clusters of gland cells. Tracheal and nerve branches are so closely applied to the gland cells that the nuclei of tracheal epithelial cells and nerve cells are frequently found on the surface of the gland cells, or between them, and sometimes these nuclei even appear to be embedded in the gland cell. The cytoplasm of the gland cells is smooth and non-vacuolar, at least in the stages examined. Fine branches of the prothoracic anterior nerve (Figure 5, pan) which arises from the interganglionic connectives between the suboesophageal and prothoracic ganglia, prothoracic transverse nerve (tn) and mesothoracic dorsal nerve (dn) innervate the ecdysial gland (Figures 4–6) of their side and are occasionally seen entering the cell bodies (Figure 6).

From the literature, it is evident that in several orders the gland cells show a considerable range of variation. In Lepidoptera they are either elongate or lobate or branched structures (FUKADA[6], HERMAN and GILBERT[5], LEE[7], WILLIAMS[2,8]). SRIVASTAVA[4] believed that there is no correlation between the systematic position of the insect and the site of the gland. It is not syncytial, as reported by WILLIAMS[2] in *H. cecropia*.

WILLIAMS[2] reported innervation of these glands by 6 nerves (2 each from suboesophageal, prothoracic and mesothoracic ganglia) whereas HERMAN and GILBERT[5] found small branches of medial nerves from the pro- and mesothoracic ganglia innervating these glands, but found it difficult to demonstrate with whole mounts or stained sections, since only a few nerves supply about 250 gland cells. SRIVASTAVA and SINGH[3], who have reported the innervation of these glands in *Papilio demoleus*, found that the fibres derive from an anterior nerve arizing from the interganglionic connective between the suboesophageal and prothoracic ganglia, and a posterior nerve which is the transverse branch of the median nerve from the prothoracic ganglion. On the basis of observations from haematoxylin-stained preparations, they reported the occurence of a net-work of the fine branches of the aforesaid nerves, which occupy the intercellular spaces of the glands. In *Philosamia ricini*, a reticular structure covers the gland cells but it does not exist in the intercellular spaces (Figure 3). However, there is no doubt that the gland is innervated by branches of prothoracic anterior, prothoracic transverse and mesothoracic dorsal nerves[9].

Zusammenfassung. Die Zellen der Häutungsdrüse von *Philosamia ricini* werden von einer dünnen azellulären Hülle umschlossen. Sie variieren häufig in Gestalt und Grösse. Feine Ausläufer des prothorakalen Nervus anterior und des transversalen Nerven, sowie des mesothorakalen Dorsalnerven, innervieren die Drüsen.

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Numerical Expression of Individuality of Mammals

Individual differences in various morphological and functional properties are observed in a closed colony of mammals. LEIDERMAN and SHAPIRO[1] described a biological index of characteristics of individuals in terms of mean square successive difference (MSSD). This index is valuable in discriminating among individual mammals in their somatic responses to ionizing radiation[2]. The index, however, has one disadvantage: dependence upon the absolute value of the biological property which is used to calculate the MSSD. The present report deals with a new index to express ubiquitously the individuality and its comparison with other indeces of individuality.

Our recognition of individuality is based on the various responses to intrinsic and extrinsic stimulants. When the stimulants are practically the same for all individuals in a given population, individuality is expressed as a numerical difference in the responses of the individuals, where the stimulants mean not only special stimulants, i.e., chemical substances, radiation, etc., but also so-called normal environmental conditions during a short period of time.

The individuality index I^2 is expressed as

$$I^2 = \frac{\sum_{1}^{n-1} (f_i)^2}{n-1}$$

where

$$f_i = d_i - e_i,\ d_i = \frac{x_{i+1} - x_i}{x_i},\ e_i = \frac{x'_{i+1} - x'_i}{x'_i}$$

The x_i is an observed value of a given biological property on the i-th day, and x_{i+1} is the value on the next day. The x_i' is the x value calculated from the regression equation refering to the observed x value and i. The d_i, e_i and f_i values have a plus or minus symbol.

If the daily responses of an individual were ideally constant, the observed daily responses must be constant, constantly increasing during the growth period and constantly decreasing with aging. The x' value is assumed to be the daily ideal responses of an individual. The terms in which the variation of daily responses of a given biological property express individuality are described by BÜNNING[3], as well. The f_i value is the shift of the observed value from the ideal value. For this reason, I^2 means the average of the shifts. By calculating d_i and e_i, one can eliminate the effect of the absolute value on the index.

Five models of individuals, A, B, C, D and E, were under consideration. They had a common given biological property, the responses of which were observed numerically at the same time for 9 days. The models A, B, C and D were made to have the same mean value (3) and the models B and C were made to have the same sample standard deviation value (0.71). The equations to calculate the ideal value were different from each other in 5 models, but the comparison of models did not suffer from this since

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the comparison was carried out on the shift from the ideal value (Table I).

