EDITORIAL BOARD

Frederick W. Alt (1990)  
Susan Berget (1990)  
Arnold J. Berk (1991)  
Alan Bernstein (1990)  
Barbara K. Birnstein (1990)  
J. Michael Bishop (1990)  
Elizabeth H. Blackburn (1991)  
Jef D. Boeke (1991)  
Michael R. Botchan (1990)  
David Botstein (1990)  
Bruce P. Brandhorst (1990)  
Marjorie C. Brandriss (1991)  
Rodrigo Bravo (1992)  
Kathryn Calame (1991)  
Judith Campbell (1992)  
Mario R. Capecchi (1990)  
John A. Carbon (1990)  
Marian Carlson (1992)  
C. Thomas Caskey (1990)  
Nam-Hai Chua (1991)  
Jonathan A. Cooper (1992)  
Nicholas Cowan (1990)  
Elizabeth A. Craig (1991)  
Thomas Curran (1991)  
Mark Davis (1990)  
Thomas Dominique (1992)  
Gideon Dreyfuss (1990)  
Mary P. Edmonds (1990)  
Robert N. Eisenman (1991)  
Sarah C. R. Elgin (1991)  
Scott Emr (1991)  
Walton L. Fangman (1991)  
Thomas D. Fox (1990)  
Mary-Jane Gething (1990)  
Stephen P. Goff (1992)  
Jack F. Greenblatt (1991)  
Rudolf Grosschedl (1992)  
Christine Guthrie (1992)  
James E. Haber (1990)  
Hidesaburo Hanafusa (1992)  
Leland D. Hartwell (1990)  
Nathaniel Heintz (1991)  
Ari Helenius (1990)  
Steven Henikoff (1991)  
Ira Herskowitz (1991)  
Alan Hinnebusch (1991)  
Michael J. Holland (1990)  
Greg Hollis (1990)  
Peter M. Howley (1991)  
Stephen H. Hughes (1992)  
Mark Johnston (1991)  
Katherine A. Jones (1992)  
Daniel Klessig (1992)  
Marilyn Kozak (1991)  
Monty Krieger (1991)  
Elizabeth Lacy (1990)  
Alan Lambowitz (1990)  
Lester F. Lau (1992)  
Michael Lenardo (1991)  
Arthur D. Levinson (1990)  
Susan Lindquist (1990)  
Douglas Lowy (1990)  
Paul T. Magee (1991)  
James Manley (1992)  
Kunihiro Matsumoto (1991)  
Frank McCormick (1992)  
Janet E. Merz (1990)  
N. Ronald Morris (1992)  
Bernardo Nadal-Ginard (1990)  
Paul Neiman (1992)  
Joseph R. Nevins (1990)  
Carol Newlon (1991)  
Mary Ann Osley (1990)  
Harvey L. Ozer (1991)  
Mary Lou Pardue (1991)  
David Patterson (1991)  
Marvin R. Paule (1992)  
Gianni Piperno (1991)  
John R. Pringle (1991)  
Randall R. Reed (1991)  
Steven I. Reed (1991)  
Jean-Paul Revel (1991)  
Jasper D. Rine (1991)  
Naomi E. Rosenberg (1991)  
Rodney Rothstein (1990)  
Norman P. Saltman (1990)  
Paul Schell (1990)  
Milton J. Schlesinger (1992)  
Matthew P. Scott (1992)  
Arthur Skoulitchi (1991)  
Frank Solomon (1991)  
Michael B. Sporn (1991)  
Allan C. Spradling (1991)  
Karen U. Sprague (1992)  
Pamela Stanley (1991)  
Nat L. Sternberg (1992)  
Bruce Stillman (1991)  
Kevin Struhl (1992)  
Kenneth D. Stuart (1991)  
Bill Sugden (1991)  
Lawrence H. Thompson (1991)  
Geoffrey Wahl (1992)  
Randolph Wall (1992)  
Peter Walter (1990)  
Jonathan R. Warner (1990)  
Reed B. Wickner (1991)  
Lewis T. Williams (1991)  
Fred Winston (1991)  
Elton T. Young (1990)  
Michael Young (1991)
Author Index

