Later, when the higher primates dropped to the ground and began locomoting on all fours, MacNeilage contends, these patterns persisted. The animals continued to use the right hand for manipulating food, holding fruit to the mouth, and cracking nuts, but they reached for food with the left hand. And vocalization remained the concern of the brain's left hemisphere. Remnants of this pattern are seen in humans today, says MacNeilage. "The link is actually not handedness but footedness," he says. "We have overwhelming evidence now that the left hemisphere's specialization for language is related more to a person's foot preference than to his hand preference." More than 90 percent of humans—including left-handed, right-footers—control language and body posture via the brain's left hemisphere, says MacNeilage.

"As elegant as the tool-use scenario for the evolution of language is, I think it was something far more lowly," MacNeilage concludes. "Language is tied much more to our posture than we realize. But posture is something we take for granted; we never give it a thought or realize that it also requires specialization." MacNeilage may never amass enough evidence to prove conclusively his "Postural Origins" theory, but he is taking on one basic empirical question that could bolster his ideas: hand preferences in chimpanzees. He and a former graduate student have devised a "multi-testing apparatus" that he believes will reveal which hand the chimps prefer for specific tasks. "Acceptance of our theory will be slow," he concedes, "but at least we've given people a relatively coherent framework for looking at some of these questions." Whether all primatologists will be grateful for this gift remains to be seen—as does the question of whether MacNeilage's attempt to draw us closer to our prosimian ancestors by means of body posture will ever succeed. ■ VIRGINIA MORELL

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Gamma-Ray Observatory: Bursting with New Results

The latest satellite data are tearing up established explanations for a longstanding puzzle—the "gamma-ray bursters"

AMONG THE MOST PUZZLING PHENOMENA in all of astrophysics are the intense blasts of radiation known as gamma-ray bursters. Typically occurring about once a day and lasting from a few thousandths of a second to a few hundred seconds, these bursts of intense gamma radiation seem to be the result of powerful explosions somewhere in the universe—but where? Astronomers can't see what these things are coming from since the bursts disappear too fast for anyone to capture them with a telescope. It isn't even clear whether the bursts originate nearby or on the outer reaches of the universe.

Now scientists have new and startling clues to the gamma-ray problem, courtesy of NASA's orbiting Gamma Ray Observatory (GRO). But don't expect easy solutions. In fact, the satellite observations actually deepen the mystery. They reveal a distribution of bursts that is far different from what many theorists expected. And as a result, the most widely accepted current theories are either out the window or in need of drastic overhaul.

The problem with current theories—as revealed by GRO—is that most of them try to explain the gamma-ray bursts as byproducts of catastrophic collapses or shifts in the dense material of neutron stars: burned-out stars whose material reaches densities in which atoms are crushed down to nothing but neutrons. Theorists have suggested that as material falls into a neutron star it could trigger its crust to collapse or even set off thermonuclear explosions—and the energy produced in that way would come out as a gamma-ray burst.

Now, by taking a survey of the distribution of these bursts through space, GRO shows they don't appear to be coming from neutron stars at all. Although neutron stars cluster in the plane of our galaxy and toward its center, the latest observations found gamma-ray bursts distributed randomly through space. Back to the drawing board.

"This result was stunning," says Gerald Fishman, project leader for the Burst and Transient Source Experiment (BATSE), which provided a wide survey. BATSE is one of four gamma-ray experiments launched last April aboard the GRO (recently renamed the Compton Observatory after physicist Arthur Holly Compton). Of the four, BATSE was the most sensitive for detecting weak and brief gamma-ray events, and so far it has picked up 117 bursts.

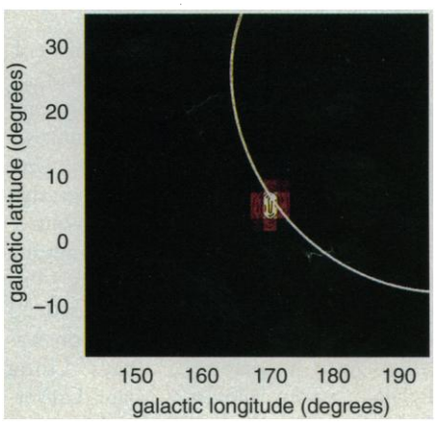

Image of a burst. *GRO detectors can capture angular position but not distance.*

BATSE didn't deliver its knockout punch to the prevailing views immediately, however. The first BATSE results, released last May, seemed to fit the neutron-star idea fine. Those results showed a preponderance of powerful bursts and a lack of weak ones. Since the weak bursts correspond (roughly) to the most distant sources, Fishman says he interpreted those data to mean there were no very distant sources: the bursts came from close by, probably in our galaxy. Further bolstering the galactic neutron star theories, a French-Russian team conducting another experiment claimed that their satellite experiment found that the bursts did line up in the plane of the galaxy—as neutron stars do.

But the latest results turned this neat picture upside down—showing the opposite. And that just didn't jibe with the consensus view. As NASA project scientist Neil Gehrels says, after this latest round of observation, the old theories are "dead or at least in serious need of first aid."

So what is the fate of the neutron star model going to be? Death? Or just a heart-stopping trip to the emergency room? Well, that depends on whom you ask. Even in the face of bad news, some advocates of the current model aren't giving up. For example, both Stan Woosley, a theorist at the University of California, Santa Cruz, and Richard Lingenfelter of the University of California at San Diego say their theories are flexible enough to accommodate the new GRO data.

