much like the earlier ones that give the forces of nature their separate identities. Because they appeared so long after the origin of the cosmic background radiation, explains Hill, these seeds could have been as large as needed without ruffling the background radiation at all.

Unlike other scenarios, Hill's doesn't rely on gravity alone to gather matter around the seeds. In the proposed late phase transition, Hill says, a new force of nature would appear, one that is so discriminating in its effects that we haven't yet detected it. The force might affect only neutrinos and show its strength only at distances of several hundred million light-years—about the scale of the biggest structures yet seen in the universe. Perhaps, he and colleagues speculate, neutrinos responding to this force could have rounded up particles into the vast structures we see.

That's a little much for some of his colleagues to swallow. "The late-time phase transitions are what is called in the trade now the invocation of the tooth fairy," says Davis. Even so, Hill and his colleagues are encouraged by a recent observation. A survey published last year, measuring the distribution of galaxies along thin but very long "pencil beams" extending into the far reaches of space, appeared to reveal clumps every 400 million light-years. "It's as though we are living in a cage with walls every 400 million light-years or so," says Hill—just the scale on which his force would act. But other cosmologists are skeptical of such galaxy surveys, arguing that current knowledge of cosmic structure is far too sketchy to favor any particular scenario of structure formation.

Peebles hopes the 1990s will improve the situation. The 1980s was a decade of theory, as particle physicists joined the cosmology game armed with "a slew of exciting and clever concepts," he recalls. "On the other had, they didn't bring with them any particular knowledge of what it was they were trying to explain."

In the next decade, he looks forward to an observational push that would bring bigger surveys of galaxies, as well as an analysis of the clumping of quasars, which lie at such large distances that they may point to yet another level of structure that needs explaining. At the same time, increasingly precise satellite and balloon measurements may turn up the first bumps in the cosmic background radiation, which could help theorists choose among scenarios. Maybe then some of the tooth fairies will take flight. "After you know what is happening really well," says Peebles, "maybe you will get some hints as to why."

■ FAYE FLAM

Neuroscience Meets in the Big Easy

New Orleans—*While all of Louisiana—and much of the nation—waited with bated breath for the vote that would decide whether an ex-Klansman and Nazi sympathizer would be elected governor of a U.S. state (he wasn't), more than 15,000 neuroscientists who had gathered here for the annual meeting of the Society for Neuroscience learned the results of another vote: Society members chose by a margin of 2 to 1 not to return to this popular convention mecca in 1996—not because so many in the state seem to sympathize with David Duke, but as a response to Louisiana's restrictive anti-abortion law, one of the toughest in the nation. Then, with the results of their vote behind them, the focus of the researchers at the meeting shifted from politics to science. Among the highpoints of the science at the meeting were new ways of recording nerve impulses from intact brains, skepticism about an experimental Huntington's treatment, and a promising new twist on eye development.*

Patch Clamping au Naturel

Patch clamping, the revolutionary technique for recording electrical currents in cells, whose developers—Bert Sakmann and Erwin Neher—were honored last month with a Nobel Prize, has been taken one important step further by David Ferster of Northwestern University. In the 1980s, patch clamping revolutionized electrical recording from cultured neurons. Then 2 years ago Sakmann found a way to use the technique in slices of brain tissue. And now, in New Orleans, Ferster reported the first use of patch electrodes to record electrically from neurons in the intact brains of living animals.

Ferster's work represents a breakthrough in what Sakmann calls "a mental barrier" to trying the technique in whole, living brains. "People said it would never work," the developer of the technique told *Science*, because researchers thought the tiny patch pipettes would clog in the messy milieu of a living brain and not form an effective seal on an individual cell. But Ferster wasn't daunted, and he found that he could in fact get the seals he needed to record from neurons in the visual cortex of cats.