Annex, Brian H., 5671
Appling, Dean R., 5679
Assoian, Richard K., 5983
Baker, Suzanne J., 5772
Bannon, Gary A., 6091
Barlowe, Charles K., 5679
Barnhart, Kerry M., 5958
Barrett, John, 5914
Baumann, Heinz, 5967
Becker, Frederick F., 5728
Bender, Timothy, 5747
Benseler, Fritz, 6046
Berget, Susan M., 5937
Bergman, Lawrence W., 5950
Bisson, Linda F., 5903
 Bloom, Kerry, 5721
Bootsma, D., 5806
Boz, Johannes L., 5857
Brentano, Steven T., 6013
Bressac, Brigitte, 5772
Brosset, S., 5865
Byrne, Paul, 5663
Carlson, Marian, 5616
Carroll, Dana, 5849
Cerdan, Maria Esperanza, 5921
Chang, Ling A., 5894
Chen, Shiming, 5663
Chisari, Francis V., 5728
Choi, Y., 5822
Clark, Ira, 5927
Clare, Robin, 5977
Collins, Tucker, 6051
Crouse, Gray F., 6003
Crouse, Joseph C., 6097
Cuadrado, Antonio, 6069
Dang, Chi V., 5914
Darrow, Andrew L., 5883
Dautry, F., 5865
Dermody, J. J., 5688
Deshaines, Raymond J., 6024
de Wit, J., 5806
Diller, Lisa, 5772
Dixit, Vishva M., 5830
Donovan, David M., 6097
Dudley, J. P., 5822
Dunaway, Marietta, 6055
Eckstein, Fritz, 6046
Evans, Janet L., 5747
Finley, Russell L., Jr., 5663
Fraser, J., 6084
Freistadt, Marion S., 5700
Friend, Stephen H., 5772
García-Ánoveros, Jaime, 6079
Garrity, Paul A., 5646
Gasson, J., 6084
Gebhardt, Mark, 5772
Gibson, Susan I., 5707
Givol, David, 6064
Gottesdiener, Keith, 6079
Gros, Philippe, 6036
Grunstein, Michael, 5721
Gryka, Magdalen A., 5772
Hanson, Robin D., 5655
Hawley, Diane K., 5782
Herrlich, Peter, 5814
Herskowitz, Ira, 5927
Hoeijmakers, J. H. J., 5806
Hölttä, Erkki, 5814
Holzman, Lawrence B., 5830
Hsu, C.-L. L., 5822
Innis, Michael A., 5977
Jahreis, Gerald P., 5967
Johnson, David L., 5950
Kang, Seogchun, 5839
Kaplan, Gerardo, 5700
Kassel, Jayne, 5772
Kato, Gregory J., 5914
Kim, Chul G., 5958
Kim, Rosalind, 5945
Kim, Sung-Hou, 5945
Kirkhausen, Tomas, 6089
Kruckenberg, Arthur L., 5903
Kuehl, W., Michael, 5747
Kuo, M. Tien, 5728
LaForge, K. Steven, 5736
Laurent, Brehon C., 5616
Lee, Mary Gwo-Shu, 6079
LeMaître, Mimì F., 6059
Lev, Sima, 6064
Ley, Timothy J., 5655
Li, Dajun, 5728
Lis, John T., 6041
Litwak, Gregory, 5772
Liu, Xingquan, 5601
Love, Harold D., Jr., 6091
Lowry, Charles V., 5921
Lynch, M., 6084
Ma, Junli, 5663
Madden, Stephen L., 5950
Marinkovic, Sanja, 5967
Marks, Rory M., 5830
Matera, A. Gregory, 5876
Mathews, C. K., 5688
Mayeda, Carol, 5991
McCormick, Frank, 5977
Meijer, Ingeborg, 5857
Mendoza, Arthur E., 6051
