
THE IMPACT OF THE "BLUE BIBLE" (CALKINS & SUMMERS, 1941) ON THE TWENTIETH-CENTURY PROTOZOLOGY*

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ABSTRACT

Exactly fifty years ago, Columbia University Press, of New York City, published a hefty blue-covered volume that was destined to have a major impact on the further development of the budding science of protozoology, especially in the universities and research laboratories of the United States of America. The work, entitled "Protozoa in Biological Research" and edited by the renowned Professor Gary N. Calkins and his young colleague Francis M. Summers, was -and still is- truly one of a kind. The tome is here considered -albeit too briefly from a historical perspective, taking into account the era in which it was produced; the status, at that time, of the field of protozoology in America and abroad; and the professional reputations of the 20 contributors to the volume. Space does not permit a detailed analysis, but it is important to establish the fact that the production of this remarkable book had a profound and lasting effect on the development of twentieth-century protozoology in America.

In the summer of 1937, at the Marine Biological Laboratory of Woods Hole, Massachusetts, Dr. Gary Nathan Calkins, Professor of Protozoology at Columbia University, New York City, gathered together a select group of specialists in protozoology to discuss the problem of stimulating greater research interest in the "unicellular animals" (as the protozoa were then called: see Corliss, 1984, for their current neoHaeckelian treatment as phyla within a single kingdom Protista that also embraces all of the algae and the "lower" fungi). It became clear that production of a scholarly book with chapters on diverse topics prepared by experts in those areas might indeed meet the need. Two further problems then became apparent: the selection of subject matter to be included and the choice of appropriate authorities to do the writing. When the 1148-page volume appeared, four years later (Calkins and Summers, 1941), it was apparent that some topics had not been -could not be- fitted in and that some specialists were missing from the roster of the 20 authors who were represented. Nevertheless, the coverage was great, the chapters had been beautifully prepared and illustrated, and the writers were distinguished protozoologists mostly from major universities in America.

We know for certain that one of the missing authorities was the great protozoan ecologist trained at Wisconsin under Drs. Birge and Juday, viz., Professor Lowell E. Noland, who was suffering from an illness in the late 1930's. At the present time, more than half a century later, I can only speculate on the identity of other well-known leaders who might have been included on an original list of potential contributors: for example, R.W. Hegner, D.H. Wenrich, R.R. Kudo, M.M. Metcalf (who died in 1940), J.A. Cushman, R. Wichterman, and E. Beltrán (of Mexico City, but a Columbia University Ph.D., year 1932, under Calkins).

Until 1941 -with the notable exception of Hegner and Andrews (1930), a 532-page book called "Problems and Methods of Research in Protozoology", containing some 21 short chapters by 27 specialist contributors (four of whom subsequently were also authors in the "blue bible" of Calkins and Summers) but almost exclusively devoted to parasitological topics -research in protozoology was reported only in scholarly journals that were often published abroad-. Reigning authorities were generally English (Dobell, Garnham, Hickson, Hoare, Minchin, Wenyon) or French (Brumpt, Chatton, Duboscq, Fauré-Fremiet, Mesnil, Nicolle) or, specially, German (Bütschli, Doflein, Haeckel, Hartmann, R. Hertwig, Jollos, Kahl, Reichenow, Schaudinn, Stammer, Wetzel). American schools had been established at a few centers (e.g., by Jennings, Hegner, and Mast at Johns Hopkins, Calkins at Columbia, Hall at New York University, Kofoid and Kirby at University of California (Berkeley), Kudo at Illinois, Wenrich at Pennsylvania, Noland at Wisconsin, Taliaferro at Chicago, Woodruff at Yale, Becker at Iowa State University, and Taylor at Stanford), but growth was slow and the general biological community in the U.S.A. did not appreciate the virtues of the protozoa as experimental organisms in research. The only common source of protozoological information before 1940 was in textbooks, and the only ones of these available in "American English" -beyond

general and invertebrate zoology texts, which devoted limited space to the protozoa -were those that had been produced by Calkins (1901, 1909, 1926, 1933) and Kudo (1931, 1939).

So, the Calkins and Summers' treatise of 1941 was a revelation to general zoologists and an inspiration to aspiring biology graduate students wondering what field of research they should enter. The masterful presentations by Kirby (two long chapters), Hall, Kidder, Jennings, Sonneborn, Taliaferro, and Taylor (see references to these works in the bibliography at the end of this paper) alone make the whole volume a most invaluable source of information on what was then known and, more importantly, on what was waiting to be discovered in the selected research fields of the contributors. For an idea of the subject matter treated in all of the 20 chapters the reader is referred to the "Literature Cited" section of the present work: any reference included there that bears the date "1941" represents a contribution of a "blue bible" author.