When the MSSD was used to express individuality, we could discriminate among 5 models. In the case of I^2, we could discriminate A, B, C, D but not B and E, and the differences among A, B, C, D were larger than those with the MSSD. In the comparison of B and E, the x values of E were 10 times as large as those of B but the pattern of variation dependent upon the time was the same in both bases. The MSSD of B was different from that of E but the I^2 was same in both cases. The results showed that the I^2 expressed the pattern of responses of individuals independently of the observed absolute value. Therefore, it seems to be a reasonable index to express individuality. The results are shown in Table II.

Table I. The observed values of 5 models of individuals

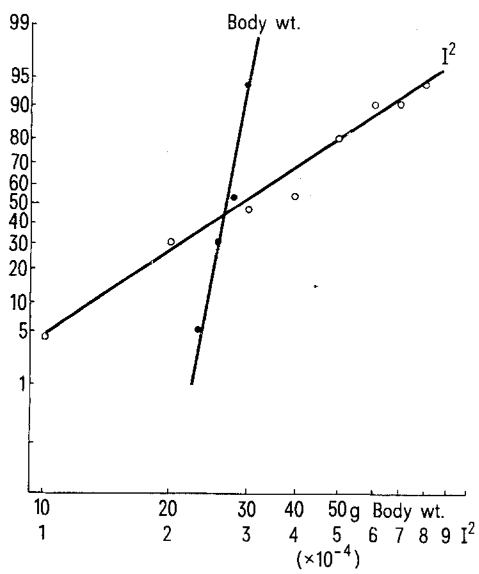
i		1	2	3	4	5	6	7	8	9
x	A	3	3	3	3	3	3	3	3	3
	B	3	4	3	2	3	4	3	2	3
	C	3	4	4	3	2	2	3	3	3
	D	4	4	4	4	3	2	2	2	2
	E	30	40	30	20	30	40	30	20	30

i, the number of observation; x, the observed values of a given biological property; A, B, C, D, E, the models of individual.

Table II. Various indeces of 5 models of individuals

	A	B	C	D	E
mean	3	3	3	3	30
S.D.	0.00	0.71	0.71	1.00	7.07
MSSD	0.00	1.00	0.50	0.25	100.00
I^2	0.00	0.13	0.08	0.02	0.13

S.D., sample standard deviation; MSSD, mean square successive difference; I^2, individuality index.



Distributions depending upon the body weight and the I^2 of mice used in the present experiment on the probability log graph paper. I^2, individuality index.

Application of the present consideration to a mouse population. A closed colony population of 42 *dd/YF* male young mice was used. The porperty used to calculate the I^2 was body weight at 10.00 h every day. Observation was continued for 10 days. At the first observation, the body weight was 25.89 ± 5.77 g (mean $\pm$ S.D.), and at the last observation, it was 29.46 ± 6.59 g. The testicular weight at the last observation was 152.70 ± 34.32 mg and the relative testicular weight to body weight was $(150.26 \pm 1.31) \times 10^{-4}$ g/g. The distributions of mice in the population according to body weight at the first observation and the I^2 were illustrated in a probability log graph paper. Both distributions of mouse showed straight lines in the present population, and the line for the I^2 sloped more than that for the body weight, which meant that the I^2 represented a more clear individuality for each individual in the population than did the body weight, without any deformation of population type dependent upon the body weight from which the I^2 was calculated. (Figure)

The regression equation for each mouse to calculate the ideal situation was calculate on the level of $p < 0.01$ of the statistical significance in all cases. When a regression line was drawn between the relative testicular weight (w) and the I^2, the line was expressed as

$$w = (2.28\, I^2 + 43.66) \times 10^{-4}$$
$$r = 0.487\ (p < 0.05).$$

The individual with a large I^2 value had comparatively large testes.

The resulting distribution dependent upon the body weight was shown a straight line on the probability log graph paper, which seemed to be based on the fact that the mouse population was one of growing mice. The biological meaning of why the I^2 had a large variance i.e. represented the individuality more clearly than the body weight did, is hardly explained with the present results. The consideration of time is not included in measuring the body weight but in calculating the I^2. The individual variance of biological properties observed with the function of time is naturally larger than that of biological properties observed without the function of time.

The result that the individual with a large I^2 value had comparatively large testes is interesting. The individual with the large I^2 value is comparatively hypersensitive against the stimuli. Although some correlation might exist between the homeostatic situation of hypersensitive individual and comparatively large testes or comparatively stimulated growth of testes, the biological meaning of the phenomenon remains to be solved.

Résumé. L'expression numérique de l'individualité des mammifères, indice de l'individualité basé sur la variation des réponses quotidiennes d'une certaine propriété biologique dans un individu. Cet indice est effectif pour exprimer l'individualité de souris d'une colonie close. Il y a une relation positive entre I^2 et le logarithme des poids relatifs des testicules.

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