Totals
4·95— 5·15	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
5·15— 5·35	—	—	—	—	1	1	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3
5·35— 5·55	—	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
5·55— 5·75	—	—	—	—	—	1	—	—	—	—	1	—	1	—	—	—	—	—	—	2	—	—	—	—	—	—	—	5
5·75— 5·95	—	—	—	2	—	1	—	1	—	—	2	—	2	2	—	—	—	—	—	—	—	—	—	—	—	—	—	10
5·95— 6·15	—	1	—	2	—	1	—	1	1	—	5	3	1	3	6	1	1	—	—	3	—	—	—	—	—	—	—	29
6·15— 6·35	—	—	1	—	2	1	—	2	2	2	2	6	4	2	2	3	—	—	—	4	—	1	—	—	—	—	2	36
6·35— 6·55	—	—	1	3	—	1	1	6	2	2	1	5	9	5	3	2	2	1	—	5	—	1	1	—	—	—	—	51
6·55— 6·75	2	2	—	2	2	1	1	1	2	6	—	8	—	—	3	1	—	—	—	2	—	1	1	—	—	—	1	36
6·75— 6·95	—	1	1	4	1	1	2	7	3	5	1	6	6	1	11	2	2	3	—	7	—	2	1	—	—	—	4	71
6·95— 7·15	—	2	4	8	7	5	3	11	6	10	4	15	9	4	8	6	4	3	—	5	—	1	1	—	—	—	3	119
7·15— 7·35	4	4	3	10	9	5	2	17	8	19	4	20	9	4	12	7	3	2	—	16	—	3	7	—	—	—	5	173
7·35— 7·55	2	5	3	13	7	9	4	17	7	7	1	17	6	10	9	2	—	6	—	4	—	1	2	—	—	—	1	133
7·55— 7·75	2	1	6	8	5	3	—	12	14	13	4	18	3	6	2	3	1	1	—	2	—	4	2	—	—	—	2	112
7·75— 7·95	5	8	6	6	19	11	4	20	6	12	4	24	17	3	4	8	2	1	—	10	—	3	1	—	—	—	2	176
7·95— 8·15	11	8	5	13	12	5	2	16	5	15	7	16	9	8	6	7	2	4	—	6	—	5	—	—	—	—	1	163
8·15— 8·35	3	6	5	10	15	4	1	21	4	9	8	24	12	7	4	5	2	1	—	6	—	2	7	—	—	—	1	157
8·35— 8·55	6	2	4	2	6	5	1	7	3	8	2	17	5	2	2	1	2	—	—	1	—	—	—	—	—	—	—	76
8·55— 8·75	3	4	2	9	2	4	—	7	3	3	2	6	12	4	1	—	2	1	—	—	—	—	—	—	—	—	—	65
8·75— 8·95	7	4	4	12	12	5	1	7	5	9	—	16	5	2	1	—	1	2	—	1	—	—	1	—	—	—	1	96
8·95— 9·15	1	—	7	8	12	2	1	10	3	5	—	6	2	4	1	1	1	—	—	1	—	1	—	—	—	—	1	67
9·15— 9·35	2	—	8	7	6	3	—	6	—	5	—	8	3	3	—	1	—	—	—	—	—	—	—	—	—	—	—	52
9·35— 9·55	—	2	4	2	1	1	—	3	—	5	—	1	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	23
9·55— 9·75	—	—	2	2	2	1	1	—	—	2	—	2	2	2	—	—	—	—	—	—	—	—	—	—	—	—	—	16
9·75— 9·95	1	—	4	—	3	4	—	—	—	3	—	3	1	2	—	—	—	—	—	—	—	—	—	—	—	—	—	21
9·95—10·15	1	—	2	—	1	—	1	2	—	3	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	1	13
10·15—10·35	—	—	1	—	—	—	—	1	—	5	—	3	1	—	—	—	—	—	—	—	—	—	1	—	—	—	—	12
10·35—10·55	—	—	1	—	—	—	—	—	1	2	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5
10·55—10·75	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
10·75—10·95	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0
10·95—11·15	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Totals	50	50	75	125	125	75	25	175	75	150	50	225	125	75	75	50	25	25	0	75	0	25	25	0	0	0	25	1725

TABLE C.

R. temporaria, Tadpoles. Body Length with and without tail.

Body Length without tail.

