those genes and their protein products to be studied much more easily.

With this method, Walden and his co-workers began trying to decipher the poorly understood mechanisms of action of two plant hormones—auxin and cytokinin—that control plant cell division and growth. To do this, the team produced numerous mutants of tobacco plants which they thought were capable of growing independently of the presence of these two hormones. Using these mutants, the team isolated a number of genes, proteins, and other factors that appeared to stimulate plant growth "downstream" of the hormones—and thus were implicated in the hormones' mechanism of action.

It now appears, however, that these mutants were not capable of independent growth after all. The investigation carried out at the institute concluded that Czaja added plant growth factors to culture media used in the experiments and manipulated the experiments to make it appear that cultured plant cells were capable of auxin- and cytokinin-independent cell division. (Czaja, who was also a co-author on the papers, declined to comment when contacted by *Science*.) Serious suspicions had been raised by early 1998, when researchers at the institute were unable to repeat results stemming from the technician's work. Walden and his co-workers began investigating and soon concluded that at least some of the results had been faked.

In March 1998, Walden informally let other plant researchers know that there were potential problems with the work, and the following month he, Schell, and another co-worker published an initial warning about the data in *Trends in Plant Science*. Nevertheless, under strict new rules on scientific misconduct adopted by the Max Planck Society in November 1997, institute officials sought, and received, Walden's resignation. "There were ample signs that [Walden] did not exercise proper responsibility for his group," says Heinz Saedler, a co-director of the Cologne institute. (Walden, who now works at a research institute in the United Kingdom, told *Science* he preferred not to comment on the affair.)

Despite the dramatic findings in this month's *Plant Journal* report, Schell says the group has no immediate plans to publish retractions of the eight papers in the journals in which they originally appeared. "This article is about the only thing we were planning to do. The main thing is to get our science going again." On the other hand, Schell adds, if the journals themselves asked for retractions, "I would consider it very seriously." But some editors of the journals involved say they believe the co-authors should submit letters stating that the results could not be reproduced. John Tooze, co–executive editor of *EMBO Journal*, says that although the journal has no hard-and-fast policy about retractions, it would be "common sense" for the authors to contact the journals involved. "A statement in each of the journals from the authors would be an appropriate thing to do," he says. And Floyd Bloom, editor-in-chief of *Science*—where three of the eight papers appeared—says that "we would have expected Dr. Schell or his institution to contact us when the results that had been published in *Science* were conclusively identified as suspect. We will be discussing the possible need for retractions of the papers that Dr. Schell and his collaborators published in *Science* with him, and will act accordingly."

Jones says that, in retrospect, flaws in some of these papers might have been spotted with closer review. For example, in the *Plant Journal* study the researchers used a second assay technique—incorporation of the DNA building block thymidine into plant cells—in addition to a cell-counting method used in the original work to determine whether cell division had occurred. "In hindsight, why wasn't the thymidine incorporation done originally; why didn't the reviewers call for that?" Jones asks. On the other hand, he says, "hindsight isn't fair. ... When the papers came out I was extremely enthusiastic." –MICHAEL BALTER

PALEONTOLOGY

Fossil Offers a Glimpse Into Mammals' Past

Last year Ji Qiang made paleontological history when he reported that he had found fossils of feathered dinosaurs in the Liaoning Formation, about 400 kilometers northeast of Beijing. Now Ji, a paleontologist from the National Geological Museum of China, has done it again: He has unearthed the world's oldest complete mammal fossil, dating back at least 120 million years. And he found it in the same fossil-laden hills that surrendered the feathered dinosaurs (*Science*, 26 June 1998, p. 2051).