Metzenberg, Robert L., 5839
Meyerowitz, Elliot, 5991
Miles, David J., 6097
Miller, Walter L., 6013
Mitchell, Pamela J., 6003
Mok, E., 5822
Molloy, Christopher J., 6069
Moore, Chris C. D., 6013
Moore, Terry L., 5747
Morella, Karen K., 5967
Mon, B., 5688
Munemitsu, Susan, 5977
Muraida, Helios, 5894
Nelson, Camille E., 5772
Nicholson, Pamela R., 5927
Nimer, S., 6084
Nye, Steven H., 5753, 5763
Odijk, H., 5806
Offringa, Rienk, 5857
Orkin, Stuart H., 6051
Orlean, Peter, 5796
Ozer, H. L., 5688
Ozturk, Mehmet, 5772
Paris, Jeanne, 5634
Patinkin, Deborah, 6046
Pawson, Tony, 5601
Pearson, Nancy J., 6097
Pecorino, Lauren T., 5883
Pohjanpalo, Pirko, 5814
Polakis, Paul, 5797
Racaniello, Vincent R., 5700
Raghavan, K. Vijay, 5991
Ray, Anuradha, 5736
Raymond, Martine, 6036
Reedijk, Michael, 5601
Remington, Mary P., 6097
Richards, J., 6084
Richter, Joel D., 5609, 5634
Rickleis, Richard J., 5883
Rine, Jasper, 5945
Roark, Margaret, 5991
Ross, S. R., 5822
Rougvie, Ann E., 6041
Saunders, Michael J., 5721
Scarpulla, Richard C., 5753, 5763
Schekman, Randy, 6024
Schmid, Carl W., 5876
Sehgal, Pravinkumar B., 5736
Seidman, Shlomo, 6046
Sheffery, Michael, 5958
Siegfried, Zahava, 6073
Simon, Ruth, 5609
Smith, Martin L., 6003
Smits, Alida M., 5857
Soreq, Hermana, 6046
Stein, Bernd, 5857
Stewart, David A., 6097
Stillman, David J., 5927
Stolorow, David T., 5937
Strickland, Sidney, 5883
Suroskey, Richard T., 5707
Sweigert, Susan E., 5849
Swendeman, Steven L., 5958
Teeter, Larry D., 5728
Thompson, L. H., 5806
Thummler, Carl S., 6059
Ting, Jenny Pan-Yun, 5747
Tod, Takeshi, 5991
Tondravi, M. Mehrdad, 6091
Trason, Ann, 6055
Treitel, Michelle A., 5616
Troelstra, C., 5806
Tye, Bik-Kwoon, 5707
Ullrich, Axel, 5977
van Dam, Hans, 5857
van der Eb, Alex J., 5857
Van der Ploeg, Lex H. T., 6079
Verma, Inder M., 5626
Villa-Garcia, Manuel, 5914
Vogelstein, Bert, 5772
Wager, Ruth E., 5983
Wang, Huaming, 5927
Weil, D., 5865
Weiner, Alan M., 5876
West, Robert W., Jr., 5663
Westerveld, A., 5806
West, Debra K., 5782
Williams, R. Sanders, 5671
Willis, Rebecca L., 6091
Wisdom, Ron, 5626
Wojcik, B. E., 5688
Wold, Barbara J., 5646
Yarden, Yosef, 6064
Yeh, Elaine, 5721
Young, Regina M., 6051
Zakut, Haim, 6046
Ziff, Edward B., 6073
Zitomer, Richard S., 5921
1991 APPLICATION FOR FULL MEMBERSHIP IN THE
AMERICAN SOCIETY FOR MICROBIOLOGY
1325 Massachusetts Avenue, NW • Washington, D.C. 20005 • (202) 737-3600 • FAX (202) 737-0368