Body Length with tail.	5·35—5·85	5·85—6·35	6·35—6·85	6·85—7·35	7·35—7·85	7·85—8·35	8·35—8·85	8·85—9·35	9·35—9·85	9·85—10·35	10·35—10·85	10·85—11·35	11·35—11·85	11·85—12·35	12·35—12·85	12·85—13·35	13·35—13·85	13·85—14·35	Totals
16·35—17·35	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
17·35—18·35	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
18·35—19·35	—	1	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3
19·35—20·35	—	1	1	1	1	—	—	—	—	—	—	—	1	—	—	—	—	—	5
20·35—21·35	—	—	1	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5
21·35—22·35	—	—	—	2	1	—	—	—	—	—	—	—	—	—	—	—	—	—	3
22·35—23·35	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	1
23·35—24·35	—	—	—	—	2	3	2	—	—	—	—	—	—	—	—	—	—	—	7
24·35—25·35	—	—	—	—	—	—	3	—	—	—	—	—	—	—	—	—	—	—	3
25·35—26·35	—	—	—	—	—	—	4	2	—	—	—	—	—	—	—	—	—	—	6
26·35—27·35	—	—	—	—	—	—	—	1	—	—	1	—	—	—	—	—	—	—	2
27·35—28·35	—	—	—	—	—	—	—	3	4	2	—	—	—	—	—	—	—	—	9
28·35—29·35	—	—	—	—	—	—	—	—	1	1	2	1	—	—	—	—	—	—	5
29·35—30·35	—	—	—	—	—	—	—	—	—	—	2	1	—	—	—	—	—	—	3
30·35—31·35	—	—	—	—	—	—	—	—	—	1	1	—	1	—	—	—	—	—	3
31·35—32·35	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—	—	—	2
32·35—33·35	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	1
33·35—34·35	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	1
34·35—35·35	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0
35·35—36·35	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	1	—	3
36·35—37·35	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0
37·35—38·35	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	1
38·35—39·35	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
39·35—40·35	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0
40·35—41·35	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0
41·35—42·35	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0
42·35—43·35	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1
Totals	2	3	5	7	4	4	9	6	5	4	8	4	2	1	3	0	1	1	69

TABLE D.

R. temporaria, Tadpoles. Body Length and Breadth of Corpuscles.

Body Length.

Breadth of Blood Corpuscles.	5·35—5·85	5·85—6·35	6·35—6·85	6·85—7·35	7·35—7·85	7·85—8·35	8·35—8·85	8·85—9·35	9·35—9·85	9·85—10·35	10·35—10·85	10·85—11·35	11·35—11·85	11·85—12·35	12·35—12·85	12·85—13·35	13·35—13·85	13·85—14·35	Totals
2·95—3·15	—	—	1	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	2
3·15—3·35	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
3·35—3·55	—	—	2	—	—	—	—	—	—	1	1	—	—	—	—	—	—	—	4
3·55—3·75	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
3·75—3·95	—	—	2	1	—	—	—	—	—	—	1	—	1	—	—	—	—	—	5
3·95—4·15	—	—	3	1	—	1	2	1	1	—	4	—	2	—	—	—	—	—	15
4·15—4·35	—	—	8	5	3	4	4	1	4	3	8	—	7	—	2	—	4	—	53
4·35—4·55	1	2	4	1	2	—	—	1	3	—	5	—	5	—	—	—	1	—	25
4·55—4·75	1	3	8	7	1	5	4	3	6	2	5	3	3	—	4	—	—	3	58
4·75—4·95	5	—	9	8	3	13	14	7	15	9	12	7	5	—	4	—	1	1	113
4·95—5·15	6	5	15	16	5	9	7	5	8	5	10	6	2	2	4	—	5	2	112
5·15—5·35	9	7	16	36	14	19	13	15	27	13	14	7	5	6	11	—	2	4	218
5·35—5·55	7	7	8	24	11	11	19	18	9	12	19	12	7	3	8	—	3	7	185
5·55—5·75	8	7	7	13	5	9	22	10	10	12	13	14	2	2	8	—	4	2	148
5·75—5·95	1	8	8	15	8	8	27	15	23	7	18	6	2	4	4	—	3	3	160
5·95—6·15	1	7	9	16	11	9	17	14	10	5	25	11	4	2	7	—	1	2	151
6·15—6·35	7	7	9	14	9	12	30	25	16	11	29	9	4	2	9	—	1	—	194
6·35—6·55	3	4	6	3	4	8	12	10	7	3	14	7	—	3	6	—	—	1	91
6·55—6·75	1	1	1	3	7	6	12	7	3	5	11	4	—	—	3	—	—	—	64
6·75—6·95	—	7	4	5	6	3	15	10	6	6	4	4	1	—	4	—	—	—	75
6·95—7·15	—	3	—	5	4	1	10	3	2	2	3	6	—	1	1	—	—	—	41
7·15—7·35	—	5	1	2	4	5	7	1	—	1	3	4	—	—	—	—	—	—	33
7·35—7·55	—	1	1	—	—	—	3	1	—	1	1	—	—	—	—	—	—	—	8
7·55—7·75	—	—	—	—	—	1	3	1	—	1	—	—	—	—	—	—	—	—	6
7·75—7·95	—	1	—	—	—	1	—	1	—	—	—	—	—	—	—	—	—	—	3
7·95—8·15	—	—	—	—	1	—	—	1	—	—	—	—	—	—	—	—	—	—	2
8·15—8·35	—	—	—	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	2
8·35—8·55	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0
8·55—8·75	—	—	—	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	2
8·75—8·95	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	1
8·95—9·15	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	1
Totals	50	75	125	175	100	125	225	150	150	100	200	100	50	25	75	0	25	25	1775

