

## Coffee Growing: Sun or Shade?

Sun cultivation of coffee (Laura Tangle, Research News, 22 Nov., p. 1299) is not only a potentially bad thing for birds, but lethal for coffee itself in habitats with a distinct dry season. Despite observing an initial spike in coffee-berry production, we have documented severe damage or "Mal de Viñas" in Guatemala (1) from insufficient shade, which leads to massive coffee tree death, often in less than a year. Similar problems occur elsewhere in Central America (2). Not only do plants suffer from drought stress, elevated ambient temperature, soil erosion, and loss of soil organic matter, but they experience leaf tissue damage and altered carbohydrate metabolism (3). *Coffea arabica*'s evolutionary origin as an understory plant favors low light (4) and presents distinct limits to breeding for heavy flowering and fruiting under full sun. Large plantations in Guatemala that converted to open-sun cultivation in the 1980s are now restoring shade tree growth.

The fact that sun cultivation fails in some regions but is successful in others is a complex and poorly understood problem that relates to local rainfall, cloud cover, and the species under cultivation (*C. robusta* is more tolerant of high light and

temperature than *C. arabica*).

The question of labeling coffee as "environmentally friendly" is also tricky. Open-sun plantations are structurally and biologically depauperate, and they require much higher agrochemical inputs (primarily fertilizer) than traditional shaded coffee. It may be true, as Robert Rice speculates, that a plantation with a single species of shade tree and heavy pesticide use is no more friendly than a sun plantation. But the main difference in agrochemical use between sun and shade plantations is not in pesticide, but fertilizer use. Herbicide use also increases with the degree of sun exposure because of increased weed growth, and chemical elimination of flowering plants can affect nectar-feeding arthropods more than conventional manual weeding. Arthropod diversity and herbivore pressure on coffee are notoriously low relative to what occurs in the shade tree canopy (5). Even in plantations with just one or two species of shade tree (*Inga* spp., for example) we have found most of the arthropod prey base for birds concentrated in the overstory (5). Chemical applications occur in the coffee shrub understory. On the other hand, soil-dwelling species such as the cicada nymphs mentioned by Young (Letters, 3 Jan., p. 12) or the larvae of scarab beetles are at risk, and

these may be significant food resources for birds. The ecological intricacies of coffee management systems must be studied with sound quantitative methods before generalizations about "friendliness" can be made.

**Charles MacVean**

*Institute of Research  
Universidad del Valle de Guatemala,  
Apartado Postal No. 82,  
01901 Guatemala, Guatemala*

## References

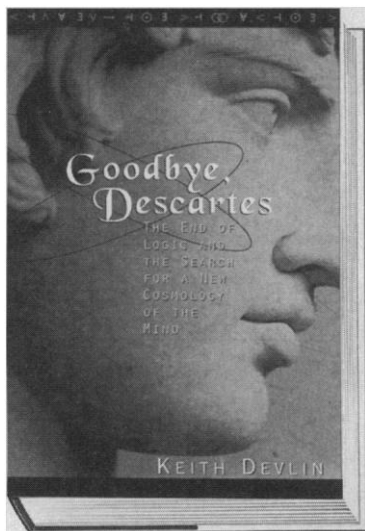
1. C. MacVean, M. Krigsvold, M. Dix, M. Braeuner, O. Arjona, "Causas y naturaleza del Mal de Viñas en cafetos de Guatemala" (Instituto de Investigaciones, Universidad del Valle de Guatemala, Guatemala, 1992).
2. R. Rice, *Agroecol. Neotropi.* 2, 1 (1991).
3. K. Tay and C. MacVean, unpublished data.
4. M. G. R. Cannell, *Coffee: Botany, Biochemistry and Production of Beans and Beverage*, M. N. Clifford and K. C. Wilson, Eds. (Croom Helm, Beckenham, Kent, United Kingdom, 1987), pp. 108-133.
5. C. MacVean and R. Greenberg, unpublished observations.



## "Atomi Gonfi"

The article "Giant atoms cast a long shadow" by Ivan Amato (Research News, 19 July 1996, p. 307) describes Rydberg atoms, but contains a statement that makes this

## Great Minds. Great Books.



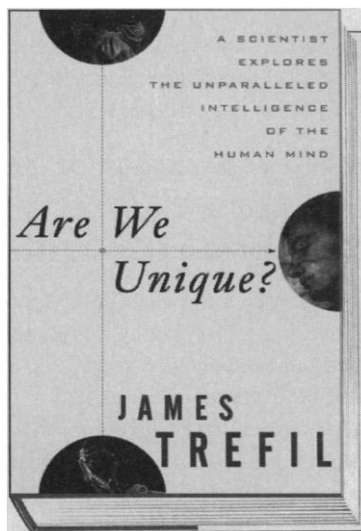
**"An excellent book that should be read by everyone who has ever wondered how we communicate with one another."**

