

Top 10 Scientific Breakthroughs of 2007

This extremely well-preserved leg bone contains enough intact collagen protein to give scientists a glimpse at the genetics of *Tyrannosaurus rex*. It turns out the ancient beast had a lot in common with chickens.

Photo: John M. Asara/Harvard Medical School Welcome to the first annual Wired News rundown of the year's 10 most important scientific breakthroughs. 2007 was an amazing year for science. Unlike recent years, there were no high-profile cases of scientific fraud -- none that went uncovered, anyway. Journal publishers took extra care, requiring scientists to duplicate results in an effort to avoid scientific, not to mention public relations, fiascos. And while those are entertaining, we'll take solid science over *Sturm und Drang* any day. Here we count down the top 10 scientific discoveries that rocked our Wired world the hardest this year.

10. Transistors Get Way Smaller

In the race to make computers faster, chipmakers rely on exotic new materials. In January, Intel announced that the element hafnium and some new metal alloys will allow them to make the millions of switches on their microprocessors far smaller. Gordon Moore, co-founder of the company and father of the law that bears his name, called it the biggest change in transistor technology since the 1960s. The tremendous accomplishment allows Intel to squeeze features on each chip down to 45 nanometers from the current standard of 65 nanometers. But the greatest benefit may be an increase in energy efficiency. That improvement comes along with the hafnium alloys that will prevent electricity from leaking across the tiny switches.

Intel started using the technology, codenamed Penryn, in November in high-end servers. Home users can expect the chips in early 2008.

9. Scientists Clone Rhesus Monkey to Produce Stem Cells

At Oregon Health and Science University, Shoukhrat Mitalipov and his team cloned a Rhesus Monkey and used the resulting embryo to create stem cells. Until then, the impressive feat had been performed only with mice.

In November, the team reported in *Nature* a surprising key to their success: avoiding ultraviolet light and dyes -- tools that are almost always used in cloning experiments -- because they can damage delicate cells.

Stem cells could be used to repair nearly any damaged organ, but they are useless if they upset the immune system. By cloning sick patients and using cells derived from their own bodies, doctors could skirt problems similar to those experienced by people with organ transplants. But some say the No. 1 discovery on our list makes cloning unnecessary. Nonetheless, some scientists, including stem-cell researchers at Harvard, say cloning is still necessary.

8. Planet Discovered That Could Harbor Life

Astrobiology enthusiasts have had many reasons to rejoice this year, but one of them has been somewhat controversial. After Stéphane Udry and his colleagues found a pair of planets that they believed could harbor life, other researchers disputed which of the two is most habitable, but agreed that the distant solar system is worthy of further study.

Using a Canadian space telescope and the European Southern Observatory in Chile, Udry inferred that the most promising object is slightly larger than earth, circles its sun in 18 days, and may be rocky. In a late April issue of *Astronomy and Astrophysics*, the University of Geneva professor provided details about his sophisticated search. Both of the celestial bodies orbit the red dwarf star Gliese 581, which is only 20 light years from earth. Although prospects for the two planets may be less hopeful than Udry and his associates projected, the methods that they used to locate the small planet could be used to make many more discoveries.

7. Engineers Create Transparent Material as Strong as Steel

Engineering researchers at the University of Michigan have created a material similar to "transparent aluminum," the fantastic substance described by Scotty in *Star Trek IV*. In the Oct. 5 issue of *Science*, Nicholas Kotov showed that clay is good for far more than making bricks and expensive skincare products. The earthen material is made up of phenomenally strong nanometer-sized particles. When arranged neatly between thin layers of a sticky but weak plastic, the tiny bits of dirt act as the ultimate reinforcements -- giving the ordinary material extraordinary strength. The sturdy composite could be used in lightweight armor or aircraft.