R. temporaria, Tadpoles. Length and Breadth of Corpuscles.

Length of Corpuscle.

Breadth of Corpuscle.

	4·95—5·15	5·15—5·35	5·35—5·55	5·55—5·75	5·75—5·95	5·95—6·15	6·15—6·35	6·35—6·55	6·55—6·75	6·75—6·95	6·95—7·15	7·15—7·35	7·35—7·55	7·55—7·75	7·75—7·95	7·95—8·15	8·15—8·35	8·35—8·55	8·55—8·75	8·75—8·95	8·95—9·15	9·15—9·35	9·35—9·55	9·55—9·75	9·75—9·95	9·95—10·15	10·15—10·35	10·35—10·55	10·55—10·75	10·75—10·95	10·95—11·15	Totals
2·95—3·15	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	2
3·15—3·35	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	2
3·35—3·55	—	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	1	—	—	—	—	1	—	—	—	—	—	—	—	—	—	4
3·55—3·75	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	1
3·75—3·95	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	1	2	—	—	—	1	—	—	—	—	—	—	—	—	—	—	5
3·95—4·15	1	—	—	—	—	—	1	—	—	—	1	2	—	2	1	1	—	—	1	1	1	—	1	—	2	—	—	—	—	—	—	15
4·15—4·35	—	2	—	2	1	2	1	7	—	1	5	4	6	2	—	2	3	—	2	4	5	2	—	—	1	1	—	—	—	—	—	53
4·35—4·55	—	—	—	2	—	1	1	1	—	1	2	—	5	3	1	2	2	1	—	—	1	—	1	1	—	—	—	—	—	—	—	25
4·55—4·75	—	—	1	—	1	4	6	1	2	4	7	5	4	1	7	2	1	1	1	5	2	1	—	—	1	—	1	—	—	—	—	58
4·75—4·95	—	—	—	—	2	6	5	6	7	5	17	14	6	6	5	9	6	4	3	1	5	2	—	2	—	—	—	1	1	—	—	113
4·95—5·15	—	—	1	1	1	3	10	2	3	10	7	13	10	5	10	6	9	3	3	4	3	4	—	2	—	1	—	—	—	—	1	112
5·15—5·35	—	—	—	—	3	6	5	10	7	8	25	27	19	15	26	19	10	10	1	10	6	6	2	—	3	—	—	—	—	—	—	218
5·35—5·55	—	—	—	—	1	4	4	5	6	15	14	21	10	15	22	10	21	3	6	12	4	7	—	1	1	1	1	1	—	—	—	185
5·55—5·75	—	—	—	—	1	1	1	4	5	9	10	14	17	5	17	15	15	8	5	7	4	4	2	1	1	1	1	—	—	—	—	148
5·75—5·95	—	—	—	—	1	1	1	9	4	8	12	24	15	16	16	11	8	6	11	5	7	2	1	2	—	—	—	—	—	—	—	160
5·95—6·15	—	—	—	—	—	1	—	2	1	6	12	28	12	8	20	15	14	7	2	3	6	4	3	1	2	2	2	—	—	—	—	151
6·15—6·35	—	—	—	—	—	—	—	3	—	4	3	20	15	19	28	25	21	12	6	13	6	3	3	3	2	5	2	1	—	—	—	194
6·35—6·55	—	—	—	—	—	—	1	1	1	3	1	3	1	6	12	14	15	4	4	13	2	3	3	—	3	—	1	—	—	—	—	91
6·55—6·75	—	—	—	—	—	—	—	—	—	2	4	3	4	—	8	16	9	4	5	2	2	1	1	—	2	1	—	—	—	—	—	64
6·75—6·95	—	—	—	—	—	—	—	—	—	—	1	3	7	4	5	8	9	5	8	9	6	5	1	2	1	—	1	—	—	—	—	75
6·95—7·15	—	—	—	—	—	—	—	—	—	—	—	—	2	3	1	2	11	3	5	4	4	3	2	—	—	—	1	—	—	—	—	41
7·15—7·35	—	—	—	—	—	—	—	—	—	—	—	—	1	3	2	6	5	3	2	3	2	2	1	—	2	—	—	1	—	—	—	33
7·35—7·55	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	1	—	—	—	3	—	2	—	1	—	—	—	—	—	—	—	8
7·55—7·75	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	2	—	—	—	—	1	—	—	1	—	1	—	—	—	6
7·75—7·95	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	3
7·95—8·15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	2
8·15—8·35	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	1	—	—	—	—	2
8·35—8·55	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0
8·55—8·75	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	1	—	—	—	—	—	2
8·75—8·95	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	1
8·95—9·15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	1
Totals	1	3	2	5	11	30	36	52	36	76	122	182	134	114	182	167	162	78	66	99	69	53	23	17	22	14	12	5	1	0	1	1775