Most mammal fossils older than 65 million years are nothing but teeth and scattered bones, but this one is an exception. "When I saw it, I freaked out—it's an incredibly complete fossil," says mammalogist John Wible of the Carnegie Museum of Natural History in Pittsburgh. In this week's issue of *Nature*, Ji and his colleagues conclude that the fossil is a close relative to the common ancestor of all mammals alive today, from humans to opossums to platypus. "This thing gives us the closest look at what the last common ancestor of modern mammals was like," says Tim Rowe, a paleontologist at the University of Texas, Austin. If Rowe is right, that ancient creature was truly bizarre: a rat-sized chimera that walked on mammalian front legs and splayed reptil-

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ScienceScope

Betting on Research More Americans than ever are wrecking their lives by gambling away their money on everything from state lotteries to Internet virtual casinos, according to a National Research Council (NRC) report set for release next week.

Gamblers now wager more than half a trillion dollars a year in the United States, according to the study, which was led by Charles F. Wellford of the University of Maryland, College Park. It concludes that the number of U.S. adults whose gaming is "pathological"—out of control and damaging to jobs, finances, and family—has grown to an estimated 1.8 million.

The federal government, however, devotes "next to nothing" to research on gambling, says John Shosky, deputy director of the president's National Gambling Impact Study Commission (NGISC). So the NRC is calling for more research and better diagnostic approaches. For example, because compulsive gambling often shows up in tandem with other compulsive behaviors, the report recommends that physicians treating people for substance abuse also be on the lookout for gambling tendencies. The NRC review is part of a larger NGISC report due 18 June.

Diet Conscious Japan's life scientists are looking forward to greater political support—thanks to a new life sciences study group in Japan's parliament, the Diet. Similar to a caucus in the U.S. Congress, the group consists of some 70 members of the ruling Liberal Democratic Party (LDP). It is chaired by Koichi Kato, a contender to be Japan's next prime minister.

A spokesperson for Hiroyuki Hosoda, an LDP member instrumental in setting up the group, says legislators have become increasingly concerned that Japan is falling behind in genomics and biotechnology, and that the Diet has no regular legislative committee to address the problem. The study group, formed last week, hopes its organizing efforts will bolster a move by five ministries to foster the growth of biotech businesses and also boost life science spending in the 2000 budget, which will be debated through the fall and go into effect 1 April 2000.

ian hindlegs.

Paleontologists had already found the fossils of many forerunners of today's mammals, allowing them to trace our ancestors' first important steps toward the modern mammalian body plan. By about 200 million years ago, mammals had already evolved from bulky, cold-blooded creatures only a step or two removed from reptiles into small animals just beginning to acquire the three-boned mammalian middle ear, and probably fur and milk as well. Yet they still retained the old reptilian style of walking, with legs spread out to the sides. Paleontologists suspect that not long after this time, one lineage branched off and became the monotremes (represented today by the platypus and echidna), which lay eggs and walk with a sprawling gait. Millions of years later a lineage called therians, the ancestors of all other living mammals, both marsupials and placentals, emerged. Therians give birth to live young, and, thanks to a series of changes to their legs, shoulders, and hips, they walk with their limbs under their bodies rather than sprawling.

Vision of the past. The ancestor of all modern mammals may have resembled this reconstruction of a 120-million-year-old mammal from China.

Beyond these basic outlines, though, the history of Mesozoic mammals is sunk in obscurity. Researchers aren't sure when the living branches got their start, or just where on the mammalian family tree many of the early species belong. Much of the trouble stems from the fact that Mesozoic mammal fossils are so scrappy that the animals are mainly known only from their teeth. And teeth alone can be deceptive: Mammals on distant branches sometimes evolved teeth that ended up looking very similar.

One particularly enigmatic group is the triconodonts, known from little more than teeth ranging from 150 million to 80 million years old. With so little material to go by, some paleontologists argued that triconodonts were very primitive protomammals, while others thought that their closest relatives were therians. Now it seems that they are right in the middle.

