over his data to a four-member audit committee for investigation.

That committee's report, released on 28 October 1998, didn't mention the alleged mix-up; instead, it acknowledged that experiments with lectin-transgenic potatoes had been carried out, but concluded they did not support the suggestion that the potatoes affected growth, organ development, or immune function in rats. Pusztai, who was forbidden by Rowett to talk to the press, sent copies of the audit report, his own rebuttal to it, and a transcript from the *World in Action* show to dozens of scientists who had asked for them, asking them to review the material.

In the news. Arpad Pusztai's data make headlines.

The responses, collected by protein chemist Edilbert Van Driessche of the Vrije Universiteit in Brussels, were presented along with a statement last week at a press conference in the House of Commons. The statement contends that Pusztai's data do suggest that the transgenic potato affected the rats' immune systems, affected their organs, and slowed their growth. The data in the audit report, it says, "appeared to be arbitrarily selected and biased towards brushing aside the conclusions of the experimental findings."

Pusztai's supporters also point to a follow-up study performed last fall by Stanley Ewen—a pathologist at Aberdeen Royal Hospitals who has worked with Pusztai for 10 years—who examined the guts of the rats from Pusztai's experiments under a microscope. Ewen, who presented the results at an EU-sponsored lectin meeting in Lund, Sweden, in November, found that the animals fed a transgenic diet had symptoms of infection, with white blood cells accumulating in their gut lining. The same reaction didn't occur in rats that had been fed a nontransgenic potato diet spiked with the same lectin. Although it's unclear how the diets could have had different effects, "they are profound changes," says Thorkild Bøg-Hansen, a lectin expert at the University of Copenhagen, "that require further investigation."

The audit committee's chairman, Rowett senior scientist Andrew Chesson, says he stands by his report but doesn't want to discuss the reviewers' findings, to avoid a debate about raw data in the press. Pusztai should publish his results in a scientific journal, Chesson says: "If the data are sound, I don't think he'd have any problem publishing them."

The new analyses of Pusztai's data immediately led Simpson to demand a "complete moratorium" on genetically modified food—a measure British Prime Minister Tony Blair said he wasn't ready to take, as he strongly believed the new food was safe. Simpson also says, "If the data are now being corroborated, someone has to explain the basis upon which his research was suppressed." Several MPs expressed suspicions about the government's role in the affair, which were stirred up even further when a newspaper revealed on 16 February that science minister Lord Sainsbury once had a financial interest in a company that owns a patent on the cauliflower mosaic promoter, a gene often used in plant genetic modification. Conservative MPs said Sainsbury was a biotech "advocate" and demanded his resignation. But Chesson says his institute was not influenced by the government or the industry and has "never ever" attempted to suppress any results. "The sooner the data get into the scientific journals, the happier we'll be," he says.

Whatever the fate of the findings, most parties agree on at least one thing: The affair has been an outstanding example of how not to communicate scientific findings to an already confused and worried public.

–MARTIN ENSERINK

CREDITS: (TOP) DAVE CHESKIN/PRESS ASSOCIATION NEWS; (BOTTOM) P. BAGLA

COSMOLOGY

Superheavy Particles From the Big Bang?

CHICAGO—Pity the poor Wimps. Although theorists have proposed that these Weakly Interacting Massive Particles—hypothetical slow-moving, exotic relics of the big bang—could account for much of the mass of the universe, no one has conclusively observed a Wimp. Worse, in their bid for the title as the unseen "dark matter" that astronomers believe our galaxy must contain in large amounts, they have to compete with big, brawny lumps of common stuff—stones or gas—that go by the acronym Machos. As if all that were not bad enough for the effete Wimps, a formidable new rival has just emerged: a Godzilla of a particle called the Wimpzilla.

Described here last month at a gathering of the world's leading cosmologists,* Wimp-

* The Pritzker Symposium on the Status of Inflationary Cosmology, University of Chicago, 29 to 31 January, with a closely related workshop from 1 to 3 February.

ScienceScope

Crops Chief Moves On After just 18 months on the job, Shawki Barghouti (below) has resigned as head of the struggling International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in Patancheru, India. The Jordanian agronomist says he has successfully steered the institute in "a new direction" and that it is time to move on.

