For one thing, she and Kenyon say, other, as-yet-unidentified genetic clocks are likely to be meting out life-span. "We're just at the very earliest stages of [finding] these genes," Kenyon notes. And aging is likely to have other kinds of regulators—such as the recently discovered gene for Werner's syndrome, which causes premature aging when it's mutated. Unlike the clock genes, which affect nondividing, postmitotic cells like those of nerves and muscles, the Werner's syndrome gene influences aging in cells still capable of dividing, so-called mitotic tissue such as skin, kidney, or liver, Campisi explains. And this gene seems to act not by slowing a clock but by affecting how cells read or copy their DNA.

There is no one mechanism of aging, says Huber Warner of the National Institute on Aging in Bethesda, Maryland. "There's both genetic and environmental factors," he points out. And although harried humans may be tempted to apply these findings to their own lives, no one yet knows whether these genes even exist in humans, or what the proteins they code for really do.

But Hekimi's team is making progress—they have discovered a potentially equivalent gene in yeast. And they are exploring whether there's any connection between the *clk* genes and the fact that restricting food intake can extend life in animals from fruit flies to mammals. Hekimi and others would like to clone the *clk* and *daf* genes and study the proteins themselves, but that's a step no one has yet taken. "I'm running around like a chicken with its head cut off, trying to get all this done," Hekimi laments. Slow, easy living may be the key to long life, but for genetic clock researchers, the pace of life has just gotten faster.

–Elizabeth Pennisi

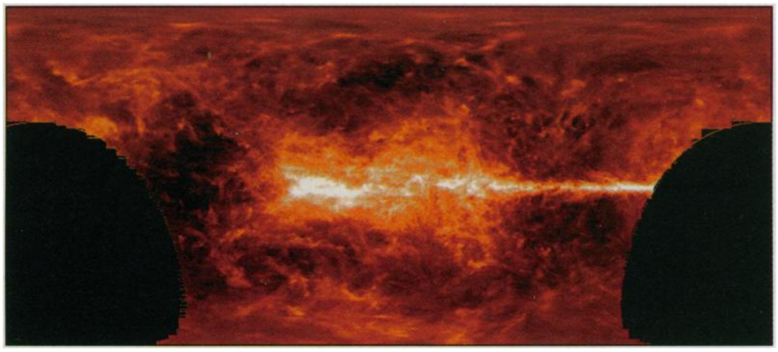
ASTROPHYSICS

A Glow From the First Galaxies?

A joint French-Dutch team may have uncovered a faint reddish glow from the cosmos's first generation of galaxies. The putative galaxies themselves are too faint and far off to be seen, but the glow of far infrared radiation emitted by shrouds of dust surrounding these first galaxies may have turned up in data collected by NASA's Cosmic Background Explorer (COBE) satellite.

COBE's original claim to fame was its detection, 6 years ago, of the detailed spectrum of the cosmic microwave background, the afterglow of the big bang itself. But finding the infrared signal of the primeval galaxies that formed millions of years later would be a comparable feat, because it requires stripping away foreground sources of infrared radiation to reveal the faint relict signal. The difficulties are such that team leader Jean-Loup Puget of the Space Astrophysics Institute in Orsay describes the detection, reported in the 1 April issue of *Astronomy and Astrophysics*, as "tentative." And COBE scientists chasing the same signal are circumspect: "Maybe there is something there," says John Mather, COBE's project scientist at NASA's Goddard Space Flight Center in Greenbelt, Maryland. "We certainly don't want to say there's none there; we just think it's not a proof."

The detection of infrared light from the earliest galaxies could help explain a puzzle: the amounts of heavy elements—which can only be created in the nuclear furnaces of stars—found in the present-day universe. To some cosmologists, current levels of these heavy elements imply an early generation of stars and galaxies, too old and distant to be visible directly. These "first-epoch" galaxies would likely be rich in gas and dust, which would absorb the starlight and re-emit it at longer wavelengths. The expansion of the universe would displace the signal even farther into the infrared region of the spectrum, and the result, today, would be a faint, far-infrared glow—the cosmic far-infrared background (CFIRB).



Foreground signal. A radio map of neutral hydrogen in our galaxy helped researchers isolate a possible cosmic background glow.

D. HARTMANN AND B. BURTON / CAMBRIDGE UNIVERSITY PRESS

To search for it, Puget and his colleagues began with recently released data from two of COBE's infrared instruments. They then subtracted foreground signals, one of which comes from dust between the planets and another from dust in our galaxy. Says Puget, "The main difficulty in this game is to take out the galactic contribution."

He and his colleagues have a new tool for doing so: an improved hydrogen map of our galaxy made by Puget's collaborators, Dap Hartmann and Butler Burton from the Leiden Observatory in the Netherlands. The survey, made with the Dwingeloo 25-meter radiotelescope, "improves substantially over what has been available," says Burton. And as the distribution of dust generally follows that of hydrogen, the researchers can correlate the hydrogen map with the far-infrared signal as measured by COBE, then extrapolate the correlation down to the zero hydrogen level to eliminate the infrared contribution from the galaxy.

What remains, claims Puget, is a far-infrared signal extending over a wavelength range of 200 to 1000 micrometers, with a gentle peak at 300 micrometers. The signal is even across the sky and is quite strong, consistent with emission from early galaxies, according to some models. But Puget concedes that there is "a bit of controversy between us and the COBE team" over whether the signal he and his colleages have isolated is a true cosmic far-infrared background.

The point of contention is the Franco-Dutch group's extrapolation from the hydrogen map. "Simply running the line down to zero is fraught with uncertainty," says COBE team member Richard Shafer. COBE's own analysis, made using a different hydrogen map and less sweeping assumptions, will appear in a trio of papers, the first of which has been accepted by the *Astrophysical Journal*. The U.S. researchers believe that features such as a "galactic halo"—a halo of dust surrounding the Milky Way—could in principle be responsible for a residual signal, and need to be carefully analyzed.

Puget and his colleagues, however, support their claims with a clutch of astrophysical arguments and invoke Occam's razor, maintaining that a CFIRB is the "least contrived" explanation of the signal. "I would be tempted to agree with Puget that it is probably extragalactic," says theorist Alberto Franceschini of the University of Padova, Italy, noting that the residual signal is even in all directions and is close to the level predicted by some models.

But the message from NASA's Mather is to expect the unexpected. "I don't believe in the predictive power of Occam's razor," he asserts. "As near as I can tell, the astrophysical situation is that things are usually complicated, not simple, and it is unnatural to assume simplicity."

–Andrew Watson

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