THE PRONUNCIATION OF BACTERIOPHAGE

In view of the fact that in many places *phage* by itself and in its combinations, as in *bacteriophage,* is being pronounced *fäzh* (*a* as in *art*), I think it not out of place to call attention to the fact that Webster's International Dictionary, 1935 edition, gives the pronunciation as *fāj*; and Dr. Frank Vizetelly for the Standard Dictionary states, "The pronunciation of *phage* is *fēj*—*e* as in *prey*."

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REPORTS

ANNUAL TABLES OF CONSTANTS AND NUMERICAL DATA

Now is the time for all good chemists, and physicists, too, to come to the aid of international effort for a permanent solution of the problem of numerical data in the physical sciences. Ten years ago, at a very heavy cost and with the generous financial support of several foundations, scientific societies, research institutes and many industrial organizations, the United States put forth her effort in the compilation of International Critical Tables. That effort met a generous response on the part of scientists, and several thousand sets of the eight volumes eventually found distribution among the scientific public. Daily, since then, these tables have been used, and citations from them, in the scientific literature here and abroad, are a constant feature, month by month. They have thus justified the time and money and effort which their preparation entailed.

International Critical Tables do not, unfortunately, supply a permanent solution of the problem of physical and chemical data. Newer and better data are constantly replacing the older data. The critical judgment of a decade ago is not necessarily the best or a final judgment. Nor does science stand still. Looking back over a decade of scientific work we see the branches of modern science that were not known when I.C.T. were published. If we think, for example, of deuterium chemistry with all the intensive developments of the last five years, with its effects on organic chemistry, on reaction kinetics, on biochemistry, on nuclear physics, on molecular structure, Raman spectra, none of these newer data of our sciences are to be found in I.C.T. Think, too, of the neutron, the positron, the proton, the deuton and the influence they have exercised on chemistry and physics, with new isotopic species, radioactive and non-radioactive, and the data that have correspondingly accumulated. New techniques in thermodynamics, with entropy data from spectroscopic sources, from low temperature heat capacity measurements, improved techniques of thermochemical measurement by combustion, hydrogenation and electromotive force data—all these have advanced at an accelerated pace in these last ten years; and, what is more important, the application of these data to important industrial developments has been correspondingly intensified. Ten years ago, for example, the application of thermodynamics in the petroleum industry was necessarily of the most elementary nature. To-day it is literally true that the modern aviation fuel will be brought to a higher pitch of perfection, necessary to modern needs, thanks to the entropy, heat capacity and thermochemical data recently accumulated by newer approaches, experimental and theoretical. X-ray analyses of industrial materials, electron diffraction studies of organic compounds, dielectric constants and molecular spectra, all are yielding data on bond distances and bond energies that make our knowledge of molecular structure more intimate and more profound. To keep I.C.T. abreast of this pace of progress, it would require a new edition or new supplements at least every five years. The organization that brought I.C.T. into existence no longer exists. It can not be reestablished without a prohibitive cost. We are forced, therefore, to inquire how, most efficiently, and with the least delay, it can be replaced.

The opportunity to achieve this objective is at hand, and it is imperative that the most serious consideration should be given to the steps necessary to a permanent solution of the problem of numerical constants and data, continually up-to-date. The International Union of Chemistry and the International Council of Scientific Unions have, for many years already, sponsored the publication of Annual Tables of Constants and Numerical Data. An International Commission with a managing board, with headquarters in rue Pierre Curie in Paris, has supervised this work. The aim was originally to publish, each year, the accumulated data of the preceding year in science. The Great War and financial difficulties caused this effort to lag. The Annual Tables have been several years behind schedule. Thanks largely to the generosity of the French Government, with additional financial assistance promised but not yet implemented from other national sources, a strenuous effort has been made in the last two years to bring Annual Tables up to date. Volume XI, Part I, of these tables, just about to appear (McGraw Hill and Co., distributors for U.S.A. and Canada), embodies material for 25 sections of data from the years 1931–34 and material for a few sections of data from the years 1931–36. Volume XI, Part II, and Volume XII will complete the data in the remaining fields up to 1936. These volumes, in active preparation, should appear before the end of 1938 or early in 1939.

