# Einstein's "biggest blunder" - or was it?

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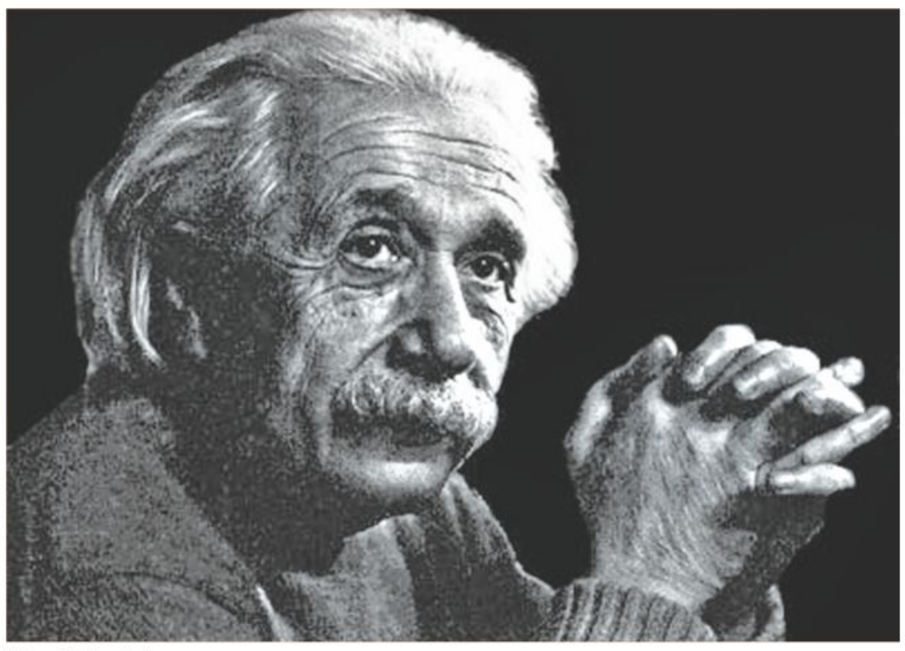
AS kids we were taught "to err is human." But can a towering scientific figure like Einstein err? To lesser mortals like us, it is comforting to know that the answer to the questions is "yes." We seldom realize that when we try to study the Universe, it has many ways of humbling us, irrespective of whether we are adept or inept, astute or obtuse. At every opportunity it reminds us that our mundane theories and fertile imaginations are woefully inadequate to unlock the enduring mysteries of the gargantuan Universe.

In 1915, after the completion of his General Theory of Relativity, Einstein was chagrined to find a near-fatal flaw in the theory. No matter how he solved the equations, they stubbornly indicated a Universe that is dynamic. The thought of an expanding Universe with a beginning, the Big Bang, struck at the very core of his belief in an "unchanging," steady-state model of the cosmos. It was like an unhittable curve-ball thrown at him.



Albert Einstein

In a misguided attempt to make the Universe static, Einstein did what most of us do when theoretical predictions go awry and disagree with experimental result. He introduced a "fudge factor" in the equations and fine-tuned its value to make the Universe static, neither expanding nor contracting. He coined the term "cosmological constant" for the factor and interpreted it as a repulsive force required to stabilize the Universe and make it motionless.

Einstein probably was unaware of physicists' mantra: "No theory should agree with all the data, because some of the data are sure to be wrong." In 1929, the great astronomer Edwin Hubble's discovery of an expanding Universe gave Einstein the goose bumps. Much to his consternation, Hubble's observation supporting the Big Bang Model made Einstein go back to the chalkboard and rethink about the cosmological constant. In 1931, he realized his mistake and embraced the Big Bang Theory as "the most beautiful and satisfactory explanation of creation which I have ever listened." He referred to the fudge factor as "the biggest blunder of my career."

Had he not been so inflexible in his belief in a steady-state Universe, Einstein could have added another feather to his multi-feathered cap - correct explanation of why the Universe is not static. The controversy over the cosmological constant, however, did not end with Hubble's discovery and Einstein's admission.

