SCIENCE

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: Eleanore Butz, R. Brooks Hanson, Barbara Jasny, Katrina L. Kelner, 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;* 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, Brent Gendleman, 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, Jocelyn Kaiser (intern), Richard A. Kerr, Eliot Marshall, Rachel Nowak, Robert F. Service, Richard Stone
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 Hodgin
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,* Leslie Blizard, *Assistant*
Art: Amy Decker Henry, *Director;* C. Faber Smith, *Associate Director;* Katharine Sutliff, *Scientific Illustrator;* Holly Bishop, *Graphics Associate;* Elizabeth Carroll, *Graphics Assistant*

Europe Office

Editorial: Richard B. Gallagher, *Office Head and Senior Editor;* Stella M. Hurtley, Jeffrey Williams, *Associate Editors;* Belinda Holden, *Editorial Associate*
News: Daniel Clery, *Editor;* Peter Aldhous, *Correspondent;* Patricia Kahn, *Contributing Correspondent (Heidelberg)*
Administrative Support: Janet Mumford; Anna Riches
Address: 14 George IV Street, Cambridge, UK CB2 1HH
Telephone: (44) 0223 302067; **FAX:** (44) 0223 302068

EDITORIAL

A Gift from the Heavens

The spectacular collisions of the fragments of comet Shoemaker-Levy 9 with Jupiter have generated public interest and excitement matched by few scientific phenomena. Some of the media coverage has been motivated by trying to imagine what would have happened had the fragments hit the Earth, but what has mainly captured attention is the wonder of the event. The drama of Earth-sized fireballs and huge holes in the atmosphere from the impact of kilometer-sized fragments at 200,000 kilometers per hour with the largest planet in our solar system (11 times the diameter of the Earth) was what many scientists had hoped for but few had expected. Coming at the 25th anniversary of the Apollo 11 moon landing, the events of last week carry a reassuring message that a phenomenon that fascinates scientists can fascinate others too, and for similar reasons: Science, regardless of its possible implications and applications, still possesses the power to enthrall.

The collision nicely illustrates the good luck, bad luck, and hard work that constitute scientific advance and discovery. There was obvious good fortune in the events that broke the comet apart and set the fragments on a collision course with Jupiter, tempered by bad luck that the impacts were on the far side of the planet. Hard work is evident everywhere. The seemingly fortuitous discovery of the comet came about through patient and diligent searching of the sky, by Carolyn and Gene Shoemaker and David Levy, for asteroids and comets; this search was spurred by the Apollo program's observations and sampling of the moon, which revolutionized our understanding of the crucial role of asteroid impacts in planetary evolution. Once the imminence of the collision was confirmed, scientists started making predictions and planning experiments, demonstrating the scientific method on a grand scale and in real time. A whole series of hypotheses on the effects of the collision based on current knowledge of Jupiter and impact dynamics were generated. These ideas are now being directly put to the test, and the ensuing speculation and discussion provide an immediate and publicly accessible illustration of the nature of scientific inquiry.

Our ability to identify the comet for what it was, to predict when and where the impacts would take place, and to muster the technological means to receive and process rapidly images of an event three-quarters of a billion kilometers away are the sorts of routine accomplishments we can too easily take for granted. The newly repaired Hubble Space Telescope has provided many of the most impressive images, and the Galileo spacecraft, despite its crippled communications system, should in the coming weeks send down the only direct images of the impacts. On the other hand, the widely varying predictions of what the impacts would look like in detail have shown how meager our understanding is of several fundamental issues. Jupiter is known to have an outer gaseous atmosphere of hydrogen, methane, ammonia, and other gases, but less is known of the composition of its deeper layers. The collision plumes may provide some clues, and observation of the way the profoundly disturbed atmosphere returns to normal will improve our understanding of its structure and dynamics.

The idea of giant cometary or asteroidal impacts on planets is most notoriously associated with the extinction of the dinosaurs, but impacts can create as well as destroy. Planets formed and grew by the collision and aggregation of comets and asteroids, and later impacts may have brought to the Earth organic material crucial to the origin of life, and then repeatedly modified the course of evolution. Our witnessing of such a dramatic impact on Jupiter brings an air of reality to our appreciation of the historical importance of such events that no amount of theoretical modeling can provide.

The serendipitous encounter between comet Shoemaker-Levy 9 and the planet Jupiter, augmented by the forensic skills of scientists, will no doubt yield a mass of new knowledge and ideas for years to come. But in the wave of public interest attending this event there is an additional element of good fortune. Rarely does an event of scientific discovery lend itself so easily to public communication and allow nonscientists a glimpse of the same combination of wonder and curiosity that underlies basic research in science and motivates many a scientific career.

David Lindley and Brooks Hanson