Founded in 1972, ICRISAT is part of a global network of 16 centers aimed at improving agriculture in the developing world (*Science*, 2 January 1998, p. 26). Barghouti says he eliminated his institute's $5 million deficit by cutting spending by 20% and by coaxing donors to add $3 million to a $25 million budget. "Not a single research program was hacked in my tenure," Barghouti claims. But not everybody is convinced that ICRISAT is out of the woods. Yeshwant

Nene, an ex-deputy director-general of the institute, fears the current "peaceful" period could end with yet another changing of the guard. Barghouti plans to leave on 1 September.

Accelerated Recycling A dismantled Dutch linear accelerator will find new life in Russia. At the end of last year, particle physicists shut down the 20-year-old Medium Energy Accelerator and the 7-year-old Amsterdam Pulse Stretcher in response to the government's decision to cut back on high-energy physics. Now, the Netherlands' only linear accelerator—a 180-meter-long pipe that fires electrons into a 68-meter-diameter storage ring—will be recycled into a synchrotron radiation source at the Joint Institute for Nuclear Research in Dubna, Russia.

Though the Dutch machine is free, the Russian institute must raise millions of dollars for reassembly, a 4-year project. "Fortunately we have a building which just fits," says Dubna chief engineer Igor Meshkov.

Contributors: David Malakoff, Wayne Kondro, Pallava Bagla, Alexander Hellemans

zillas could be millions to trillions of times more massive than Wimps and would have been created even earlier in the mayhem of the big bang. Their large mass means that relatively few of them could account for most of the weight of the universe. "Size does matter," growls Rocky Kolb of the Fermi National Accelerator Laboratory and the University of Chicago, who presented the work for a team of theorists.

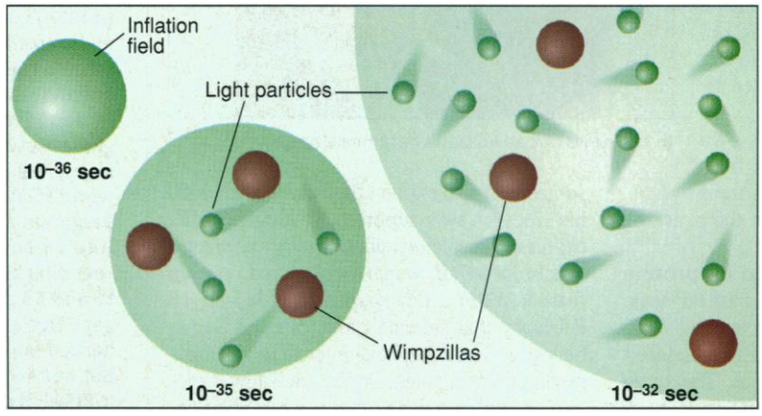
Wimpzillas are as much a figment of theory as their lighter cousins, but for some theorists they're an especially welcome one. They could turn out to be the very same particles that are the linchpins of an effort to explain all the forces of nature in a single framework—a so-called grand unified theory (GUT) —put forth in 1990 by John Ellis of CERN in Geneva, Switzerland, Dimitri Nanopoulos of Texas A&M University, and others. And debris thrown off by Wimpzillas when they decay, as the GUT predicts, might explain the rare, mysterious cosmic rays that slam into Earth's atmosphere at astonishingly high energies (*Science*, 1 September 1995, p. 1221and 22 December 1995, p. 1923). Nanopoulos says Wimpzillas have him so excited, "I am almost getting white hair."

The monster particles emerge naturally in cosmologists' standard creation story, says Kolb. The story begins when the tiniest mote of the primordial emptiness happens to pop into a state called a "false vacuum," setting loose a tremendous, exponential expansion. The false vacuum has more energy in it than ordinary emptiness, and according to Einstein's equations of relativity, this energy acts like gravity thrown into reverse, driving the expansion—a runaway process called inflation.