—*Library Journal*

**"Superb historical analysis."**

—*Wilson Quarterly*

0-471-14216-6 \$27.95

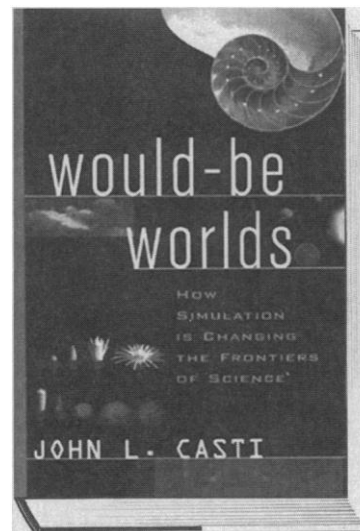


**"Mr. Trefil surpasses all other scientists writing about science for the public."**

—*The New York Times Book Review*

**"Fine science writing...an important insight."**—*Publishers Weekly*

0-471-15536-5 \$24.95



**"Casti is one of the great science writers of the 1990s."**—*San Francisco Examiner*

**"Discusses many subtle and important questions....An easy and enjoyable read."**

—*Nature*

0-471-12308-0 \$24.95

**WILEY**  
TRADE PUBLISHING

Available at bookstores everywhere or call 1-800-225-5945  
or visit our Web site at <http://www.wiley.com>

Circle No. 35 on Readers' Service Card

research field appear to be much younger than it is. The article states that "[Rydberg atoms] were first detected in interstellar space in 1965, when radio astronomers picked up emissions from hydrogen atoms implying that they had been excited into long-lasting Rydberg states." In fact, 30 years earlier, these atoms were observed by Edoardo Amaldi and Emilio Segré (1). They were found by spectroscopic experiments that studied the effect of the pressure of various gases on the wavelength of the emitted line. The theory was published in the same issue of the same journal by Enrico Fermi (2). The Roman investigators called these atoms "*atomi gonfi*," or "swollen atoms."

This discovery would probably have had much more impact if it had not been for the discovery by Fermi's group of artificial radioactivity induced by neutrons; the group switched from atomic to nuclear physics in about 1 year. The first long report of these experiments appeared in the same issue of *Il Nuovo Cimento* (3).

Ugo Amaldi

Particle Physics Experiments Division,  
European Laboratory for Particle Physics,  
(CERN),  
CH-1211 Geneva 23, Switzerland

#### References

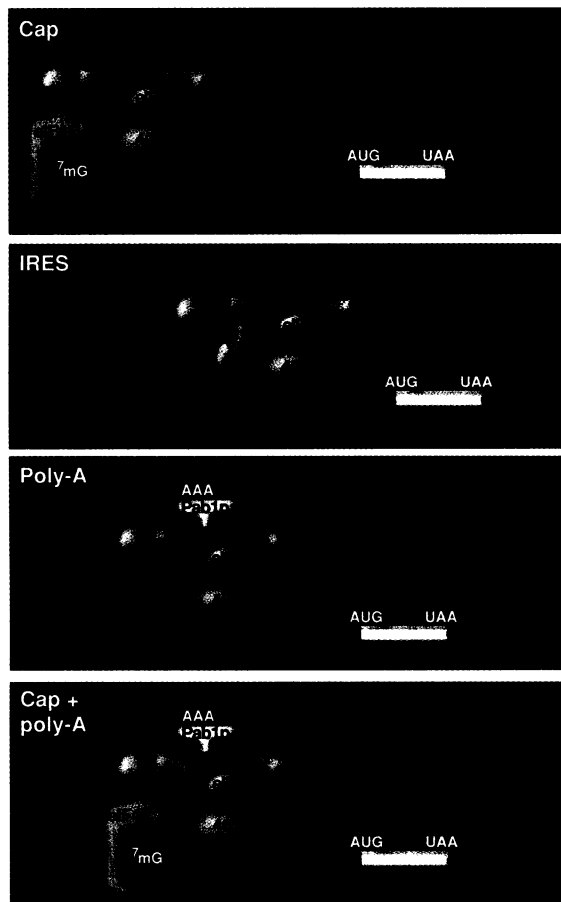
1. E. Amaldi and E. Segré, *Nuovo Cimento* **11**, 145 (1934).
2. E. Fermi, *ibid.*, p. 157.
3. E. Fermi *et al.*, *ibid.*, p. 429.

#### Letters to the Editor

Letters may be submitted by e-mail (at [science\\_letters@aaas.org](mailto:science_letters@aaas.org)), fax (202-789-4669), or regular mail (*Science*, 1200 New York Avenue, NW, Washington, DC 20005, USA). Letters are not routinely acknowledged. Full addresses, signatures, and daytime phone numbers should be included. Letters should be brief (300 words or less) and may be edited for reasons of clarity or space. They may appear in print and/or on the World Wide Web. Letter writers are not consulted before publication.

#### Corrections and Clarifications

The figure on page 501 of the Perspective "eIF4G: A multipurpose ribosome adapter?" by Matthias W. Hentze (24 Jan., p. 500) was incorrect. The correct figure appears below.



## AN OPEN



## AND SHUT CASE



## FOR AUTOMATED PLASMID MINI-PREPS.

- **High Purity**—sufficient for both automated fluorescent and manual sequencing
- **Easy Operation**—begin prep with direct loading of crude bacteria culture; *no* centrifugation step
- **Fast**—up to 24 Mini-Preps per hr.
- **Consistent Results**—up to 5 µg of plasmid per ml.

**Call 1-800-466-7949 now to learn how the new, improved Mini-Prep 24 can automate your plasmid DNA prep. Case closed.**

**MacCONNELL**  
RESEARCH

11339 Sorrento Valley Rd.  
San Diego, CA 92121 (619) 452.2603

**1-800-466-7949**

Circle No. 3 on Readers' Service Card