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.

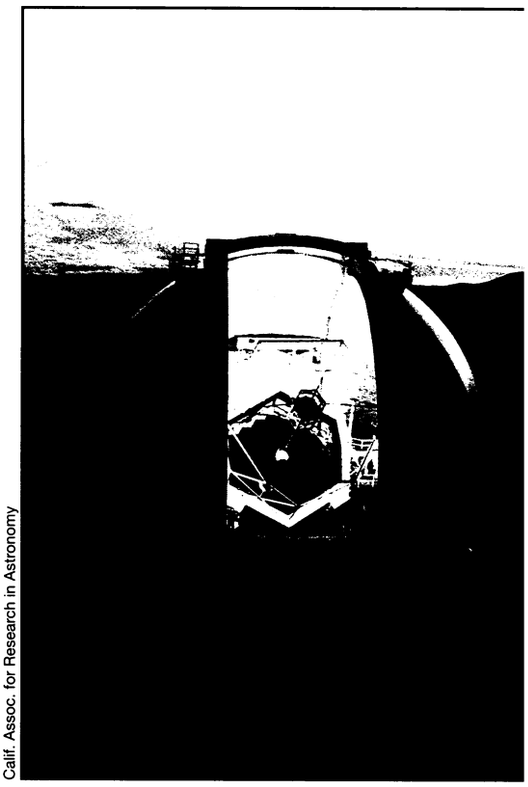
According to the Big Bang, the temperature of the microwave background increases linearly with redshift, a measure of the distance to faraway objects.

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

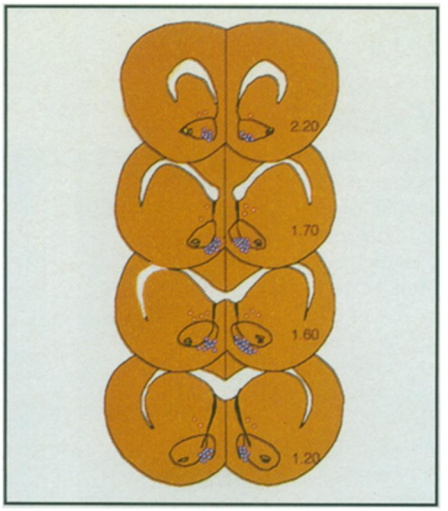
It's a cruel punishment for drug dependency. Those who finally decide to kick the habit or who simply can't get hold of any drugs may experience withdrawal, complete with shaking and sweating. Many addicts have no doubt wondered what could be making them feel so bad.

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



Four sections of the rat brain. The circles and crosses show injection sites of drugs designed to activate or block the D2 dopamine receptor. Circles show where the drugs influenced withdrawal symptoms, and crosses show where the drugs did nothing. The circles are all in the brain's nucleus accumbens.

dopamine and withdrawal — not a cause-and-effect relationship, contends Aston-Jones.

To demonstrate how dopamine contributes to the physical effects of going cold turkey, Harris and Aston-Jones gave a dopamine agonist, a compound that mimics dopamine's action, to rats addicted to morphine. The agonist "significantly attenuated all [physical] withdrawal symptoms measured," the investigators assert. The stronger the dose, the milder the symptoms.

Pretreating the rats with a dopamine-receptor antagonist, which blocks the receptors, prevented the agonist from working its magic, they report.

Piping an agonist into the accumbens that targets a specific dopamine receptor, the D2, proved particularly effective at preventing withdrawal symptoms. Giving a similar injection into parts of the brain near — but not in — the accumbens did nothing to stop them. And a different agonist that acts on the D1 receptor sometimes made the physical pangs of not getting the drug worse, Harris and Aston-Jones found.

Finally, blocking dopamine receptors in the accumbens seemed to turn on physical withdrawal symptoms in morphine-dependent animals but not in non-addicted animals.

Because other researchers have injected opiate antagonists into the accumbens of opiate-addicted animals and produced only mild signs of withdrawal, Harris and Aston-Jones conclude that "the accumbens may not be a major site for the initiation of opiate withdrawal symptoms." Instead, it may help regulate the body's response to getting off opiates.

The findings have "strong clinical implications," argues Aston-Jones, since they show which dopamine receptors influence withdrawal symptoms. Now, he says, researchers need to test drugs known to activate these receptors.

While Wise doubts the new study will result in better treatments for addicts, "I'm sure other people will [say it will]." He explains: "I'm more conservative."

Indeed, Derek van der Kooy of the University of Toronto disagrees with many of the team's conclusions regarding dopamine. His studies suggest that dopamine agonists and antagonists both block the ill effects of leaving drugs behind. Withdrawal involves a change in the firing pattern of the neurons activated by dopamine, his data suggest, not a simple increase or decrease in their activity.

— T. Adler

Wine: This stain could mar reputations

Did you ever pour a red wine and notice that a dark red stain appeared to be painted on the inside of the bottle? Well, consumers of Australian reds have been noting such deposits increasingly. Now afflicting some 5 to 10 percent of such wines, these lacquerlike deposits threaten to blemish the growing reputation of Australia's export-dominated wine industry.

Such bottle stains — which also plague some European and American reds — have received scientific scrutiny for decades. But their precise identity resisted an unveiling, largely because the deposits did not dissolve in any of the standard materials used to analyze chemical composition.

Now, borrowing a relatively new chemical assay used by soil scientists, the Australian Wine Research Institute (AWRI) in Glen Osmond has unmasked the culprit. In the just-released August JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY, researchers from AWRI and the nearby University of Adelaide describe this deposit as a mix of tannins, red pigments, and grape protein. The tenacious deposit is somewhat comparable to the tannin-based stain that plates the inside of teapots.

The bottle stains are different from the sediment crystals that form in older reds, notes AWRI biochemist Elizabeth J. Waters, who led the new study. "That sediment is almost 100 percent potassium hydrogen tartrate [a salt that's in wine]," she observes, while the bottle stain has no detectable salts.

Some white wines also form deposits — a fluffy haze that settles near the bottom of a bottle. This haze appears to consist of nothing but protein, the new Australian analyses indicate. The red-wine stains, by contrast, contain only about 20 percent protein.

"Wine is a milieu of chemicals that can interact," observes enologist Carlos Muller at California State University at Fresno. These chemicals can slowly polymerize — form long, chainlike molecules — and precipitate. Indeed, chemists had long surmised that the bottle stains were polymers of phenols, such as tannins, Muller notes.

Muller says that the Australian team's "excellent job" has now "advanced the knowledge of these precipitates" — demonstrating that they are made up of things in addition to phenols.

Bottle stains do not affect a wine's flavor or pose a risk to drinkers. Indeed, notes renowned enologist Vernon Singleton, now retired from the University of California, Davis, these deposits suggest a developing maturity. And "while we'd rather a [red] wine mature without it, this [bottle staining] can happen to almost any."

Because several countries refuse to import wine with visible deposits, and because even cosmetic defects make many consumers wary, AWRI has launched a campaign to stamp out the stain. Toward that end, the institute will investigate how wine-processing steps (such as early bottling or excess oxygen) and bottle treatment (such as storage in overly warm conditions) might foster the stubborn deposits. And because these deposits may not precipitate until several years after bottling, Waters' team has developed an overnight and a 2-week process to accelerate a wine's "aging" — and reveal signs of its susceptibility to bottle staining.

— J. Raloff

Waters/AWRI

Wine-stained bottle.