Inflation goes on for 10^{-35} second or so, creating more and more space filled with false vacuum—and nothing else. "There's no radiation. No matter. No House managers. It's a good universe," says Kolb, in one of the symposium's many tilts at the impeachment proceedings then playing out in Washington. The chilly symmetry of the false vacuum somehow shatters at about 10^{-35} second, ending the era of exponential expansion. Its energy is converted into an outrushing fireball of particles and radiation—the start of the big bang.

The heat of that fireball could have gone into creating ordinary Wimps, with masses as high as a million times the mass of the proton (10^6 giga-electron volts, or GeV). They would have been spawned as particles of both matter and antimatter, which would annihilate each other when they meet. But the weak attractions between Wimps and the continued expansion of the universe, which would have swept some Wimps out of harm's way, could have ensured enough survivors to account for the large fraction of cosmic mass—up to 90%—thought to be dark matter.

But now Kolb and his collaborators Antonio Riotto of CERN and Daniel J. H. Chung of the University of Michigan, Ann Arbor, have come up with the heavyweight challenger. Following an example set by Andrei Linde of Stanford University, Lev Kofman of the Canadian Institute for Theoretical Astrophysics at the University of Toronto, Alexei Starobinsky of the Landau Institute in Moscow, and others, they began eyeing the instants just after inflation and before the main fireball, when higher energies—and, hence, higher masses—might be available.



Wimpzillas weigh in. These hypothetical particles would form in the universe's earliest moments, as it grew from grapefruit-size (10^{-36} seconds) to basketball-size and beyond.

"All of a sudden we have found that this is a pretty rich physics regime," says Linde—and a rich source of particles. Riotto says that he, Kolb, and Chung soon found several ways to produce superheavy particles. The trio's favorite relies on the pairs of virtual particles that pop in and out of existence in any vacuum, according to quantum mechanics. The "reverse gravity" still in effect at the end of inflation rips any such pair apart, so that instead of meeting up, annihilating, and disappearing, the particles take on a real existence. The Wimpzillas would have been scarce enough to avoid meeting each other and annihilating when expansion slows in the later fireball.

Such particles could be as heavy as 10^{13} GeV—femtograms, a mass normally in the domain of high-resolution chemistry, not particle physics—so just a smattering of them could account for dark matter. And since annihilation is never a threat, intrinsically weak interactions are not required. "Wimpzillas might be charged," Riotto says. "They might also have strong interactions."

But it's a weakly interacting Wimpzilla around 10^{12} GeV that interests Nanopoulos, because his and Ellis's so-called "flipped SU(5)" GUT long ago predicted a heavy analogue to the proton at about that mass. Their theory predicts that such a particle, which they called a crypton, should decay after a long but finite lifetime, flinging off particles that could slam into Earth's atmosphere as ultrahigh-energy cosmic rays.

While the new calculations have delighted some researchers, they have hit others like a punch in the stomach. Wimps fit naturally into a less ambitious particle theory called supersymmetry, which many physicists favor. Observers might also be feeling queasy, since if rare, lumbering Wimpzillas make up the dark matter, then current Wimp searches (*Science*, 1 January, p. 13) would have no hope of turning up a signal unless the universe is populated by an even more bizarre mixture of the two particles. And it's only getting worse. Linde and colleagues, for example, say they might have found a way to make relics as heavy as 10^{18} GeV. Says Linde, "We call our particles fat Wimpzillas."

—JAMES GLANZ

FEDERAL RESEARCH

Efforts to Evaluate R&D Found Wanting

Follow the rules, work together, use outside experts—and don't neglect the young ones. That's the message from a National Academy of Sciences (NAS) panel asked to help federal agencies evaluate their R&D efforts as part of a 1993 law that many research officials have sought help in implementing.

The Government Performance and Results Act (GPRA) requires every federal agency, starting this year, to link its budget to its program goals and explain how it plans to measure progress toward those goals. The exercise has challenged officials at agencies, such as the National Science Foundation (NSF) and the National Institutes of Health (NIH), which support basic research that often may take decades to generate any social or economic payoff. Some officials and scientists have argued that any evaluation is doomed to fail or—worse—that it will force agencies to emphasize trivial results that can be easily quantified.

Nonsense, says the Committee on Science, Engineering, and Public Policy (COSEPUP), a joint panel of NAS, the National Academy of Engineering, and the Insti-