6. Soft Tissue from T. Rex Leg Bone Analyzed

This spring, the oldest patient in the pathology department of Beth Israel Deaconess Medical Center in Boston was a 68-million-year-old *Tyrannosaurus rex*. For the first time, scientists have analyzed biological molecules from the ancient creatures. Working with soft tissue from a leg bone that was extremely well-preserved in prehistoric Montana sediments, John Asara read the chemical recipe of a protein that served as a springy structural element in the dinosaur's bones. In the April 13 issue of *Science*, he and his colleagues compared the deadly predator to animals that roam the earth today and concluded that it has a lot in common with chickens.

5. Laboratory Mice Cured of Rett Syndrome

Researchers affiliated with the Wellcome Trust have shown evidence that Rett syndrome, a neurodevelopmental disorder that afflicts one in every 10,000 female births, might be curable. Caused by a mutation, the disorder prevents children from walking, talking or speaking and gives them terrible tremors. By creating mice with a similar affliction,

Adrian Bird and his colleagues at Edinburgh University and the University of Glasgow tested the effects of fixing the bad gene. In the Feb. 23 issue of Science, they explained that the disease does not cause permanent damage to nerve cells, and breathing problems and tremors in mice stop when they are nudged into producing normal MeCP2 -- the protein corrupted by the disease.

4. Enzymes Convert Any Blood Type to O

Several major Type O blood shortages, including crises at the National Institutes of Health this fall and throughout Georgia in late summer, highlight the importance of creating a versatile blood type. In the rare instance that someone receives a transfusion of the wrong type, deadly reactions (caused by sugar molecules on the surfaces of red blood cells) can cause the immune system to go haywire.

In April, Henrik Clausen, a professor at the University of Denmark, published research in Nature describing a way to convert any kind of blood into Type O -- the type that almost anyone can tolerate. He discovered enzymes that shear the problem-causing sugars from the surfaces of A, B and AB type red blood cells. Produced by bacteria, the molecular machines could theoretically turn any kind of blood into Type O. Clausen and his colleagues described their search for the pacifying proteins in the April 1 issue of Nature Biotechnology.

ZymeQuest, a startup company from Massachusetts, is now developing a device that hospitals can use during blood shortages.

3. Mummified Dinosaur Excavated and Scanned

Paleontologists from England's University of Manchester have excavated the mummy of a nearly intact plant-eating dinosaur. Preserved by minerals for over 65 million years, the petrified body is in such pristine condition that the researchers could see a striped pattern on what remains of its scales. The scientists transported the fossilized hadrosaur this fall to a giant CT scanner in Canoga Park, California, where technicians captured terabytes of 3-D images that have already revealed surprises about the creature's muscle mass and the spacing of its bones. Tyler Lyson, now a graduate student in geology at Yale University, made the initial find seven years ago while fossil hunting in the Hell Creek formation of North Dakota.

2. Chimpanzees Make Spears for Hunting

Two anthropologists watched in mixed amazement and horror as several female chimpanzees crafted spears and used them to somewhat brutally hunt smaller mammals. Following a troop of the primates in a Senegalese savanna, Jill Pruetz of Iowa State University and Paco Bertolani of Cambridge observed them breaking the branches off of trees, picking leaves from the sides, and sharpening the tips to deadly points. In the

March edition of *Current Biology*, the scientists explained that such sophisticated animal behavior could reveal a great deal about how early humans used primitive tools.

1. Researchers Turn Skin Cells to Stem Cells

Using a virus to reprogram skin cells, two teams of scientists managed to skirt the greatest ethical issue facing regenerative medicine -- the destruction of human embryos. Groups led by Shinya Yamanaka of Kyoto University and Junying Yu of the University of Wisconsin coaxed a type of skin cell called fibroblasts into forming muscle, heart, fat and nerve tissues without using any eggs. Unfortunately, the hijacked cells often became tumors. Following up on his initial discovery this November, Yamanaka told *Nature Biotechnology* that by inserting three growth genes instead of four, the lab-grown flesh can be controlled without becoming cancerous.

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