It may well be that the delays in publication, which these volumes aim to resolve, will prove ultimately to be a blessing in disguise. The collection of data, covering several years of work in one field, has led the publishers in Paris to offer for sale individual sections, in monograph form, of the volumes now appearing. These units can be sold separately, at a price of $1 to $2, and are thus accessible to workers, in special fields at practicable prices, who could not be expected to procure the complete volumes of data. This separate publication of individual units also enhances the utility of Annual Tables to libraries and their users. Thus, by the purchase of each volume as published and each monograph as it appears, a library can always reserve the volume for library use, but the individual monographs can be taken out on loan to the laboratories and offices, where their special data can be thus continuously accessible to a worker in that field.

Of the data in Volume XI, Part I, about to appear, we can signalize, by way of exemplification, the following of ten separate monographs.

1. Deuterium and Deuterium Compounds (1932–36) by G. Champetier, 79 pp.
2. Dielectric constants and Dipole moments (1931–34) by P. Debye and H. Sack, 66 pp.
3. Free Energy, Heat Content, Entropy and Activity (1931–34) by J. Gueron and J. P. Mathieu, 69 pp.
6. Vapor Pressure, Boiling Points and Gas Laws (1931–34) by W. P. Jorissen, P. C. van Keekem and W. H. Keesom, 65 pp.
9. Electromotive Forces; Oxidation-Reduction Potentials (1931–36) by H. S. Harned and G. Åkerlöf, 45 pp.
10. Thermochemistry (1931–34) by W. A. Roth, 82 pp.

Of Volume XI, Part II, we can note the forthcoming publication of monographs on

Molecular Spectra (1931–36) by V. Henri.

15. Raman Effect (1935–36) by M. Magat, 146 pp.
21. Entropy, Heat Content, Free Energy (1935–36) by J. Gueron and J. P. Mathieu, 42 pp.
16. Light Scattering, Reflexion and Refraction (1931–36).
22. Electrolytic and Chemical Equilibria (1931–36) by R. Griffith A. McKeown and W. S. Shutt, 67 pp.

Acting on an inquiry addressed to it by the American Committee, the managing board has worked out a program which will permit the retention of the monograph idea and at the same time yield annually one volume of Tables of Constants. At the present time there are fields in which research is busy, numerical material abundant and change rapid. This is, for example, the case, at the present time, for nuclear physics, Raman spectra (see Monograph 15 above), dielectric constants, possibly thermochemistry and kinetics. Let us call such sections A. For many other sections, publication once in four years is adequate to collate the available material. The proposal now under study comprises the publication of one volume each year. In alternate years the material (A) which is accumulating rapidly, and covering two years only of data, will be issued. The other years will be employed in publishing, each alternate year, half of the sections, say B and C, in which pressure of new data is not so great. A four-year sequence would therefore be A,B,A,C, which would then repeat itself indefinitely.

This new proposal, if adopted, can lead to an enormous increase in the value of Annual Tables. It will solve the problem of keeping International Critical Tables up-to-date. It simplifies the problem of using such tables, since the newer data in the less busy sections can be covered with one fourth the labor involved in using the Annual Tables of former years. The data in the busy sections will never be more than two years behind publication, which is as it should be in busy fields. The new scheme solves a very difficult editorial problem associated with the older method of conduct of the tables, where one or two dilatory contributors or a contributor unable to complete an assignment due to sickness could hold up a complete volume indefinitely. The new arrangement would diminish such a risk to a fraction of the earlier one by such a division of sections over a period of four years. The new scheme would also diminish the valueless material that inevitably must creep into data published annually. A more critical survey of available data is possible when four years of data are simultaneously examined by those compiling the material.

Should such a program meet with approval by scientific men here it should be put into effect immediately. The years from 1939 to 1942 are transition years in which the project can be put into effect due to the present status of the Annual Tables as already outlined in a preceding paragraph. The plan is consistent with the monograph scheme, which should become the central and most promising feature of Annual Tables for the individual scientist. The Monographs permit the publication of data as ready, with the minimum of delay; the volumes provide the libraries with the same data in collected and permanent form.

Given the support of American science to this proposal, it is certain that a large measure of enthusiastic support can be secured internationally. It is probable that the scheme outlined above could have been put into effect at an earlier date had American cooperation on this basis been assured. Some financial aid for the project in its new form will be needed during the initial years. American research institutions, industrial organizations and the various foundations can reasonably be looked to for such support. The National Research Council will have the project under consideration during their spring meetings. It is to be hoped that such consideration can be based upon the expressed 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,
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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.