Forty three years after Einstein's death, studies of exploding stars in distant galaxies revealed that the Universe is not only expanding, it is doing so at an ever-faster rate. Astronomers started pondering: What could be the cause of this accelerated expansion? Could the expansion be propelled by a repulsive force much stronger than the attractive gravity, but acting in the opposite direction? Whatever it is, the mysterious cosmic force causing the Universe to accelerate is neither matter nor radiation.

Hard to believe though, it was Einstein's infamous fudge factor that came to the rescue. His cosmological constant was resuscitated and shown to be the manifestation of a yet to be detected phantom energy - Dark Energy, which is responsible for causing the expansion of the Universe to accelerate.

Thanks to the exploding stars, Einstein's reputation albeit slightly dented by his misplaced faith has been restored and he has been rehabilitated to his original stature again. "So was it really a blunder to propose a concept so useful to cosmology?" asked cosmologist George Gamow, a proponent of the Big Bang Theory. Blunder it was; but one thing is certain, the blunder turned out to be one of Einstein's greatest contributions to cosmology, an interesting embellishment of the Big Bang model. A constant that was introduced to make the Universe immobile has been revived to make it mobile. Its influence increases as the Universe expands. As Einstein said: "Anyone who has never made a mistake never tried anything new."

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BRONZEBLOOM

## Pre-agricultural boom

Traditional rice farming.

RESEARCHERS from China's Fudan University have found major prehistoric human population expansions may have begun before the Neolithic period, which probably led to the introduction of agriculture.

Major prehistoric human population expansions in three continents may have begun before the Neolithic period -- around 15-11,000 years ago in Africa, from around 13,000 years ago in Europe and around 12-8,000 years ago in the Americas.

The findings are published in Scientific Reports.

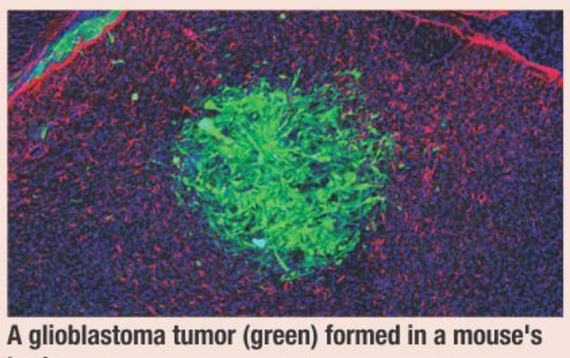
The development of agriculture facilitated extensive human population growths and activities, but whether these major expansions began before or after the Neolithic era, a period during which humans started to grow crops and domesticate animals, remains controversial. Agriculture is thought to have first developed in the Fertile Crescent of West Asia around 12-11,000 years ago, and was then developed independently over the next few thousand years in other regions.

To compare global patterns of population growth, Li Jin and colleagues analyzed over 900 mitochrondrial genomes generated by the 1000 Genomes Project, representing 11 populations in Africa, Europe and the Americas. They identified the expansion lineages and were able to reconstruct the historical demographical variations. On all three continents, most of the major lineages coalesced before the first appearance of agriculture.

Source: **Science Daily**

TELLTALEMUTATION

## Recurring brain cancer explained



A glioblastoma tumor (green) formed in a mouse's brain.

NEW work could help explain why a deadly type of brain cancer recurs easily even after surgery, radiation and chemotherapy have apparently banished it. Fully developed brain cells, not just stem cells, may take on new identities to evade therapy and come back later, the study suggests.

Just two changes to cancer-related genes in some adult brain cells are enough to spur the genesis of glioblastomas, Inder Verma, a molecular biologist at the Salk Institute for Biological Studies in La Jolla, Calif., and colleagues report online October 18 in Science.

"To me it says something very scary," says Martine Roussel, a molecular biologist at St. Jude Children's Research Hospital in Memphis. "With just the right combination of hits you can become a glioma," as glioblastomas are sometimes called.

Roussel, who studies a different type of brain cancer called medullablastoma, says that the new study delves into a debate about which types of cells can lead to cancer. Some forms of cancer seem to start only when mutations build up in specific cells. Previous studies had indicated that glioblastoma may result when genes within naturally occurring stem cells in the brain are mutated. But the new study indicates that glioblastoma can originate in at least two types of mature brain cells, and which genes are struck by mutations is more important than the type of cell, Roussel says.