The teeth of the new find, which Ji and his colleagues named *Jeholodens jenkinsi* (Jeholodens, or "tooth of Jehol," refers to an ancient name for the region, and jenkinsi honors Harvard mammal paleontologist Farish Jenkins), identify it as a triconodont. The rest of the fossil offers a surreal mix of anatomy. Its rear legs are designed for the old reptilian stance, yet its shoulders and front legs are designed to be as mobile as any therian's. "You have the elbows pointing back, whereas you have the knees pointing to the side," says Zhexi Luo, a paleontologist at the Carnegie Museum of Natural History and one of Ji's co-authors. "Were it not for the fact that the whole thing was articulated, we wouldn't have dared come out with such an apparent contradiction."

Using this anatomy, the paleontologists fit *Jeholodens* onto the mammal family tree, finding that it branched away from an ancestral mammal just before the lineages of living mammals originated. In their report, the researchers point out that this relationship offers two tantalizing choices for how the mammalian body evolved. One possibility is that the modern mammalian shoulders and front legs evolved twice: They appeared first in the triconodonts, after that group branched away from the lineage leading to modern mammals, including monotremes, which retained the more reptilian stance. Much later, mobile forelimbs then evolved independently in the first therians.

But given the evidence, says Luo, it's equally possible that *Jeholodens* represents the first step to modern mammals. In this scenario, modern shoulders and arms evolved only once, in the common ancestor of *Jeholodens*, monotremes, and therians. But when monotremes evolved, they reverted back to the more primitive anatomy as they adapted to their own peculiar ecological niches. Meanwhile, the therian lineage held onto the flexible front legs and then added on advanced hind ones.

It might seem peculiar for one pair of limbs to change so much earlier than the other. But Rowe points out that mammal embryos develop their front limbs first, and the back ones catch up later. That precedence is also reflected in the evolution of other vertebrates—fish evolved their front pair of fins before their rear ones. Because evolution changes body shape by building on an existing developmental program, evolutionary patterns often echo those in ontogeny. "It arises first in development, it arose first in phylogeny. So this case could just be carrying on the trend," says Rowe.

Paleontologists such as Rowe aren't ready to choose between the two scenarios, though. The only way to decide between the two versions of mammalian history will be to find good fossils of primitive monotremes and therians. And if the recent past is any indication, the best place to look is back in the Liaoning Formation. "Virtually everything that's turned up there has brought some Earth-shattering insight," says Luo. "My forecast is that this site will rival Olduvai Gorge."

—CARL ZIMMER

Carl Zimmer is the author of *At the Water's Edge*.

SCIENCE AND THE MEDIA

Chinese Center Sues Over Study Coverage

BEIJING—The workshop was meant to train volunteers to prick the fingers of thousands of elderly Chinese as part of an international study of human longevity. But as the first drops of blood appeared, Tong Zeng saw red. Initially worried about the welfare of the elderly subjects, he soon wondered whether the participants would be properly informed and if the genetic component of the study might be used for commercial purposes that would not benefit China. Working at the China Research Center on Aging (CRCA), the organization conducting the project, Tong helped launch a media campaign that led the government to temporarily halt the project last spring. Although the furor has ebbed, the genetic fruits of the research—more than 4000 blood samples already collected—have yet to be harvested. Instead, they sit locked inside a well-guarded safe, with domestic scientists waiting for the necessary resources to analyze them.

The campaign was not the first time Chinese newspapers and magazines had questioned the reasons behind genetic research involving foreign scientists. And it came as the government was preparing rules to restrict the export of genetic material (*Science*, 18 September 1998, p. 1779). But this time the targets of the media assaults did not remain silent. Last fall, the Beijing-based CRCA sued two local newspapers and one weekly magazine for libel, claiming that its reputation had been damaged by what it said were false and misleading articles. The case, which is pending before local courts in Guangzhou, Shenzhen, and Nanchang, asks for $360,000 to cover the center's legal expenses and the cost of any delays in the research. Xiao Zhenyu, deputy director of CRCA, says he hopes that the media also "will apologize openly" for their conduct.

"The accusations are ridiculous and fabricated," says one of the principal investigators, demographer Zeng Yi, a professor at Beijing University who also is affiliated

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