TABLE F.

R. temporaria, Tadpoles. Body Length and Indices.

Body Length.

Indices. (Breadth/Length.)	5·35—5·85	5·85—6·35	6·35—6·85	6·85—7·35	7·35—7·85	7·85—8·35	8·35—8·85	8·85—9·35	9·35—9·85	9·85—10·35	10·35—10·85	10·85—11·35	11·35—11·85	11·85—12·35	12·35—12·85	12·85—13·35	13·35—13·85	13·85—14·35	Totals
·3355— ·3755	—	—	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3
·3755— ·4155	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
·4155— ·4555	—	—	5	—	—	1	—	—	—	1	1	—	1	—	—	—	—	—	9
·4555— ·4955	—	—	8	5	1	2	—	—	3	1	3	1	5	—	—	—	—	—	29
·4955— ·5355	—	—	10	3	—	—	4	—	2	1	2	1	3	—	1	—	—	2	29
·5355— ·5755	1	2	11	8	2	3	4	2	6	—	5	1	5	—	—	—	—	—	50
·5755— ·6155	5	8	10	22	4	13	13	9	7	4	12	10	5	1	2	—	2	—	127
·6155— ·6555	13	4	13	21	6	10	18	5	13	2	15	9	3	—	4	—	—	1	137
·6555— ·6955	10	12	15	42	11	14	28	20	27	11	20	7	5	4	9	—	2	4	241
·6955— ·7355	10	9	11	27	16	18	31	12	29	12	18	9	2	3	8	—	6	3	224
·7355— ·7755	6	19	13	25	14	20	31	30	34	25	23	7	4	5	19	—	7	9	291
·7755— ·8155	3	12	10	12	15	19	31	24	16	17	34	18	7	7	17	—	5	4	251
·8155— ·8555	2	5	11	5	15	17	33	30	9	16	31	16	3	4	7	—	3	—	207
·8555— ·8955	—	2	2	2	3	5	12	10	3	4	22	9	6	—	4	—	—	2	86
·8955— ·9355	—	2	2	—	8	1	11	4	—	3	11	8	1	1	2	—	—	—	54
·9355— ·9755	—	—	—	2	3	2	8	3	—	2	3	2	—	—	2	—	—	—	27
·9755—1·0155	—	—	—	—	1	—	1	1	1	—	—	1	—	—	—	—	—	—	5
1·0155—1·0555	—	—	—	—	1	—	—	—	—	1	—	1	—	—	—	—	—	—	3
Totals	50	75	125	175	100	125	225	150	150	100	200	100	50	25	75	0	25	25	1775

TABLE G.