The book allowed a depth of treatment impossible to include in a standard textbook. And the clear illustrations and flawless editing also made the volume very attractive. To have the writings of 20 outstanding specialists still active in their areas all in one place was another advantage to the reader whether he or she was an established researcher or a neophyte in the field. A graduate-level production, the work became ideal "required reading" for budding protozoologists, parasitologists, and cell biologists in many teaching institutions. The bibliographies, rich in historical as well as current-at-the-time references to the relevant literature, proved to be immensely helpful to professors and students alike.

The book was really one of a kind, and I do not hesitate to imply that nothing like it has appeared before or even since its publication. Some of my colleagues might beg to differ, reminding us that various multi-authored, multi-volume treatises on protozoa have been published within the past 50 years. That is true, and many of these sets of works are indeed most valuable. But, they have either focussed on single (if extensive) areas, such as "biochemistry and physiology" (e.g., see the long series edited by Lwoff, 1951; Hutner and Lwoff, 1955; Hutner, 1964; Levandowsky and Hutner, 1979a,b, 1980, 1981; and the outstanding single volume edited by Kidder, 1967) or "parasitology" (e.g., see Kreier, 1977a-c, 1978), or have been considerably less lengthy and/or single-authored and narrower (less comprehensive) in coverage.

The most likely successor to Calkins and Summers' "blue bible" -and it was so hailed at the time of its publication- was T.T. Chen's four-volume "Research in Protozoology" (Chan, 1967a, b, 1969, 1972). (Three of the contributors to sections in those volumes, incidentally, had also been authors in the 1941 tome). But the work courageously edited by Chen differs from that of Calkins and Summers in several respects not all of which are complimentary. For example, it is inconveniently multi-volumed, with the separate books published some years apart (except for Vols. 1 and 2, both appearing in 1967); the total of the combined pages is 1980, but this is only some 800 more than area in the "blue bible" and the pages are considerably smaller in size and much less attractively composed; the separate parts of the volumes are not labeled, either as "sections" or "chapters"; and the quality of the contributions is not uniformly as high as it might be, although there are some very excellent treatments of certain subjects that were not covered at all in the 1941 book (e.g., ecology, by L.E. Noland; radiation, A.C. Giese; nuclei, D.M. Prescott and I.B. Raikov; and cell division, E. Zeuthen). And the sections by Vance Tartar (on morphogenesis) and by Dorothy R. Pitelka (on fibrillar systems) have already become classics in the literature. These last two topics were also well represented in 1941 (in the contributions offered by Summers and Taylor, respectively), but a considerable amount of new information had accrued in those areas during the intervening 30 years.

On proceeding pages, general mention has been made concerning the skills and reputations of the 20 contributors to the volume edited by Calkins and Summers. Their names are listed here, in alphabetical order: E.R. Becker, H.W. Beams, G.N. Calkins, R.P. Hall, T.L. Jahn, H.S. Jennings, G.W. Kidder, R.L. King, H. Kirby, C.A. Kofoid, R.F. MacLennan, S.O. Mast, O.W. Richards, T.M. Sonneborn, F.M. Summers, W.H. Taliaferro, C.V. Taylor, J.P. Turner, J.H. Weatherby, and L.L. Woodruff. (For the titles of their chapters, all of which were single-authored except the one by Beams and King, see the bibliography of this paper).

Space does not permit separate treatment of each author here; "thumbnail sketches" of several (Becker, Calkins, Hall, Jennings, King, Kirby, Kofoid, Woodruff) are included, with photographs, in the short pictorial history of protozoology published 13-14 years ago by the writer (Corliss, 1978, 1979). While all contributor are correctly judged as having been authorities in their specialities, they were no all of the same age by any means: Calkins, Jennings, and Kofoid were well into their seventies; but several authors were in only their thirties while others had ages running in the forties and fifties at the time of publication of their chapters. Eight of the 20 specialists, including the three oldest ones (see above), and, sadly, the two youngest ones (MacLennan and Turner), passed away within 10 years of the book's date of publication. The only author, to my knowledge, still active in research today is Dr. George W. Kidder of Amherst College, who has been publishing on the biochemistry of the ciliate *Tetrahymena* for over half a century now.

Interestingly enough, and not too surprising, perhaps, is the fact that several schools of protozoological research were the suppliers of two-thirds of the authorships: Kofoid led the group, with four of his doctoral students as contributors; Calkins and three, including Woodruff, only 10 years his junior and his first Ph.D. in protozoology at Columbia; and Hall and Jennings each one of their early and very outstanding students, Jahn and Sonneborn, respectively.