"There are far too many compelling reasons to believe the neutron star model," says Woosley. Further analysis of the breakdown of energies of these bursts, for example, indicates a source with a strong magnetic field, he says, just like that surrounding

neutron stars. Lingenfelter is being coy. He says that in the middle of the night after the GRO announcement, he had a nocturnal flash that can explain the new findings in a way consistent with neutron star theory. But he's not telling just what it is yet: he plans to disclose his brainstorm at a GRO meeting in Huntsville, Alabama, in October.

Other astrophysicists, however, are ready to let the old model go and consider new possibilities. But as they do so, they face some tough theoretical problems. For one thing, the unexpectedly even distribution of the gamma-ray bursters (which would suggest that the bursts could come from anywhere, within or outside our galaxy) is difficult to reconcile with the other result: the lack of weak sources, which would seem to show the bursts are nearby, and hence bounded by something. But if they aren't bounded by our galaxy, what is the boundary? Astronomers cite two possibilities—both extreme. The sources could lie in a "shell" or "cloud" close to our solar system. But Fishman asks, "What could this cloud be? Why wouldn't we see other objects in such a cloud?"

On the other hand, the sources could come from very far outside the galaxy—perhaps being bounded only by the edge of the universe itself. But if that were true, it would mean that the bursts are more energetic than any other known astrophysical phenomenon—even a supernova.

That apparently radical notion doesn't faze Bohdan Paczynski of Princeton, who years ago rejected the idea that the gamma-ray bursts come from neutron stars in our galaxy. He argues that very rare events such as the collision of two neutron stars or an encounter between a neutron star and a black hole (very different and more infrequent events than those called for in the current model) could give rise to explosions with the requisite energy. "There's nothing that outrageous about gamma-ray bursts at those energies," he says. And, if the entire universe were involved, a rate of one a day corresponds to the relative rarity of one in 100,000 years in any given galaxy.

While the latest GRO results have set a new controversy in motion, Fishman hopes that a further dose of the same could restore consensus. Perhaps, he says, observation of a few hundred bursts will disclose a pattern that gives away the bursts' location. In addition, NASA scientists plan to do spectral analysis and classifications of different kinds of bursts to gather clues to the nature of the sources. Such new experiments are bound to turn up more clues. But whether they will resolve the longstanding puzzle and restore amity in the field—or merely deepen the perplexity and heighten the tension—is, for the moment, anybody's guess. ■ FAYE FLAM

Transgenic Animals May Be Down on the Pharm

Commercial production of human pharmaceutical proteins in the milk of dairy animals may soon be feasible

Pharmaceutical Proteins Limited

Protein producers. *The milk, not the fleece, of these transgenic sheep may be golden.*

IN AESOP'S FABLE, THE GOOSE that laid the golden egg endowed its owner with untold riches. Today, genetic engineers are creating their own versions of the fabled goose—new breeds of sheep, goats, and cows that secrete valuable human pharmaceutical proteins into their milk. Indeed, in the September issue of *Bio/Technology*, three independent research teams report new results that have brought the technology to the threshold of commercialization. "Two years ago, people were doubtful of this technology," says Robert Bremel, an animal biotechnologist at the University of Wisconsin, Madison. "But now the work shows that the mammary gland can be used as an impressive bioreactor."

What excites researchers like Bremel is the prospect of developing critters, otherwise ordinary dairy animals, that can produce large quantities of previously scarce—and therefore expensive—human proteins. Among the proteins are the clotting factors needed to treat hemophilia; erythropoietin, which is used to ameliorate the bone marrow suppression caused by drug therapies for AIDS and cancer; and alpha-1 antitrypsin (AAT), which is being investigated as treatment for emphysema and other degenerative lung diseases. Currently the proteins are either isolated from human sources or made in bacteria by recombinant DNA technology, and the costs range from about $110 per gram for AAT to $1.5 million per gram for erythropoietin.

But the recent successes don't mean that these and other pharmaceuticals will be commercially manufactured in mammary "bioreactors" tomorrow. Why? There's at least one major technical hurdle that has to be overcome: The yields in milk are, for the most part, still too low for commercial production. And on the regulatory front, the producers will have to prove that their proteins are not only safe but biologically equivalent to the natural human proteins.

Two of the three teams reporting their results in *Bio/Technology* have made major progress on the yield problem, however. The one closest to commercial production levels includes researchers from Pharmaceutical Proteins, Ltd., in Edinburgh, Scotland, and the Agricultural and Food Research Council's Institute of Animal Physiology and Genetics Research, also in Edinburgh. Using gene transfer technology, they have produced sheep that yield milk containing up to 35 grams per liter of human AAT. According to team leader Alan Colman, that's a good start, but they need to breed more high producers.

The second team, including researchers from Tufts University School of Veterinary Medicine in North Grafton, Massachusetts, and Genzyme Corp. in Cambridge, has also made strides recently, in their case developing transgenic goats carrying the gene for a longer acting form of tissue plasminogen activator. Their best goat produces the clot-buster at the rate of about 3 grams per liter of milk.

The Edinburgh and Genzyme groups didn't get their current high yields overnight, however. Both had to tinker with the gene constructs they use to create their transgenic animals, although they went at this differently. Based on mouse experiments, the Edinburgh group decided to switch from the cDNA construct (a DNA copy of the AAT messenger RNA that lacks the gene's intron sequences) they used at first to a copy of the genomic AAT gene for the current work. "We got a much better level of expression with genomic DNA than with cDNA," says Martyn Breeze of Pharmaceutical Proteins.

The Genzyme group, meanwhile, focused on the promoter sequences that regulate gene