

JOURNAL OF BACTERIOLOGY

VOLUME 106 • NUMBER 2 • MAY 1971

EDITORIAL BOARD

L. LEON CAMPBELL, Editor-in-Chief (1975)
University of Illinois, Urbana

R. L. ANDERSON, Editor (1975)
Michigan State University, East Lansing

ROY CURTISS III, Editor (1974)
The University of Tennessee, Oak Ridge

S. G. BRADLEY, Editor (1974)
Virginia Commonwealth University, Richmond

ALLEN G. MARR, Editor (1973)
University of California, Davis

Martin Alexander (1972)
W. Lane Barksdale (1972)
M. E. Bayer (1972)
Claire M. Berg (1973)
Robert W. Bernlohr (1973)
Alan Campbell (1972)
A. J. Clark (1972)
Royston C. Clowes (1972)
V. W. Cochrane (1972)
S. F. Conti (1972)
A. L. Demain (1972)
John A. DeMoss (1972)
Martin Dworkin (1973)
Ellis Eaglesberg (1972)
Herman Friedman (1972)
A. T. Ganesan (1972)
Howard Goldfine (1972)
Joseph S. Gots (1972)
Harlyn O. Halvorson (1972)
F. M. Harold (1973)
Leonard Hayflick (1972)

George Hegeman (1971)
Charles E. Helmstetter (1972)
D. S. Hoare (1971)
Joseph T. Holden (1972)
John G. Holt (1972)
Stanley C. Holt (1971)
John Ingraham (1973)
John H. Law (1971)
Hillel S. Levinson (1972)
W. R. Lockhart (1972)
Donald G. Lundgren (1971)
Manley Mandel (1972)
Paul Margolin (1972)
Alvin Markovitz (1973)
Julius Marmur (1971)
Robert G. Martin (1971)
M. L. Morse (1972)
Richard P. Novick (1973)
Kenneth Paigen (1972)
Leo Parks (1973)
H. J. Phaff (1972)
Allen T. Phillips (1973)

Jack Preiss (1971)
H. V. Rickenberg (1972)
John Roth (1973)
M. R. J. Salton (1972)
Moselio Schaechter (1972)
David Schlessinger (1972)
W. R. Siström (1972)
Lucille Smith (1972)
Bernard S. Strauss (1972)
Noboru Sueoka (1972)
Paul S. Sypherd (1971)
A. L. Taylor (1971)
H. E. Umbarger (1973)
Arthur Weissbach (1971)
N. E. Welker (1973)
R. W. Wheat (1972)
Helen R. Whiteley (1972)
Meyer J. Wolin (1973)
Barbara E. Wright (1973)
Frank E. Young (1973)
Stanley A. Zahler (1971)

ROBERT A. DAY, *Managing Editor, 4715 Cordell Ave., Bethesda, Md. 20014*

EX OFFICIO

R. E. HUNGATE, President (1970-1971)

DONALD E. SHAY, Secretary

MORRIS F. SHAFFER, Vice-President (1970-1971)

T. J. CARSKI, Treasurer

The *Journal of Bacteriology*, a publication of the American Society for Microbiology, 4715 Cordell Ave., Bethesda, Md. 20014, is devoted to the advancement and dissemination of fundamental knowledge concerning bacteria and other microorganisms. The *Journal* is published monthly, and the twelve numbers are divided into four volumes per year. The subscription price is \$52 (Postal Union Countries, \$54; other foreign, \$55) per year. Single copies are \$5.00 (foreign, 5.25). Members of the American Society for Microbiology may receive the *Journal* as part of their dues. Correspondence relating to reprints, defective copies, availability of back issues, lost or late proofs, disposition of submitted manuscripts, and general editorial matters should be directed to the ASM Publications Office, 4715 Cordell Ave., Bethesda, Md. 20014. Correspondence from ASM members relating to membership dues, member subscriptions, changes of address, incorrect address, incorrect journals, etc., should be

directed to the American Society for Microbiology, 1913 I St., N.W., Washington, D.C. 20006. Nonmembers of the Society should write The Williams & Wilkins Co., 428 E. Preston St., Baltimore, Md. 212 regarding institution of nonmember subscriptions and nonreceipt journals. Published monthly by the ASM at 428 E. Preston St., Baltimore, Md. 21202.

Second class postage paid at Baltimore, Md. 21202, and at additional mailing offices.

Made in the United States of America.

Copyright © 1971, American Society for Microbiology
All Rights Reserved.

