

Science

EDITORIAL

Publisher: Richard S. Nicholson
Editor-in-Chief: Daniel E. Koshland Jr.
Editor: Ellis Rubinstein
Managing Editor: Monica M. Bradford
Deputy Editors: Philip H. Abelson (*Engineering and Applied Sciences*); John I. Brauman (*Physical Sciences*); Thomas R. Cech (*Biological Sciences*)

Editorial Staff

Assistant Managing Editor: Dawn Bennett
Senior Editors: Eleanor Butz, R. Brooks Hanson, Barbara Jasny, Katrina L. Kerner, David Lindley, Linda J. Miller, Phillip D. Szuromi, David F. Voss
Associate Editors: Gilbert J. Chin, Pamela J. Hines, Paula A. Kiberstis, Suki Parks, L. Bryan Ray
Letters: Christine Gilbert, *Editor*; Steven S. Lapham
Book Reviews: Katherine Livingston, *Editor*; Annette Theuring, *Assistant Editor*; Susan Randolph, *Editorial Assistant*
Contributing Editor: Lawrence I. Grossman
Editing: Valerie Jablow, Cara Tate, *Senior Copy Editors*; Douglas B. Casey, Harry Jach, Erik G. Morris, Christine M. Pearce
Copy Desk: Ellen E. Murphy, *Supervisor*; Joi S. Granger, Beverly Shields, Melissa Q. Rosen, Kameaka Williams, *Assistant*
Editorial Support: Sherryf Farmer, *Supervisor*; Linda Dienavs, Carolyn Kyle, Michele Listisard, Diane Long, Patricia M. Moore
Administrative Support: Sylvia Kihara, Charlene King, Jeanette Prastein
Telephone: 202-326-6501; **FAX:** 202-289-7562; **TDD:** 202-408-7770

News Staff

News Editor: Colin Norman
Features Editor: John M. Benditt
Deputy News Editors: Tim Appenzeller, Joshua Fischman, Jean Marx, Jeffrey Mervis
News & Comment/Research News Writers: Christopher Anderson, Linda B. Felaco (copy), Faye Flam, Constance Holden, Richard A. Kerr, Eliot Marshall, Rachel Nowak, Robert F. Service, Richard Stone, Lisa Seachrist (intern)
U.S. Bureaus: Marcia Barinaga (Berkeley), Jon Cohen (San Diego), Anne Simon Moffat (Chicago), John Travis (Boston)
Contributing Correspondents: Joseph Alper, Barry A. Cipra, Robert Crease, Elizabeth Culotta, Ann Gibbons, Virginia Morell, Dennis Normile (Tokyo), Robert Pool, Gary Taubes
Administrative Support: Fannie Groom, Jennifer Hodgkin
Telephone: 202-326-6500; **FAX:** 202-371-9227; **Internet Address:** science_news@aaas.org

Art & Production Staff

Production: James Landry, *Director*; Wendy K. Shank, *Manager*; Lizabeth A. Harman, *Assistant Manager*; Laura A. Creveling, Scherraine B. Mack, Linda C. Owens, *Associates*
Art: Amy Decker Henry, *Director*; C. Faber Smith, *Associate Director*; Katharine Sutliff, *Scientific Illustrator*; Holly Bishop, *Graphics Associate*; Elizabeth Carroll, *Graphics Assistant*; Leslie Blizard, *Assistant*

Europe Office

Senior Editor: Richard B. Gallagher
Associate Editor: Jeffrey Williams
News Editor: Daniel Clery
Correspondent: Peter Aldhous
Editorial Associate: Belinda Holden
Address: Thomas House, George IV Street, Cambridge, UK CB2 1HH
Telephone: (44) 0223 302067; **FAX:** (44) 0223 302068