Ferster's accomplishment was more than a mere technical breakthrough. He and graduate student Bharathi Jagadeesh used the method to address a long-standing debate about how certain neurons in the visual cortex are able to respond selectively to lines with a specific spatial orientation. Some researchers have hypothesized that inhibiting signals from neighboring neurons help tune that specificity, but Ferster and Jagadeesh used the patch electrode to add up the electrical signals coming into the neurons while the cats looked at patterns on a screen, and found no evidence of the proposed inhibition.

Sakmann notes that Ferster has answered a question that Sakmann himself tackled and failed to answer 25 years ago, using the old method of impaling neurons with sharp electrodes. But that's not the only progress made possible by Ferster's work. The patch-clamp advance opens the door to many experiments that have previously been impossible in living animals—such as recording the activity of tiny neurons in the brain stem and elsewhere in the brain that are too small to impale, and doing the kind of detailed analysis of ion currents into and out of cells that only patch clamping can achieve. Concludes Sakmann, "It's marvelous."

Grafts for Huntington's—Too Much Too Soon?

Mexico city neurosurgeon Ignacio Madrazo may not have enjoyed the Big Easy as much as the average meeting attendee last week. Madrazo is one of a small group of pioneers who have used brain grafts as therapy for Parkinson's disease. For a decade or more, the concept of attacking neurodegenerative diseases with brain grafts—especially with grafts of fetal tissues—has exerted an intellectual appeal. After all, it makes a certain intuitive sense to replace tissue that has degenerated with, say, fresh fetal tissue. But while this tack has been tried on 100 or so Parkinson's patients at various research hospitals around the world during the past 4 years, progress has been slower than people had hoped: Only recently have a handful of patients shown improvement. Which is why Madrazo met with sharp criticism from his

fellow neuroscientists in New Orleans when he presented his latest results on a much tougher challenge: using grafts to treat Huntington's disease.

What makes Huntington's the tougher job is that while the Parkinson's grafts need only to produce the neurotransmitter dopamine to be effective, the success of Huntington's grafts may depend on the grafted neurons actually hooking up correctly with other neurons. Madrazo claims to have met that challenge. One year after surgery, he says, his sole Huntington's transplant patient has improved. But other researchers who work with Huntington's patients see little evidence of real improvement in the data the Mexican surgeon offers. What is more, they argue that his latest gamble was recklessly premature—because he didn't start out with an animal model. "You have to do it the scientific way," says Walter Koroshetz, who treats Huntington's patients at Massachusetts General Hospital. "You have to do it in animals first."

But that doesn't mean that brain tissue transplants aren't going to have a role in Huntington's, because other groups are taking Koroshetz's advice. After carrying out successful grafting experiments in rats in which he destroyed the brain region that degenerates in Huntington's disease, Ole Isacson of Harvard Medical School has now completed apparently successful grafts of brain tissue from fetal rats into five baboons with drug-induced brain lesions that cause a Huntington's-like condition. Before the grafts, the baboons showed involuntary movements similar to those in human Huntington's patients. Within 9 weeks of surgery, they had improved significantly, and examination of their brains showed that the grafted rat neurons had survived. Koroshetz calls those results "encouraging," noting that Isacson is "starting at the beginning and working his way up." He cautions, however, that the technique is "not [ready for human trials] yet."