Author Index

- Achtman, Mark, 529
Anker, P., 634
Atkins, J. F., 421
- Barksdale, Lane, 707
Barton, Robert W., 508
Bean, Barry, 412
Berg, Claire M., 297
Bernlohr, R. W., 375
Blackburn, T. H., 394
Blasi, Francesco, 508
Boyd, John W., 578
Boyer, Ernest W., 561
Brown, Albert T., 456
- Campbell, L. Leon, 603
Chibata, Ichiro, 493
Clark, Alvin J., 529
Cochrane, Vincent W., 301
Cohen, Murray, 347
Cole, Roger M., 712
Cooper, Stephen, 709
Costerton, J. W., 659
Cox, C. D., Jr., 356
Crawford, Irving P., 331
- DeVoe, I. W., 659
Doi, Roy H., 305
Dul, Michael J., 672
Dworkin, Nomi B., 543
- Ferretti, Joseph J., 691
Fisher, Clark A., 707
Fisher, William D., 626
Fralick, Joe A., 626
Friedberg, Errol C., 500
- Gahan, P., 634
Gherna, R. L., 687
Goebel, Werner, 311
Goldberger, Robert F., 508
Gott, Cora L., 438, 444
Grandgenett, Duane P., 551
Greeb, J., 421
Greer, Sheldon, 615
Greppin, H., 634
Gunsalus, I. C., 468
- Hageage, G. J., Jr., 687
- Hartline, Richard A., 468
Hartman, Paul A., 561
Haschke, Richard H., 603
Herman, Robert K., 543
Higgins, I. J., 702
Highton, Peter J., 646
Hirota, Yukinori, 523
Hobbs, D. G., 646
Hughes, R. C., 694
- Inouye, Masayori, 539
- Jahnke, Linda, 596
Jensen, Thomas E., 683
Jones, H. E., 339
Jones, Lily A., 386
Joyce, Gay H., 403
- Katagiri, M., 369
King, John J., 500
Kisumi, Masahiko, 493
Klein, Harold P., 596
Komatsubara, Saburo, 493
Kovach, John S., 508
- Lacroute, Francois, 519
Langvad, Finn, 679
Lerud, R. F., 571
Lesk, E. M., 394
Leutgeb, Werner, 588
Lindstrom, E. S., 700
Loper, J. C., 421
Lovett, Paul S., 697
- McDonald, William C., 672
MacLeod, Robert A., 659
Mandel, M., 608
Maurer, Richard, 331
Meinke, William J., 386
Mindich, Leonard, 514
Mitchell, Ralph, 640
- Ohta, Y., 702
- Panos, Charles, 347
Payne, W. J., 356
Phibbs, P. V., Jr., 375
- Phillips, Arthur W., 578
- Qadri, S. M. Hussain, 438, 444
- Radke, Kathryn L., 432
Rado, Thomas A., 301
Ranhand, Jon M., 712
Ribbons, D. W., 702
Riley, P. S., 356
Rossi, John J., 297
Rossier, A., 634
- Schneider, R. P., 479, 487
Schrempf, Hildgund, 311
Schwarz, Uli, 588
Scott, Randolph H., 438
Seidler, Ramon J., 608
Shull, Fred W., Jr., 626
Sicko, Linda M., 683
Siegel, Eli C., 432
Sinensky, Michael, 449
Sirotnak, F. M., 318
Spence, Kemet D., 325
Stahly, Donald P., 551
Stokes, Elaine, 694
Stratton, Lewis P., 626
Stroun, M., 634
Szaniszló, Paul J., 640
- Tomasz, Alexander, 412
- Van Etten, James L., 704
Vapnek, Daniel, 615
- Wheelis, M. L., 369
White, David C., 403
Whiteley, H. R., 571
Wiley, W. R., 479, 487
Willecke, Klaus, 514
Willets, Neil, 529
Williams, Robert P., 438, 444
Winkler, Herbert H., 362
Wittenberger, Charles L., 456
Wuesthoff, G., 709
- Yamakawa, Toshio, 305
Yoch, Duane C., 700
Yoshikawa, Masanosuke, 523
Young, Frank E., 697

JOURNAL OF BACTERIOLOGY

INSTRUCTIONS TO AUTHORS

Submit manuscripts in duplicate (original and one carbon) to ASM Publications Office, 4715 Cordell Ave., Bethesda, Md. 20014.

General policy. Any manuscript submitted must be a report of unpublished original research, which is not being considered for publication elsewhere. Each manuscript should present the results of an independent, cohesive study; "series" papers are discouraged. A manuscript accepted and published by the *Journal* must not be published again in any form without the consent of ASM.

Contributors should indicate, in the covering letter accompanying their manuscript, which subject section of the *Journal* table of contents their paper should be listed under. However, final decision will be made by the Editors.