Science Editorial Board

Charles J. Arntzen	F. Clark Howell
David Baltimore	Paul A. Marks
J. Michael Bishop	Yasutomi Nishizuka
William F. Brinkman	Helen M. Ranney
E. Margaret Burbidge	Bengt Samuelsson
Pierre-Gilles de Gennes	Robert M. Solow
Joseph L. Goldstein	Edward C. Stone
Mary L. Good	James D. Watson
Harry B. Gray	Richard N. Zare
John J. Hopfield	

Progress in Parasitology

The success of parasitism as a survival strategy is evidenced by the fact that parasitic organisms far outnumber non-parasitic ones. Humans, for example, host over a hundred kinds of eukaryotic parasites alone. In recent years understanding of the biology of parasites has grown enormously, particularly (but not exclusively) at the molecular level. These advances, the focus of this issue of *Science*, are important not only for their intrinsic scientific interest but also because they open up a range of new possibilities for therapeutic strategies against parasitic diseases. The victims of parasitic disease are primarily the populations of developing countries, so the successful application of new therapies is crucially dependent on policy decisions, both in the developed countries where most of the research is carried out and in the countries where the results are applied. A second focus of this special issue, therefore, is analysis of the societal and economic impact of parasitic disease and the politics of parasitological research.

A feature of recent work has been the elucidation of many alternative solutions that parasites have found to the problems of survival and proliferation. In *Perspectives*, Borst and Rudenko discuss some of the unique mechanisms of gene transcription in parasites, as seen in the rapid and diverse antigenic variation in trypanosome coat glycoproteins; Simpson and Maslow describe how parasites can store genetic information as incomplete cryptogenes that are filled out by RNA editing; and Nilsen reviews the use of trans-splicing to assemble complete mRNA molecules from separate protein-coding and translational control modules.

There have also been notable contributions to the understanding of host physiology. In their *Perspective*, Capron and Capron mention how several of the current paradigms in cellular immunology, including the powerful concept of T helper subpopulations, originated and were verified in experimental models of parasitic disease. Another well-known example is the interaction of malaria with sickle cell anemia, which led to a greater understanding of red cell physiology, the genetics of human populations, and the biochemical response of hemoglobin to oxygen. The study of parasites has also spurred new ideas in mathematical ecology. The Article by Anderson discusses specific advances in the population biology of disease, and, more broadly, insights into the interaction of populations that illuminate both parasitism and competition for ecological niches.

The diseases caused by parasites in humans are many and varied. A major killer, malaria, is the subject of an Article by Miller, Good, and Milon, who weave together the exciting recent findings from the laboratory (for example, the identification of ligands and receptors for red cell invasion) and from the field (such as the increased severity of the disease during pregnancy) to provide a comprehensive overview of pathogenesis. Developments in vector ecology and biology, which raise the possibility of taming malaria through control of the mosquitoes that transmit *Plasmodium* species, are described in the *Perspective* by Collins and Besansky.

However, malaria is by no means the only parasitological problem. The six major tropical diseases—malaria, schistosomiasis, filariasis, African trypanosomiasis, Chagas disease, and leishmaniasis—together account for more than 1 million deaths annually and are the cause of morbidity in hundreds of millions more. Consequently, as Evans and Jamieson explain in a *Policy Forum*, these diseases contribute in no small measure to the economic difficulties of developing countries. Those most affected are typically the poorest people in the poorest countries who, of course, have the poorest health care facilities.

In spite of the advances in basic biology and of the potentially enormous benefits to mankind in controlling the dread parasitic diseases, funding for research in parasitology, whether for primary research or for product development by industry, is not healthy. The current crisis in research funding is highlighted in the *News* section, and a bold new approach to collaboration between national research agencies and industry is outlined in the *Policy Forum* from Godal.

Parasitology is at a crossroads. The continuing rapid pace of research puts parasite biology at the cutting edge of basic science, but the coming challenge is now to translate that scientific knowledge into therapeutic strategies to tackle disease worldwide. It is to be hoped that the threat of shrinking research budgets will not prevent us from meeting that challenge.

Richard B. Gallagher, Jean Marx, and Pamela J. Hines