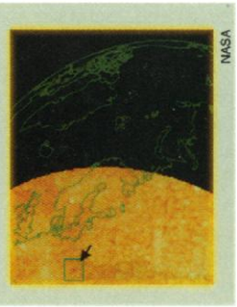
LETTERS

"The search should begin . . ."

Astronomers derive "surprising implications" from the controversial proposal that house-sized, icy objects are continually colliding with Earth (right, does dark spot reveal a "snowball"'s impact with the atmosphere?). Researchers debate whether data from "a new genetic technique" (with possible implications for the treatment of sickle cell anemia) are "a major breakthrough" or the result of an "artifact." And a 1996 finding about environmental estrogens is withdrawn.



"Snowballs" from Space?

If "snowballs" the size of houses are hitting Earth's atmosphere (Research News, 30 May, p. 1333), it would have surprising implications, not only for the origin of the oceans, but for the entire solar system. Planets are good brooms, and the lifetime of small objects in comet-like orbits is much shorter than the lifetime of the solar system (*1*, *2*). If snowballs are hitting Earth, they must come from outside the planetary orbits. One plausible source for such material is the Kuiper Belt, a region outside the orbit of Neptune populated by cometary objects. The Kuiper Belt is thought to be the origin of most of the short-period comets (*3*). The apparently high density of snowballs near Earth could be used to estimate the amount of mass in the Kuiper Belt, if we were to assume that it provides the parent population.

From a simple geometrical model, encounters with roughly 20 snowballs per minute, with an average mass of about 30 tons, suggest a local mass density of about 10^{-17} grams per cubic centimeter. Adopting a simple model of the Kuiper Belt with an opening angle of 10 degrees out to a radius of 50 astronomical units (*4*), and assuming a uniform density of material (as given by the density near Earth), yields a mass resulting from snowballs in the Kuiper Belt on the order of a tenth of the mass of Earth. But we know that the density of objects in the Kuiper Belt must be higher than the local density of similar objects by at least a factor of 100, on the basis of the number and size of the known short-period comets and the number and size of objects found in the Kuiper Belt itself. The impact of so many snowballs on Earth would imply a mass on the order of 10 Earth masses, or more, of Kuiper Belt objects within 50 astronomical units, greatly exceeding the mass of only 0.06 to 0.25 Earth masses inferred from observations (*4*). Such snowballs would have implications as well for the size distribution of the Kuiper Belt objects (*5*).

If the source of the snowballs were further afield, perhaps the Oort Cloud or even the interstellar medium, then even larger masses would be required to explain their claimed density in the inner solar system. If the snowballs were coming from interstellar space, their mass would exceed the estimated "missing mass" in the universe.

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2. H. F. Levison and M. J. Duncan, *Icarus* **108**, 18 (1994).
3. H. F. Levison, in (*1*), pp. 173–191.
4. J. Luu and D. Jewitt, in (*1*), pp. 245–254.
5. D. R. Davis and P. Farinella, *Icarus* **125**, 50 (1997).

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The Purpose of Glycolysis

In the 11 April Research News article "What makes brain neurons run?" by Marcia Barinaga (p. 196), neurophysiologist Marcus Raichle argues (as phrased by Barinaga) that "nobody doubts that glucose consumption rises as much as blood flow in activated brain areas, and that oxygen use—by anyone's measure—lags behind. And that . . . argues strongly that there must be anaerobic metabolism of glucose in