A charge of \$25 per printed page is assessed for publication in the *Journal*. Most institutions and granting agencies in the United States permit the payment of publication charges as a part of their general research support. It is recognized, however, that such funds are not always available to laboratories outside the United States. In such cases, the cost of publication will be borne by the American Society for Microbiology.

The "editorial style" of the *Journal* essentially follows the *Style Manual for Biological Journals* (2nd ed., AIBS, 1964). Genetics symbols should essentially follow the recommendations of Demerec et al. (*Genetics* 54:61, 1966). Biochemical abbreviations should essentially follow the rules of the IUPAC-IUB (*J. Biol. Chem.* 241:527, 1966). Enzyme activity should be expressed in terms of international units (*Enzyme Nomenclature*, Elsevier Publishing Co., 1965), and the EC number should be given parenthetically at first use in the text. In expressing lengths, weights, and volumes, the prefixes nano (n) and pico (p) should be used instead of millimicro (m μ) and micromicro ($\mu\mu$). Express lengths in nanometers (nm; 10⁻⁹ m) or in micrometers (μ m; 10⁻⁶ m) instead of millimicrons (m μ ; 10⁻⁶ m), microns (μ ; 10⁻⁶ m), or Angstroms (A; 10⁻¹⁰ m). Express parts per million (ppm) as micrograms per milliliter (μ g/ml), micrograms per gram (μ g/g), or microliters per liter (μ liters/liter), as appropriate. The *Journal* reserves the privilege of editing manuscripts to make them conform with the adopted style.

Form of manuscript. Manuscripts should be typed on bond paper (8 1/2 by 11 inches). All parts of the manuscript should be typed double-space or, preferably, triple-space, with margins of at least 1 1/2 inches at the top, bottom, and both sides of each page. Most manuscripts can and should be divided into the following sections: Abstract, Introduction, Materials and Methods, Results, Discussion, Acknowledgments, and Literature Cited.

Abstract. An Abstract appears at the beginning of each paper in the *Journal*. The Abstract should not exceed 250 words.

Literature Cited. In the text, references are cited by number. The Literature Cited section should be typed in alphabetical order, by first author, and numbered. Names of journals are abbreviated according to *Access* (American Chemical Society, 1969). Citations of abstracts, theses, "unpublished data," "personal com-

munication," and "in press" will not be accepted in the Literature Cited.

Tables. Each table should be typed on a separate page. The data should be arranged so that columns of like material read down, not across. The headings should be sufficiently clear so that the meaning of the data will be understandable without reference to the text. Explanatory footnotes are permitted, but detailed descriptions of the experiments are not. The materials and methods used to gain the data should properly remain in the section of that name.

Figures. A complete set of figures, preferably glossy photographs, not larger than 8 1/2 by 11 inches, should accompany each of the two copies of the manuscript. Each figure should be numbered and should include the name of the author, either in the margin or on the back (marked lightly with a soft pencil). Graphs (*submit as photographs*) should be finished drawings not needing further artwork or type-setting. Absolutely no part of a graph should be typewritten (except the legend, which should be typed on a separate page). All lettering should be done with a lettering set. Most graphs will be reduced to 2 1/2 inches in width, and all elements in the drawing should be prepared to withstand this reduction. The legend of the figure should provide enough information so that the figure is understandable without reference to the text. Experimental details from Materials and Methods should not be repeated in figure legends.

Nomenclature of microorganisms. The name of a species is a binary combination consisting of the name of the genus followed by a specific epithet. In general, the nomenclature presented in *Bergey's Manual of Determinative Bacteriology* (7th ed., 1957) is used. If an author challenges this nomenclature, his own judgment will be followed, but the name in *Bergey's Manual* should follow in parentheses the first time the name is used in the text and in the Abstract. When a new bacterial name is proposed in a manuscript, an international authority on nomenclature will be consulted for an opinion. When a new species, or a new variety of a species, is proposed, an acceptable photomicrograph or electron micrograph of the cells should be submitted. If the cells are motile, the photomicrograph or electron micrograph should show the nature and arrangement of flagella. As one of the requirements for description of a new species, we require deposition of the type culture in a recognized culture collection and designation of the accession number.

Notes. The accepted form for Notes is somewhat different from the foregoing. Contributors should consult a recent issue of the *Journal* for style. Notes should not exceed 500 words. The Abstract should not exceed 25 words.

Copyright. Once a paper has been published in the *Journal*, which is a copyrighted publication, the legal ownership of all parts of the paper, including the illustrations, has passed from the author to the ASM. If the same author, or any author, wishes to republish material previously published in the *Journal*, he must first receive written permission from ASM.

Reprints. Reprints (in multiples of 100) may be purchased by contributors. A table showing the cost of reprints, and an order form, will be sent with the proof.