Homotyposis in Length of Red Blood Corpuscles in R. temporaria (Adult Frogs).

Length of First Corpuscle.

Length of Second Corpuscle.	39·4—38·5	38·4—37·5	37·4—36·5	36·4—35·5	35·4—34·5	34·4—33·5	33·4—32·5	32·4—31·5	31·4—30·5	30·4—29·5	29·4—28·5	28·4—27·5	27·4—26·5	26·4—25·5	25·4—24·5	24·4—23·5	Totals
39·4—38·5	—	1	7	—	2	19	17	18	16	13	3	2	—	—	—	—	98
38·4—37·5	1	4	11	14	51	73	52	67	44	27	34	11	—	2	1	—	392
37·4—36·5	7	11	36	36	108	201	153	222	157	127	66	28	12	3	9	—	1176
36·4—35·5	—	14	36	122	136	289	260	358	219	145	144	41	22	6	15	6	1813
35·4—34·5	2	51	108	136	606	737	641	795	425	341	268	99	20	14	16	4	4263
34·4—33·5	19	73	201	289	737	1142	1035	1292	853	586	450	142	43	22	18	7	6909
33·4—32·5	17	52	153	260	641	1035	990	1245	839	618	531	208	84	39	39	11	6762
32·4—31·5	18	67	222	358	795	1292	1245	1568	1254	837	677	300	95	38	46	8	8820
31·4—30·5	16	44	157	219	425	853	839	1254	1098	706	595	298	92	36	30	2	6664
30·4—29·5	13	27	127	145	341	586	618	837	706	546	452	221	91	48	43	1	4802
29·4—28·5	3	34	66	144	268	450	531	677	595	452	470	222	98	47	51	8	4116
28·4—27·5	2	11	28	41	99	142	208	300	298	221	222	124	64	20	33	—	1813
27·4—26·5	—	—	12	22	20	43	84	95	92	91	98	64	28	12	24	1	686
26·4—25·5	—	2	3	6	14	22	39	38	36	48	47	20	12	2	5	—	294
25·4—24·5	—	1	9	15	16	18	39	46	30	43	51	33	24	5	12	1	343
24·4—23·5	—	—	—	6	4	7	11	8	2	1	8	—	1	—	1	—	49
Totals	98	392	1176	1813	4263	6909	6762	8820	6664	4802	4116	1813	686	294	343	49	49000

TABLE H.

Homotyposis in Index of Red Blood Corpuscles of Tadpoles, R. temporaria.

Index of First Corpuscle.

Index of Second Corpuscle.	34—	38—	42—	46—	50—	54—	58—	62—	66—	70—	74—	78—	82—	86—	90—	94—	98—	102—	Totals
34—	2	2	8	6	15	9	8	14	4	2	2	—	—	—	—	—	—	—	72
38—	2	—	3	5	7	3	6	9	5	4	2	2	—	—	—	—	—	—	48
42—	8	3	8	18	29	25	30	34	21	11	15	9	4	1	—	—	—	—	216
46—	6	5	18	42	47	68	92	74	86	55	50	55	23	20	6	—	1	—	648
50—	15	7	29	47	46	61	83	88	93	49	68	42	20	11	9	4	—	—	672
54—	9	3	25	68	61	82	151	148	195	130	144	113	59	19	10	3	4	—	1224
58—	8	6	30	92	83	151	308	346	510	401	413	314	185	67	36	20	3	3	2976
62—	14	9	34	74	88	148	346	366	520	467	439	366	255	102	67	29	8	2	3384
66—	4	5	21	86	93	195	510	520	940	804	1015	718	486	189	121	59	14	4	5784
70—	2	4	11	55	49	130	401	467	804	688	895	730	548	198	143	78	18	11	5232
74—	2	2	15	50	68	144	413	489	1015	895	1266	1082	788	339	180	103	24	13	6888
78—	—	2	9	55	42	113	314	366	718	730	1082	972	906	400	226	110	34	17	6096
82—	—	—	4	23	20	59	185	255	486	548	788	906	890	403	286	128	25	10	5016
86—	—	—	1	20	11	19	67	102	189	198	339	400	403	204	125	47	7	4	2136
90—	—	—	—	6	9	10	36	67	121	143	180	226	286	125	82	46	3	4	1344
94—	—	—	—	—	4	3	20	29	59	78	103	110	128	47	46	14	3	4	648
98—	—	—	—	1	—	4	3	8	14	18	24	34	25	7	3	3	—	—	144
102—	—	—	—	—	—	—	3	2	4	11	13	17	10	4	4	4	—	—	72
Totals	72	48	216	648	672	1224	2976	3384	5784	5232	6888	6096	5016	2136	1344	648	144	72	42600

