

AICHE JOURNAL

MARCH 1999 • VOL. 45, NO. 3

The AICHE JOURNAL, a monthly publication of the American Institute of Chemical Engineers, is devoted to fundamental research and developments having immediate or potential value in chemical engineering.

EDITOR

Matthew V. Tirrell

MANAGING EDITOR

Haeja Lim Han

ASSOCIATE EDITORS

Mark A. Barteau

Edward L. Cussler

Julio M. Ottino

George Stephanopoulos

COPY EDITOR

Arthur H. Baulch

EDITORIAL ASSISTANTS

Jeff Karpinos

Karen M. Simpson

CONSULTING EDITORS

Juan de Pablo

Computational Research

Alice P. Gast

Materials

Carol K. Hall

Thermodynamics

Eric W. Kaler

Colloidal Phenomena

Michael T. Klein

Reaction Engineering

Douglas A. Lauffenburger

Bioengineering

Glen H. Pearson

Materials Processing

Ronald W. Rousseau

Crystallization

John Seinfeld

Environmental Engineering

Michael Shuler

Biochemical Engineering

PUBLISHER

Stephen R. Smith

MARKETING MANAGER

Lois Anne DeLong



Make sure your children don't go into the woods alone.

The Uniform Gift to Minors Act (UGMA) allows you to set aside funds for your children's future. If you're an AIChE member, Putnam funds can put you squarely on the path to giving. UGMA plans will give your kids money for college, homes and starting their own families. Call us at 800 98-AIChE (24243) and we'll show you how you can provide for them now and guide them securely on their way...with no money lost to sales charges or redemption fees.

PUTNAM CAPITAL APPRECIATION-M (Total Return)

1 Year 40.08%	3 Year —	Since Inception 31.30%
------------------	-------------	---------------------------

PUTNAM VOYAGER-M (Total Return)

1 Year 44.86%	3 Year 27.29%	Since Inception 27.31%
------------------	------------------	---------------------------

Call 800 98-AIChE (24243) for a free prospectus. AIChE members pay no initial sales charges and no redemption fees when buying Putnam Funds. Please read the prospectus carefully before investing. The mutual funds are distributed by Marsh & McLennan Securities Corporation.

All returns assume reinvestment of distributions at NAV and represent past performance; they do not guarantee future results. Investment return and principal value will fluctuate so that an investor's shares when redeemed may be worth more or less than their original cost.

**AIChE Financial
Edge**

AIChE Journal (ISSN 0001-1541) is published monthly by the American Institute of Chemical Engineers, 3 Park Ave., New York, NY 10016-5901. Manuscripts should be submitted to Editor Matthew V. Tirrell at the Dept. of Chemical Engineering and Materials Science, University of Minnesota, Minneapolis, MN 55455, phone (612) 625-5823, fax (612) 624-6564. The statements and opinions in the *AIChE Journal* are those of the contributors, and AIChE assumes no responsibility for them. Annual subscription rates are as follows. Print version: U.S., \$765; international, \$845; U.S. members, \$95; international members, \$175; U.S. student members, \$55; international student members, \$135. Single print copy: members, \$18 (U.S.)/\$25 (international); nonmembers, \$80 (U.S.)/\$88 (international). Online version only: members, \$130; student members, \$90. Print version plus Online: U.S. members, \$150; international members, \$230; U.S. student members, \$110; international student members, \$190. Periodicals postage for domestic and air mail postage for foreign mailing paid at New York, NY and additional mailing offices. Copyright 1999 by the American Institute of Chemical Engineers. Subscribers are requested to give prompt notification of any change of address. Postmaster: Send changes of address to *AIChE Journal*, 3 Park Ave., New York, NY 10016-5901.

Authorization to photocopy items for internal or personal use, or the internal or personal use of specific clients, is granted by AIChE for libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that a fee of \$15.00 per article is paid directly to CCC, 222 Rosewood Drive, Danvers, MA 01923. This consent does not extend to copying for general distribution, for advertising or promotional purposes, for inclusion in a publication, or for resale. Articles published before 1988 are subject to the same copyright conditions. *AIChE Journal* fee code: 0001-1541/99 \$15.00 per article.