Retinoids May Help You See in More Ways Than One

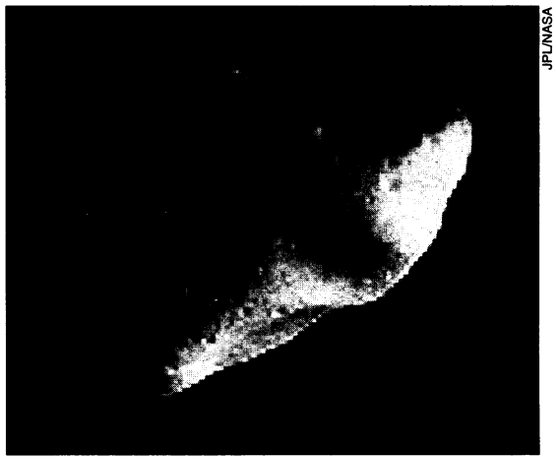
One of the most intriguing problems in developmental biology is how the early embryo provides the clues that tell cells which part of the organism to become. The first signals must give simple directions such as: "You're the front, you're the back." And those fundamental orientations provide the initial geometry of the developing embryo. In very early development this seems to be accomplished by gradients of diffusible molecules—high at one part of the embryo, and gradually tapering off with distance from that point. But the search for similar gradients in the developing nervous system has been long and controversial. Which is why attendees at one session of the meeting perked up at a report that hints at the existence of such a gradient in the developing retina of the mouse.

One possible gradient substance that has gotten a lot of press lately is retinoic acid, a relative of vitamin A. Retinoic acid has an influence on early wing development in the chicken, and also has been shown to turn on developmentally important genes. But the debate continues over whether retinoic acid really does form gradients that orchestrate development, and if so, where it does this. "In no system is there really good evidence of a gradient," says Thomas Jessell, who works on the problem at Columbia College of Physicians and Surgeons. Researchers are actively looking for such gradients in the chick limb bud, and in the spinal column.

In New Orleans, Ursula Dräger of Harvard reported findings that suggest retinoic acid may influence development in yet another tissue, and a fitting one at that: the retina, where a related molecule, retinal, later acts as the light-sensitive pigment in adult eyes. Dräger's group found that the developing retina contains two forms of an enzyme that makes retinoic acid. One form, found only in the ventral retina, is much more active, leading to higher retinoic acid concentrations in the ventral than in the dorsal half.

This kind of asymmetry is just what one would expect of a molecule that helps pattern the developing retina, Dräger says. Jessell calls the result "intriguing," adding that "it suggests retinoids may have some role in development of the eye as well as in its later function." ■ MARCIA BARINAGA

Galileo Hits its Target


JPL/NASA

The Galileo spacecraft has sent back the first closeup view of an asteroid, taken from a distance of 16,000 kilometers, and the image is triggering congratulations all around. Ground-based astronomers are justifiably proud of how well they predicted what Galileo would see in its 29 October encounter with Gaspra. Mission controllers are pleased at the stunningly accurate camera aim, which let them receive the image a year ahead of schedule despite Galileo's crippled antenna system.

The astronomers' achievement is all the more impressive considering that Gaspra, a lump of rock shaped like a partially deflated football that was found to measure only 20 by 12 by 11 kilometers, is nothing more than a point of light from Earth. Nonetheless, Earth-based astronomers had determined the size and shape of the asteroid to within 10% or 15%. They even came remarkably close to its surface reflectivity of 20%—about twice as reflective as Earth's moon.

Astronomers also forecast Gaspra's ravaged appearance. Based on the calculated frequency of collisions large and small in the asteroid belt, Noriyuki Namiki and Richard Binzel of the Massachusetts Institute of Technology concluded that a body as small as Gaspra must be a fragment from a relatively recent catastrophic collision of larger bodies. So small an object, they said, could not have survived long in the rough and tumble of the asteroid belt. And lo and behold, Galileo found a body so irregularly shaped—and yet relatively free of impact craters—that team member Joseph Veverka of Cornell University assumed it must be a fragment from a catastrophic collision that took place no more than several hundred million years ago.

Astronomers had thought they might have to wait until November 1992 to learn how well their predictions held up. Controllers had expected Galileo's antenna problems (*Science*, 23 August, p. 846) to throw off its camera's aim, so that an entire mosaic of images would have to be returned to Earth to find Gaspra—something that could not be done until the spacecraft swung past Earth next year. But Galileo's targeting turned out to be so good—on the order of putting a large house in San Francisco in your cross hairs from Los Angeles—that only a part of one image needed to be returned to allow Gaspra's early debut. ■ RICHARD A. KERR