intentions, and other aspects of mental life occurs in the preschool years. Some investigators, including Perner, suspect that children construct "theories of mind," much as scientists fashion theories to account for natural phenomena (SN: 7/17/93, p.40).

One school of thought views children's comprehension of mental states as an innate capacity; another sees it as the by-product of a maturing general ability to reason in healthy kids.

The sibling findings of Perner's group suggest that, if an innate tendency to theorize about mental states exists, it gets triggered at different times in children, depending on the number of siblings in the home.

The researchers first studied 76 children, half between 3 and 4 years old, half between 4 and 5 years old. Of that number, 22 were only children, 42 had one brother or sister, 11 had two siblings, and 1 had three siblings.

An experimenter told each child a false-belief story enacted with dolls. Half the youngsters heard about a character named Max, who puts some chocolate in a cupboard and goes outside to play. His mother then puts the chocolate in a different cupboard. When Max decides to come in and eat the chocolate, the researcher asked the children, "Where will Max look for the chocolate?"

The remaining children heard a similar version of this story, in which Max leaves the house and tells his brother Sam where he mistakenly thinks the chocolate can be retrieved. An experimenter then asked, "Where will Sam look for the chocolate?"

About three-quarters of the 4-year-olds in the study answered these questions correctly, compared to 40 percent of the 3-year-olds. Three-quarters of those with two or more siblings also answered the questions correctly, regardless of age; the proportion of correct responses dropped to 60 percent for those with one sibling and 40 percent for only children.

In a second study, 42 children were asked questions about another false-belief story. Each of the 3- to 5-year-olds had only one sibling; 15 had an older sibling (the oldest of whom was 11) and 27 had a younger sibling.

Two-thirds of both older and younger children understood false belief, the researchers report. Thus, family size makes a specific impact on children's belief reasoning rather than on more general intellectual capacities, the psychologists suggest.

Other researchers have found that false-belief understanding rises in children who make more attempts to interact cooperatively with an older sibling. Belief and pretense are closely related concepts, leading Perner's group to offer pretend play among siblings as a way to enhance understanding of false belief. — *B. Bower*

Taking the temperature of the far cosmos

Score another point for the Big Bang. In a celebrated confirmation of cosmology's most popular theory, a spacecraft 4 years ago measured the temperature of the cosmic microwave background (SN: 1/20/90, p.36). Astronomers believe this faint glow represents radiation left over from the fireball that spawned the expanding cosmos. The universe has cooled considerably since its birth, and the temperature of the relic radiation in nearby regions of space, 2.73 kelvins, exactly matches the predicted cooling.

But scientists have tried for years, with little success, to examine a related facet of the microwave background: Probing more distant reaches of the universe, which reveals the way the cosmos looked at earlier, presumably warmer times, should yield a higher temperature for the microwave glow.

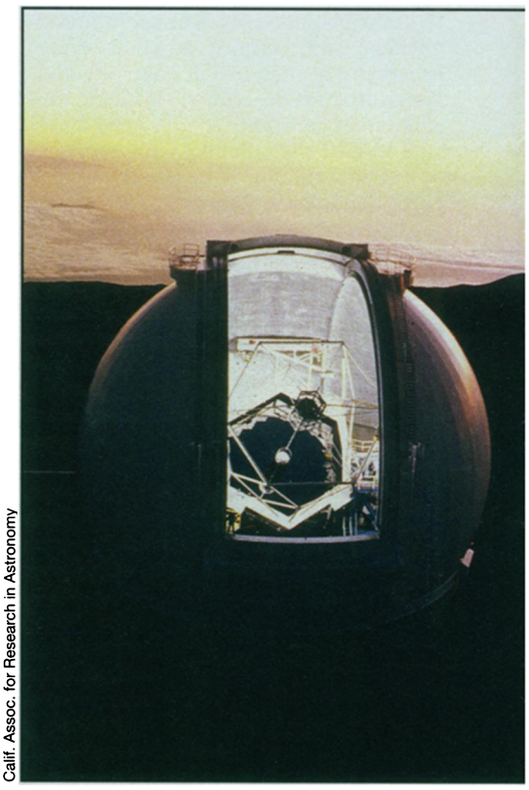
According to the Big Bang, the temperature of the microwave background increases linearly with redshift, a measure of the distance to faraway objects.

Using a high-resolution spectrograph and the 10-meter W.M. Keck Telescope atop Hawaii's Mauna Kea, researchers have now taken the temperature of two distant gas clouds observed as they appeared at 25 percent of the cosmos' current age. Antoinette Songaila and Lennox L. Cowie of the University of Hawaii in Honolulu and their colleagues report their work in the Sept. 1 NATURE.

The measurements "are strikingly consistent with the Big Bang theory," comments David M. Meyer of Northwestern University in Evanston, Ill.

The two clouds studied lie directly in the path of light from a quasar and contain carbon atoms. Analyzing the quasar light absorbed by these atoms, the team calculated the relative number of carbon atoms occupying either of two closely spaced energy levels. The atoms in each level serve as a sensitive probe of the energy imparted to them by the microwave background, providing a measure of its temperature.

Within experimental errors, the team found that one cloud— at 7.58 kelvins — matches the temperature predicted for the microwave background at that distance. The other cloud has a temperature some 3 kelvins higher. Cowie notes that the numbers give only an upper limit on the microwave background. Local effects also contribute to the excitation of carbon atoms in each cloud, and this may explain the higher temperature in the second cloud. — *R. Cowen*



Calif. Assoc. for Research in Astronomy

W.M. Keck telescope.

Source of withdrawal pangs found in brain

It's a cruel punishment for drug dependency. Those who finally decide to kick the habit or who simply can't get hold of any drugs may experience withdrawal, complete with shaking and sweating. Many addicts have no doubt wondered what could be making them feel so bad.

According to Glenda C. Harris and Gary Aston-Jones of Hahnemann University in Philadelphia, it's dopamine, a chemical messenger, in the brain's nucleus accumbens that helps impose this harsh sentence. Researchers disagree, however, on the finding's clinical implications.

Their new results, reported in the Sept. 8 LANCET, further support dopamine's good guy–bad guy image: This chemical helps provide the high and then turns against users when they fail to deliver the goods — more drugs (SN: 6/30/90, p.406).

Uncovering the role of the nucleus accumbens in withdrawal "is an important finding...[that] will stimulate a lot of new research," says Roy A. Wise of Concordia University in Montreal.

Other experiments had shown that dopamine concentrations in the accumbens can crash when addicted animals go off drugs. When animals get drugs that ward off the symptoms of withdrawal, dopamine concentrations in the accumbens don't decrease. But these findings demonstrated only an association between