Significantly, many of the world's leaders in protozoology today are the students -of the students of those students- of the 20 contributors to that everlastingly valuable "blue bible" of Calkins & Summers, the heuristic work published 50 years ago that I have been describing -albeit too briefly in the present paper. The foresight and energetic determination of Professor Gary N. Calkins, as senior editor of that memorable volume, deserve a special salute. Those of us working in any area of protozoology today owe Calkins and his co-authors a lasting debt of gratitude for publicizing -and really being the first to do so in a comprehensive way- the importance of our wee protist in modern biological researches of many kinds.

LITERATURE CITED

- BECKER, E.R., 1941. Certain aspects of pathogenicity of Protozoa. Chapt. XVII. *In*: Calkins, G.N. and F.M. Summers, eds., *Protozoa in Biological Research*, Columbia University Press, New York, pp. 818-829
- BEAMS, H.W. and R.L. KING, 1941. Some physical properties of the protoplasm of the Protozoa. Chapt. II. *In*: Calkins, G.N. and F.M. Summers, eds., *Protozoa in Biological Research*, Columbia University Press, New York, pp. 43-110
- CALKINS, G.N., 1901. *The Protozoa*. Macmillan, New York. 347 p.
- CALKINS, G.N., 1909. *Protozoology*. Lea & Febiger, New York and Philadelphia. 349 p.
- CALKINS, G.N., 1926. *The Biology of the Protozoa*. Lea & Febiger, New York and Philadelphia. 623 p.
- CALKINS, G.N., 1933. *The Biology of the Protozoa*. 2nd ed. Lea & Febiger, Philadelphia. 623 p.
- CALKINS, G.N., 1941. General considerations. Chapt. I. *In*: Calkins, G.N. and F.M. Summers, eds., *Protozoa in Biological Research*, Columbia University Press, New York, pp. 3-42.
- CALKINS, G.N. and F.M. SUMMERS, eds., 1941. *Protozoa in Biological Research*. Columbia University Press, New York. 1148 p.
- CHEN, T.-T., ed., 1967a. *Research in Protozoology*. Vol. 1. Pergamon Press, London and New York. 428 p.
- CHEN, T.-T., ed., 1967b. *Research in Protozoology*. Vol. 2. Pergamon Press, London and New York. 398 p.
- CHEN, T.-T., ed., 1969. *Research in Protozoology*. Vol. 3. Pergamon Press, London and New York. 744 p.
- CHEN, T.-T., ed., 1972. *Research in Protozoology*. Vol. 4. Pergamon Press, London and New York. 413 p.
- CORLISS, J.O., 1978. A salute to fifty-four great microscopists of the past: a pictorial footnote to the history of Protozoology. Part I. *Trans. Amer. Microsc. Soc.*, 97: 419-458.
- CORLISS, J.O., 1979. A salute to fifty-four great microscopists of the past: a pictorial footnote to the history of Protozoology. Part II. *Trans. Amer. Microsc. Soc.*, 98: 26-58.
- CORLISS, J.O., 1984. The kingdom Protista and its 45 phyla. *BioSystems*, 17: 87-126.
- HALL, R.P., 1941. Food requirements and other factors influencing growth of Protozoa in pure cultures. Chapt. IX. *In*: Calkins, G.N. and F.M. Summers, eds., *Protozoa in Biological Research*, Columbia University Press, New York, pp. 475-516.
- HEGNER, R.W. and J. ANDREWS, eds., 1930. *Problems and Methods of Research in Protozoology*. Macmillan, New York. 532 p.