Source: **Science News**

LOCALE

## Brain's molecular architecture

NEUROSCIENTISTS from New York University and the University of California, Irvine have isolated the "when" and "where" of molecular activity that occurs in the formation of short-, intermediate-, and long-term memories. Their findings, which appear in the journal the Proceedings of the National Academy of Sciences, offer new insights into the molecular architecture of memory formation and, with it, a better roadmap for developing therapeutic interventions for related afflictions.

Neuroscientists have isolated the "when" and "where" of molecular activity.

"Our findings provide a deeper understanding of how memories are created," explained the research team leader Thomas Carew, a professor in NYU's Center for Neural Science and dean of NYU's Faculty of Arts and Science. "Memory formation is not simply a matter of turning molecules on and off; rather, it results from a complex temporal and spatial relationship of molecular interaction and movement."

Neuroscientists have previously uncovered different aspects of molecular signaling relevant to the formation of memories. But less understood is the spatial relationship between molecules and when they are active during this process.

To address this question, the researchers studied the neurons in Aplysia californica, the California sea slug. Aplysia is a model organism that is quite powerful for this type of research because its neurons are 10 to 50 times larger than those of higher organisms, such as vertebrates, and it possesses a relatively small network of neurons -- characteristics that readily allow for the examination of molecular signaling during memory formation. Moreover, its coding mechanism for memories is highly conserved in evolution, and thus is similar to that of mammals, making it an appropriate model for understanding how this process works in humans.

The scientists focused their study on two molecules, MAPK and PKA, which earlier research has shown to be involved in many forms of memory and synaptic plasticity -- that is, changes in the brain that occur after neuronal interaction. But less understood was how and where these molecules interacted.

To explore this, the researchers subjected the sea slugs to sensitization training, which induces increased behavioral reflex responsiveness following mild tail shock, or in this study, mild activation of the nerve form the tail. They then examined the subsequent molecular activity of both MAPK and PKA. Both molecules have been shown to be involved in the formation of memory for sensitization, but the nature of their interaction is less clear.

What they found was MAPK and PKA coordinate their activity both spatially and temporally in the formation of memories. Specifically, in the formation of intermediate-term (i.e., hours) and long-term (i.e., days) memories, both MAPK and PKA activity occur, with MAPK spurring PKA action. By contrast, for short-term memories (i.e., less than 30 minutes), only PKA is active, with no involvement of MAPK.

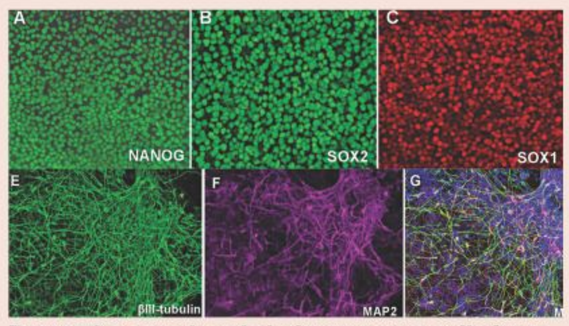
The study's other co-authors were Xiaojing Ye, a postdoctoral fellow in NYU's Center for Neural Science, Andreea Marina, an undergraduate at UC Irvine at the time of the study. The research was conducted at NYU's Center for Neural Science and UC Irvine's Center for Neurobiology of Learning and Memory.

This work was supported by grants RO1 MH 041083 and RO1 MH 081151 from the National Institute of Mental Health, part of the National Institutes of Health, and a grant IOB-0444762 from the National Science Foundation.

Source: **Science Daily**

RESURRECTED

## Life from the dead




Researchers produced pluripotent stem cells from the fibroblast cells in the brain lining of human corpses.

DEATH will come for us all one day, but life will not fade from our bodies all at once. After our lungs stop breathing, our hearts stop beating, our minds stop racing, our bodies cool, and long after our vital signs cease, little pockets of cells can live for days, even weeks. Now scientists have harvested such cells from the scalps and brain linings of human corpses and reprogrammed them into stem cells.

