and Parkinson's diseases. "Cigarette smokers are believed to have a lower risk of contracting either of these diseases, and nicotine is thought to afford the protection," Brennan writes. Numerous studies have shown that smoking wards off Parkinson's; the evidence on Alzheimer's is less clear.

Of course, smoking carries lethal risks: lung cancer, heart disease, stroke. At a scientific symposium earlier this year on nicotine's therapeutic potential, Edward D. Levin, a professor of psychiatry and behavioral sciences at Duke University, began with this advice: "Don't smoke!"

Animal Numeracy

"What Do Animals Think about Numbers?" by Marc D. Hauser, in *American Scientist* (Mar.–Apr. 2000), P.O. Box 13975, Research Triangle Park, N.C. 27709–3975.

More than 1,000 rhesus monkeys live on the Puerto Rican island of Cayo Santiago. Hauser, a psychology professor at Harvard University and the author of *Wild Minds* (2000), gave some of the wild monkeys there an arithmetic test. He and his students conspicuously placed two bright purple eggplants behind a screen but when they removed the screen the monkeys might behold one, two, or three eggplants. Just as human infants had done in similar tests, the monkeys tended to look longer when one or three eggplants appeared instead of the expected two.

From those and other experiments, Hauser says, it appears that wild rhesus monkeys, like human infants, can distinguish among *one*, *two*, *three*, and *many* objects. Other research, moreover, has shown that with training, monkeys and other animals can develop more sophisticated numerical abilities. Pigeons and rats, for instance, have learned to peck or press a button 24 times, no more, no less, to obtain a food pellet. Recent experiments by Columbia University psychologists demonstrated that captive rhesus monkeys can grasp the ordinal relations among the numbers one to nine and indicate the proper numerical order for various quantities of different images. "The rhesus monkeys' performance was excellent—but only after receiving hundreds of training trials," notes Hauser.

Though the situations that animals confront in the wild may call for limited numerical abilities—chimpanzees, for instance, insist on "strength in numbers" (at least three adult males) before they'll attack an intruding chimp from another pack—they apparently do not require the numerical precision and skills found in humans. This prompts Hauser to ask: "What kind of evolutionary or ecological pressures would have favored the numerical competence found in *Homo sapiens*?" His admittedly speculative answer: When trading appeared on the scene, precision became necessary to ensure a fair exchange. "Selection favored those individuals capable of enumeration and combinatorial computation with symbols." And thus, he says, was the groundwork laid for algebra, calculus, and set theory.

What's in a Meme?

"The Meme Metaphor" by Mark Jeffreys, in *Perspectives in Biology and Medicine* (Winter 2000), Johns Hopkins Univ. Press, Journals Div., 2715 N. Charles St., Baltimore, Md. 21218–4363.

Darwinist Richard Dawkins's speculative concept of a *meme*—a replicating cultural entity analogous to a gene, that might explain how human culture evolves—has caught on in recent years. There's even a three-year-old academic journal devoted to the fledgling science of memetics. Unlike some prominent scientists, Jeffreys, an English professor at the University of Alabama at Birmingham, does not dismiss memetics out of hand, but he says much work is needed to make the meme metaphor scientifically useful.

What is a meme? A lexicon on the *Journal of Memetics* website (*www.cpm.mmu.ac.uk/jom-emit*) gives this definition: "A contagious information pattern that replicates by para-