Eligibility
ASM welcomes to full membership anyone who is interested in its objectives and has a minimum of a bachelor's degree or equivalent in microbiology or a related field.

Initiation
Memberships are initiated and renewed in January each year. Unless there are directions to the contrary, membership nominations received prior to September 1 are credited to the current year, and back issues of the selected publications for the current year are furnished, if available. Nominations received after September 1 will become effective the following January.

NAME
(CIRCLE ONE)
MISS DR. MR. MRS. MR.
MAIL NAME

ADDRESS

STATE/PROVINCE
ZIP/POSTAL CODE
COUNTRY

PHONE (_______) OFFICE (81) (_______) HOME (82) YEAR OF BIRTH ____________ SEX ________

HIGHEST DEGREE
SUBJECT AREA
YEAR EARNED

EMPLOYER ______________________________ PRESENT POSITION ________________________

SIGNATURE OF APPLICANT ___________________________ DATE ____________

*Nominated by ___________________________ Signature of ASM member

*If you are not associated with an ASM nominating member you can still apply for membership and we will contact you.

Member Information
How did you learn about the ASM? (Check one):
☐ A colleague
☐ An advertisement in a journal
☐ Presenting a paper at an ASM meeting
☐ An ASM Branch
☐ A professor
☐ Direct mail inquiry
☐ Student membership in ASM
☐ An ASM journal
☐ A workshop, conference or meeting
☐ None of the above

Dues
Annual dues for 1991 are $75. Dues include ASM News (monthly) and a $51 credit which may be deducted from the total cost of the journal(s) you purchase at the special membership rates indicated below.

Journals
☐ Enclosed is my dues payment (U.S. Dollars only) ........................................... $75
☐ Please send me the following ASM journal(s) at Member Price(s):

<table>
<thead>
<tr>
<th>U.S. &amp; Foreign</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. &amp; Canada</td>
<td>$43.00 $69.00 $189.00</td>
</tr>
<tr>
<td>Surface*</td>
<td></td>
</tr>
<tr>
<td>Air</td>
<td></td>
</tr>
<tr>
<td>Antimicrobial Agents and Chemotherapy (monthly)</td>
<td></td>
</tr>
<tr>
<td>Applied and Environmental Microbiology (monthly)</td>
<td></td>
</tr>
<tr>
<td>Molecular and Cellular Biology (monthly)</td>
<td></td>
</tr>
<tr>
<td>Clinical Microbiology Reviews (quarterly)</td>
<td></td>
</tr>
<tr>
<td>Infection and Immunity (monthly)</td>
<td></td>
</tr>
<tr>
<td>International Journal of Systematic Bacteriology (quarterly)</td>
<td></td>
</tr>
<tr>
<td>Journal of Bacteriology (twice monthly)</td>
<td></td>
</tr>
<tr>
<td>Journal of Clinical Microbiology (monthly)</td>
<td></td>
</tr>
<tr>
<td>Journal of Virology (monthly)</td>
<td></td>
</tr>
<tr>
<td>Microbiological Reviews (quarterly)</td>
<td></td>
</tr>
<tr>
<td>ASM News (monthly)</td>
<td>0-0-0-0 0-0-0-0 0-0-0-0</td>
</tr>
<tr>
<td>ASM News (monthly)</td>
<td></td>
</tr>
<tr>
<td>Total Journal Fees $</td>
<td>Subtotal (if less than zero, enter zero) $</td>
</tr>
<tr>
<td>Add your $51 Membership Dues</td>
<td>+ $51</td>
</tr>
<tr>
<td>Total (Dues plus Journals)</td>
<td></td>
</tr>
</tbody>
</table>

PAYMENT IN U.S. DOLLARS MUST ACCOMPANY APPLICATION
A membership card, voting registration form, ASM Placement Service Information and the journal(s) of your choice will be sent within 90 days upon completion of processing. ASM dues are tax deductible to the extent permitted by law. ASM designates $13 of your dues for ASM News. Rates are for 1991 only.

Applicants must remit in U.S. Dollars by check or draft payable to ASM through a U.S. bank located within the Continental U.S. Applicants from Canada may use check made out in U.S. Dollars and drawn on a Canadian bank or applicants may choose to pay with VISA, MasterCard, or American Express. If that is your preference, please fill in the box below.

☐ VISA # _______________________________ EXP 00-00-00-00
☐ MASTERCARD # ___________________________ EXP 00-00-00-00
☐ AMEX # ________________________________ EXP 00-00-00-00

TODAY'S DATE MONTH DAY YEAR NAME NAME AS IT APPEARS ON YOU CARD

SIGNATURE ________________________________

MCB 11/90
Eligibility
Any matriculated student majoring in microbiology or a related field who has not earned a doctoral degree is eligible for election as a Student Member. Student Members have all the privileges of membership except the right to vote and hold office in the Society. Student Members receive ASM News monthly and are entitled to subscribe to the Society's scientific journals at member rates.

Initiation
Memberships are initiated and renewed in January each year. Unless there are directions to the contrary, membership nominations received prior to September 1 are credited to the current year, and back issues of the selected publications for the current year are furnished, if available. Nominations received after September 1 will become effective the following January.