- HUTNER, S.H., ed., 1964. *Biochemistry and Physiology of Protozoa*. Vol. 3. Academic Press, New York and London. 616 p.
- HUTNER, S.H. and A. LWOFF, eds., 1955. *Biochemistry and Physiology of Protozoa*. Vol. 2. Academic Press, New York and London. 388 p.
- JAHN, T.L., 1941. Respiratory metabolism. Chapt. VI. *In: Calkins, G.N. and F.M. Summers, eds., Protozoa in Biological Research*, Columbia University Press, New York, pp. 352-403.
- JENNINGS, H.S., 1941. Inheritance in Protozoa. Chapt. XV. *In: Calkins, G.N. and F.M. Summers, eds., Protozoa in Biological Research*, Columbia University Press, New York, pp. 710-771.
- KIDDER, G.W., 1941. The technique and significance of control in protozoan culture. Chapt. VIII. *In: Calkins, G.N. and F.M. Summers, eds., Protozoa in Biological Research*, Columbia University Press, New York, pp. 448-474.
- KIDDER, G.W., ed., 1967. *Protozoa*. Vol. 1 of Florkin. M. and B.T. Scheer, eds., *Chemical Zoology*, Academic Press, New York and London. 912 p.
- KIRBY, H., 1941a. Relations between certain Protozoa and other animals. Chapt. XIX. *In: Calkins, G.N. and F.M. Summers, eds., Protozoa in Biological Research*, Columbia University Press, New York, pp.890-1008.
- KIRBY, H., 1941b. Organisms living on and in Protozoa. Chapt. XX. *In: Calkins, G.N. and F.M. Summers, eds., Protozoa in Biological Research*, Columbia University Press, New York, pp. 1009-1113.
- KOFOID, C.A., 1941. The life cycle of the Protozoa. Chapt. XI. *In: Calkins, G.N. and F.M. Summers, eds., Protozoa in Biological Research*, Columbia University Press, New York, pp. 565-582.
- KREIER, J.P., ed., 1977a. *Parasitic Protozoa*. Vol. 1. Academic Press, New York and London. 441 p.
- KREIER, J.P., ed., 1977b. *Parasitic Protozoa*. Vol. 3. Academic Press, New York and London. 563 p.
- KREIER, J.P., ed., 1977c. *Parasitic Protozoa*. Vol. 4. Academic Press, New York and London. 386 p.
- KREIER, J.P., ed., 1978. *Parasitic Protozoa*. Vol.2. Academic Press, New York and London. 730 p.
- KUDO, R.R., 1931. *Handbook of Protozoology*. Charles C. Thomas, Springfield, Illinois. 451 p.
- KUDO, R.R., 1939. *Protozoology*. 2nd ed. Charles C. Thomas, Springfield, Illinois. 689 p.
- LEVANDOWSKY, M. and S.H. HUTNER, eds., 1979a. *Biochemistry and Physiology of Protozoa*. 2nd ed., Vol. 1. Academic Press, New York and London. 462 p.
- LEVANDOWSKY, M. and S.H. HUTNER, eds., 1979b. *Biochemistry and Physiology of Protozoa*. 2nd ed., Vol. 2. Academic Press, New York and London. 509 p.
- LEVANDOWSKY, M. and S.H. HUTNER, eds., 1980. *Biochemistry and Physiology of Protozoa*. 2nd ed., Vol. 3. Academic Press, New York and London. 446 p.
- LEVANDOWSKY, M. and S.H. HUTNER, eds., 1981. *Biochemistry and Physiology of Protozoa*. 2nd ed., Vol. 4. Academic Press, New York and London. 574 p.
- MACLENNAN, R.F., 1941. Cytoplasmic inclusions. Chapt. III *In: Calkins, G.N. and F.M. Summers, eds., Protozoa in Biological Research*, Columbia University Press, New York, pp. 111-190
- MAST, S.O., 1941. Motor response in unicellular animals. Chapt. V. *In: Calkins, G.N. and F.M. Summers, eds., Protozoa in Biological Research*, Columbia University Press, New York, pp. 271-351.
- RICHARDS, O.W., 1941. The growth of the Protozoa. Chapt. X. *In: Calkins, G.N. and F.M. Summers, eds., Protozoa in Biological Research*, Columbia University Press, New York, pp. 517-564.
- SONNEBORN, T.M., 1941. Sexuality in unicellular organisms. Chapt. XIV. *In: Calkins, G.N. and F.M. Summers, eds., Protozoa in Biological Research*, Columbia University Press, New York, pp. 666-709.

- SUMMERS, F.M., 1941. The Protozoa in connection with morphogenetic problems. Chapt. XVI. In: Calkins, G.N. and F.M. Summers, eds., Protozoa in Biological Research, Columbia University Press, New York, pp.772-817.
- TALIAFERRO, W.H., 1941. The immunology of the parasitic protozoa. Chapt. XVIII. In: Calkins, G.N. and F.M. Summers, eds., Protozoa in Biological Research, Columbia University Press, New York, pp. 830-889.
- TAYLOR, C.V., 1941. Fibrillar systems in ciliates. Chapt. IV. *In*: Calkins, G.N. and F.M. Summers, eds., Protozoa in Biological Research, Columbia University Press, New York, pp.191-270.
- TURNER, J.P., 1941. Fertilization in Protozoa. Chapt. XII. *In*: Calkins, G.N. and F.M. Summers, eds., Protozoa in Biological Research, Columbia University Press, New York, pp. 583-645.
- WEATHERBY, J.H., 1941. The contractile vacuole. Chapt.VII. *In*: Calkins, G.N. and F.M. Summers, eds.,Protozoa in Biological Research, Columbia University Press, New York, pp. 404-447
- WOODRUFF, L.L., 1941. Endomixis. Chapt. XIII. *In*: Calkins, G.N. and F.M. Summers, eds., Protozoa in Biological Research, Columbia University Press, New York, pp. 646-665.