In other words, dead people can yield living cells that can be converted into any cell or tissue in the body.

As such, this work could help lead to novel stem cell therapies and shed light on a variety of mental disorders, such as schizophrenia, autism and bipolar disorder, which may stem from problems with development, researchers say.

**Making stem cells**

Mature cells can be made or induced to become immature cells, known as pluripotent stem cells, which have the ability to become any tissue in the body and potentially can replace cells destroyed by disease or injury. This discovery was honored last week with the Nobel Prize.

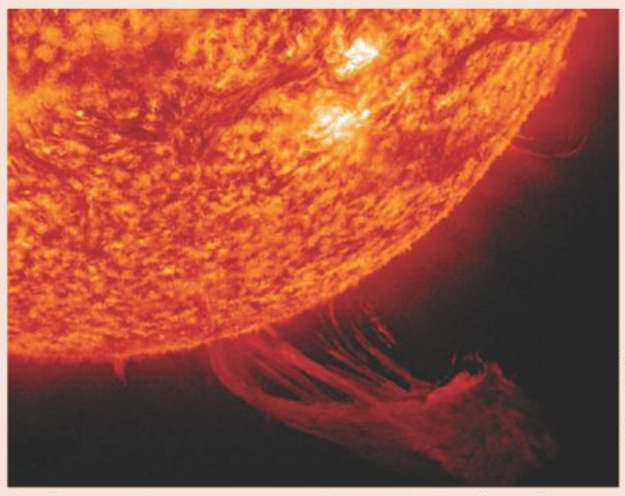
Past research showed this same process could be carried out with so-called fibroblasts taken from the skin of human cadavers. Fibroblasts are the most common cells of connective tissue in animals, and they synthesize the extracellular matrix, the complex scaffolding between cells. [Science of Death: 10 Tales from the Crypt]

Cadaver-collected fibroblasts can be reprogrammed into induced pluripotent stem cells using chemicals known as growth factors that are linked with stem cell activity. Reprogrammed cells could then develop into a multitude of cell types, including the neurons found in the brain and spinal cord. However, bacteria and fungi on the skin can wreak havoc on the culturing processes used to grow cells in labs, making the process tricky to successfully carry out.

Now scientists have taken fibroblasts from the scalps and the brain linings of 146 human brain donors and grown induced pluripotent stem cells from them as well.

Source: **Live Science**

ORANGEWAVE



A solar prominence rose up and swept away from the sun. Source: **Live Science**

## Plasma wave from sun

A giant wave of super-hot solar plasma larger than the Earth erupted from the sun on Friday (Oct. 19) in a spectacular display captured by a NASA spacecraft.

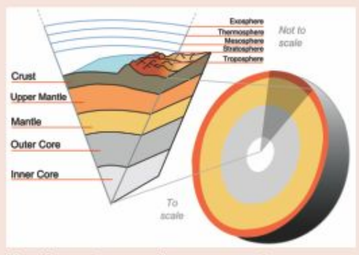
The huge solar prominence occurred at 4:15 a.m. EDT (0815 GMT) and was recorded in amazing detail by the high-definition cameras aboard NASA's Solar Dynamics Observatory before escaping the sun.

"Once it started breaking away, the process only took 10 hours before it was out of sight," NASA media specialist Steele Hill explained in a photo description. "The prominence stretched out many times the size of Earth."

DID YOU KNOW?

## What makes the Earth's inner core?

The inner core of the Earth, its in nnermost part as detected by seismological studies, is a primarily solid ball about 1,220 km (760 mi) in radius, or about 70% that of the Moon. It is believed to consist of an ironnickel alloy, and may have a temperature similar to the Sun's surface, approximately 5700 K (5430 °C).




Earth cutaway from core to exosphere.

The existence of a solid inner core distinct from the liquid outer core was discovered in 1936 by seismologist Inge Lehmann using observations of earthquake-generated seismic waves that partly reflect from its boundary and can be detected by sensitive seismographs on the Earth's surface.