NAME (CIRCLE ONE) 

FIRST INITIAL LAST

ADDRESS

STATE/PROVINCE ZIP/POSTAL CODE

PHONE ( ) OFFICE ( ) HOME ( ) YEAR OF BIRTH SEX

HIGHEST DEGREE MET by STUDENT 

SCHOOL

SIGNATURE OF APPLICANT DATE

SIGNATURE OF CHAIRMAN OF MAJOR DEPARTMENT MEMBER #

*NOMINATED BY SIGNATURE OF ASM MEMBER MEMBER #

*If your departmental chairman is a member of the ASM, a nominating signature is not required. If you are not associated with an ASM nominating member, you can still send in this member application form and we will contact you. Be sure to include your dues.

Member Information
How did you learn about the ASM? (Check one):

☐ A colleague ☐ An advertisement in a journal ☐ Presenting a paper at an ASM meeting
☐ A professor ☐ Direct mail inquiry ☐ An ASM Branch
☐ An ASM journal ☐ A workshop, conference or meeting ☐ None of the above

Journals
Please check:

☐ Enclosed is my dues payment (U.S. Dollars only) ........................................... $15
☐ Please send me the following ASM journal(s) at Member Price(s):

<table>
<thead>
<tr>
<th>U.S. &amp; Canada</th>
<th>FOREIGN</th>
<th>Surface*</th>
<th>Air</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antimicrobial Agents and Chemotherapy (monthly)</td>
<td>$43.00</td>
<td>$69.00</td>
<td>$189.00</td>
<td></td>
</tr>
<tr>
<td>Applied and Environmental Microbiology (monthly)</td>
<td>$45.00</td>
<td>$80.00</td>
<td>$205.00</td>
<td></td>
</tr>
<tr>
<td>Molecular and Cellular Biology (monthly)</td>
<td>$49.00</td>
<td>$99.00</td>
<td>$334.00</td>
<td></td>
</tr>
<tr>
<td>Clinical Microbiology Reviews (quarterly)</td>
<td>$20.00</td>
<td>$32.00</td>
<td>$67.00</td>
<td></td>
</tr>
<tr>
<td>Infection and Immunity (monthly)</td>
<td>$45.00</td>
<td>$85.00</td>
<td>$245.00</td>
<td></td>
</tr>
<tr>
<td>International Journal of Systematic Bacteriology (quarterly)</td>
<td>$35.00</td>
<td>$42.00</td>
<td>$82.00</td>
<td></td>
</tr>
<tr>
<td>Journal of Bacteriology (twice monthly)</td>
<td>$49.00</td>
<td>$98.00</td>
<td>$333.00</td>
<td></td>
</tr>
<tr>
<td>Journal of Clinical Microbiology (monthly)</td>
<td>$43.00</td>
<td>$73.00</td>
<td>$198.00</td>
<td></td>
</tr>
<tr>
<td>Journal of Virology (monthly)</td>
<td>$49.00</td>
<td>$98.00</td>
<td>$333.00</td>
<td></td>
</tr>
<tr>
<td>Microbiological Reviews (quarterly)</td>
<td>$20.00</td>
<td>$32.00</td>
<td>$67.00</td>
<td></td>
</tr>
<tr>
<td>ASM News (monthly)</td>
<td></td>
<td></td>
<td></td>
<td>$80.00</td>
</tr>
</tbody>
</table>

*Surface mail is a combination of air freight and surface delivery

If you want to receive the 1991 Annual Meeting Program (Free), check here: Offer Expires March 1, 1991
If you want to receive the 1991 ICAC Program & Abstracts (Free), check here: Offer expires July 1, 1991

PAYMENT IN U.S. DOLLARS MUST ACCOMPANY APPLICATION

A membership card and the journal(s) of your choice will be sent within 90 days upon completion of processing. ASM dues are tax deductible to the extent permitted by law. ASM designates $12 of your dues for ASM News. Rates are for 1991 only.

Applicants must remit in U.S. Dollars by check or draft payable to ASM through a U.S. bank located within the Continental U.S. Applicants from Canada may use check made out in U.S. Dollars and drawn on a Canadian bank or applicants may choose to pay with VISA, MasterCard, or American Express. If that is your preference, please fill in the box below.

☐ VISA # ☐ MASTERCARD # ☐ AMEX # EXPIRATION DATE: MO/ yr
☐ TODAY'S DATE: MONTH DAY YEAR SIGNATURE NAME AS IT APPEARS ON YOUR CREDIT CARD

SIGNATURE

MCB 11/90