In this table "34—" signifies all corpuscles, the index of which falls into the range 34 up to, but not including, 38 and so on.

TABLE I.

Homotyposis in Length of Red Blood Corpuscles of Tadpoles, R. temporaria.

Length of First Corpuscle.

Length of Second Corpuscle.	50—	55—	60—	65—	70—	75—	80—	85—	90—	95—	100—	105—	Totals
50—	—	4	3	7	21	20	10	3	4	—	—	—	72
55—	4	6	26	33	61	56	50	29	18	2	3	—	288
60—	3	26	150	195	418	295	344	178	99	25	19	—	1752
65—	7	33	195	286	699	430	494	245	122	41	35	5	2592
70—	21	61	418	699	1986	1629	1700	837	502	124	100	11	8088
75—	20	56	295	430	1629	1500	1596	742	495	129	62	6	6960
80—	10	50	344	494	1700	1596	1836	964	674	212	143	17	8040
85—	3	29	178	245	837	742	964	558	411	128	75	6	4176
90—	4	18	99	122	502	495	674	411	384	152	104	11	2976
95—	—	2	25	41	124	129	212	128	152	56	59	8	936
100—	—	3	19	35	100	62	143	75	104	59	40	8	648
105—	—	—	—	5	11	6	17	6	11	8	8	—	72
Totals	72	288	1752	2592	8088	6960	8040	4176	2976	936	648	72	36600

In this table "50—" signifies all corpuscles the lengths of which were 50 or any value up to, but not including, 55 working units. It differs from Table H in that only 61 individuals were included, 10 showing more or less signs of leg development were excluded by the tabulator, but the corpuscles of these 10 do not seem on examination to be markedly different from those of the remainder.

TABLE J.

Homotyposis in Index of the Red Blood Corpuscles of Toadpolls (B. vulgaris).

Index of First Corpuscle.

Index of Second Corpuscle.	46—	50—	54—	58—	62—	66—	70—	74—	78—	82—	86—	90—	94—	98—	102—	106—	Totals
46—	—	4	5	5	6	5	8	5	5	1	2	1	1	—	—	—	48
50—	4	4	10	11	14	17	25	25	20	3	6	3	2	—	—	—	144
54—	5	10	10	15	27	32	42	37	35	22	20	3	4	1	1	—	264
58—	5	11	15	10	22	42	69	67	49	18	16	6	3	2	1	—	336
62—	6	14	27	22	72	135	164	206	133	64	50	8	8	2	1	—	912
66—	5	17	32	42	135	260	364	462	307	185	107	28	12	6	5	1	1968
70—	8	25	42	69	164	364	554	794	558	252	166	55	21	11	8	5	3096
74—	5	25	37	67	206	462	794	968	798	386	212	74	19	14	9	4	4080
78—	5	20	35	49	133	307	558	798	678	379	220	63	25	5	9	4	3288
82—	1	3	22	18	64	185	252	386	379	222	111	42	9	3	4	3	1704
86—	2	6	20	16	50	107	166	212	220	111	62	19	9	1	4	3	1008
90—	1	3	3	6	8	28	55	74	63	42	19	2	3	1	2	2	312
94—	1	2	4	3	8	12	21	19	25	9	9	3	—	1	2	1	120
98—	—	—	1	2	2	6	11	14	5	3	1	1	1	—	1	—	48
102—	—	—	1	1	1	5	8	9	9	4	4	2	2	1	—	1	48
106—	—	—	—	—	—	1	5	4	4	3	3	2	1	—	1	—	24
Totals	48	144	264	336	912	1968	3096	4080	3288	1704	1008	312	120	48	48	24	17400

In this table "46—" signifies the group of corpuscles with 46 for index, and any value up to but not including 50, and so on.