pressed views of our leading scientific men. The Committee of Enquiry on Annual Tables, set up by the Division of Chemistry and Chemical Technology, is ready to transmit such views to the Research Council. All communications should be addressed to the writer as chairman of the committee at Frick Chemical Laboratory, Princeton, N. J. All such communications will receive the most earnest consideration of those who are charged with the responsibility of securing a solution of this most important problem for the future of research, both scientific and industrial.

HUGH S. TAYLOR,
Chairman, Committee of Enquiry on Annual Tables, National Research Council

SPECIAL ARTICLES

ON THE ORDER OF RELATIVE GROWTH INTENSITIES

IT has been shown for a wide variety of data that the equation, $y = bx^k$, is a general expression for the relation between a part (y) and the whole (x), as the organism increases in size. While this relative growth function can be regarded only as an empirical approximation, yet the approximation is perhaps close enough in many cases to warrant comparing relative growth intensities from the values of k. In a study of relative growth in *Notonecta undulata,* a common back-swimmer, 72 individuals were followed through their development from egg to adult.[1] Measurements taken at the six instars allow an estimate to be made of the true ontogenetic relative growth constants for the individual as well as for the average. From the average measurements it is found for the females, when leg-length (y) is taken against body-length (x), that the values of k for the first, second and third legs are 1.074, 1.069 and 0.948, respectively. Similar values of k for the males are 1.013, 1.012 and 0.908 for the first, second and third legs, respectively. There is a regular antero-posterior gradient, but this is perhaps misleading in the light of the results obtained when the individuals are studied separately. Among the females there were 20 which showed a regular antero-posterior growth gradient. The average values of k for these 20 animals are 1.092, 1.047 and 0.955 for the first, second and third legs, respectively. There were 15 females which showed the high point of the gradient in the middle; their average values of k are 1.046, 1.093 and 0.950 for the first, second and third legs. Among the males 17 showed a regular antero-posterior gradient. Their average values of k are 1.046, 0.997 and 0.916 for the first, second and third legs. The remaining 18 males showed a gradient with high point in the middle; the average values of k are 0.991, 1.048 and 0.904 for the first, second and third legs. While the general level of the gradient is higher in females, yet the difference between the high and low points of the gradient is about the same in both sexes. The average difference with its probable error for all 72 individuals, which include several aberrant specimens, is 0.135 ± 0.002. Although the order of relative growth intensities differs among the individuals, there is an exceptionally high degree of constancy in the relation between the high and low points of the gradient.

Data on the length of the three distal segments of the legs have been used to get a knowledge of the growth gradient within the legs. The results show that the high point of the gradient is represented by the tibia in the first leg and by the femur in the second and third legs. Here again the gradient is uniformly at a higher level in the females. The k-values from the average measurements for the femur, tibia and tarsus of the first leg against body-length are 1.066, 1.144 and 1.028 for females; and for males 0.971, 1.101 and 0.945. Corresponding figures for the homologous segments of the second leg are 1.114, 1.059 and 1.056 for females; and for the males 1.060, 1.013 and 1.010. For the third leg similar values are 1.141, 0.946 and 0.742 for females; and for males 1.104, 0.924 and 0.743. The difference between the high and low points of the gradient in the first leg is 0.116 for the females and 0.156 for the males. Similar values for the second leg are 0.058 and 0.05; and for the third leg 0.399 and 0.361. These values in the neighborhood of 0.37, 0.14 and 0.05, which give the difference in relative growth intensities in the several cases, are approximately the reciprocals of e, e^2 and e^3, which are 0.368, 0.135 and 0.0498, respectively. It was pointed out above that the average difference between the high and low points in the gradient for leg-growth along the thorax is 0.135. Are these relations between relative growth intensities and negative powers of e merely a curious coincidence or are they another instance of nature playing the mathematician? But in any case, the main point of the present note is to call attention to the problem which exists in regard to the order of relative growth intensities at the different levels in the gradient that are marked for us by the parts of the organism, and to point out that that order may differ in the individual from that which is found when average measurements are used for the determination.

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[1] The data were collected by Dr. L. B. Clark, of Union College, whom I wish to thank for generously allowing me their use for the present note.