

# What hath God wrought!

**Num 23:22** God brought them out of Egypt; he hath as it were the strength of an unicorn.

**Num 23:23** Surely *there is* no enchantment against Jacob, neither *is there* any divination against Israel: according to this time it shall be said of Jacob and of Israel, What hath God wrought!

**Rom 1:20** For the invisible things of him from the creation of the world are clearly seen, being understood by the things that are made, *even* his eternal power and Godhead; so that they are without excuse:

(All examples are from Scientific American magazines .. year, month, and page number..e.g.. 1511-70)

In everyday life, distance and location are mundane absolutes.

Yet physics now suggests that at the most fundamental level, the universe is nonlocalthere is no such thing as place or distance.

Initially Isaac Newtons conception of gravity seemed to imply the phenomenon of nonlocality because the attractive force between masses appeared to act magically across expanses.

Albert Einsteins general relativity instead ascribed gravity to the curvature of spacetime.

Yet it introduced a deeper sense of nonlocality by showing that space-time positions have no intrinsic meaning. (1511-70)

A babys brain enters a sensitive period at the age of six months a time when a child is best able to perceive the sounds of a language or two in preparation for developing the fluent tones and cadences of a native speaker.

The built-in capacity for language does not on its own propel the child past the first utterances of Mama and Dada.

To learn this most important of social skills requires that a baby pay careful attention to countless hours of parent-speak. Insights from research into early language acquisition have reached a degree of sophistication that has enabled neuroscientists to contemplate the possibility of using brain recordings to test whether a childs brain is developing as it should. (1511-64)

Something is causing the expansion of the universe to speed up but what?

Scientists have proposed that a force called dark energy is behind the acceleration or, alternatively, that current understanding of gravity must be modified. If dark energy is the culprit, at least two explanations are possible.

A new project called the Dark Energy Survey (DES) will aim to solve this mystery by studying the history of cosmic expansion and the extent to which dark energy may have stymied the clumping together of galaxies throughout space.

It will tackle these questions in four ways through observing supernovae, the signatures of primordial sound waves, gravitational lensing (the bending of light by matter in the universe) and clusters of galaxies. (1511-40)

Egypt's most famous monument, the 481-foot-tall, 756-foot-wide Great Pyramid of Giza was built around 2,525 B.C.. It was the tallest building in the world for at least the next 3,800 years.

For years archaeologists who study the Giza pyramids in Egypt have focused on the engineering details of these monuments.

But the real significance of the pyramids lies in the social organization they gave rise to. New finds in the ancient city of Heit el-Ghurab near Giza and a contemporaneous Red Sea port known as Wadi el-Jarf are revealing the government, labor and trade infrastructures that the pharaohs developed to get the pyramids, particularly the Great Pyramid, built.

These infrastructures brought Egypt tremendous lasting wealth and enriched the economies of its trading partners. (1511-32)

IceCube is a neutrino-hunting particle detector buried in ice at the South Pole.

Neutrinos usually fly straight through matter but occasionally smash into atoms in the ice to create signals IceCube can detect.

The project has discovered dozens of neutrinos with higher energies than any found before, many of which most likely originated in extreme cosmic events taking place in the far-off universe.

These cosmic neutrinos can be used as tracers to study the nature of the mysterious distant events and should help explain the strange

sources of the cosmic rays that bombard Earth from deep space. (1510-58)

I, at any rate, am convinced that He is not playing at dice, Albert Einstein wrote to a colleague in 1926.

Repeated over the years, his sound bite became the quintessential put-down of quantum mechanics and its embrace of randomness.

Closer examination, though, reveals that Einstein did not reject quantum mechanics or its indeterminism, although he did think for solid scientific reasons that the randomness could not be a fundamental feature of nature.

Today many philosophers argue that physics is both indeterministic and deterministic, depending on the level of reality being considered.

This view dissolves the much debated dilemma between determinism and free will. Even if everything that particles do is preordained, the choices we make can be completely open because the low-level laws governing particles are not the same as the high-level laws governing human consciousness. (1509-88)

Einstein's general theory of relativity has stood

firm for a century, but it has never been tested in places where gravity is extremely strong, such as the edge of a black hole.

The Event Horizon Telescope (EHT), a global network of radio telescopes, will perform such tests by resolving the event horizon of Sagittarius A\*, the black hole at the center of the Milky Way.

These observations will explore whether Sagittarius A\* is a black hole or an exotic object such as a naked singularity. If it is a black hole, does it behave the way general relativity says it should? If the EHT detects deviations from Einsteins predictions, other instruments that come online in the next several years will be able to independently check those results. (1509-74)

Traveling very fast allows you to go forward in time.

Traveling backward in time is much harder, but mathematics says it is possible through geometric structures called closed timelike curves.

A wormhole is one such curve.

You would enter it through a spherical opening.

Once inside, everything you observed in space would be normal and so would the passage of time.

Closed timelike curves are useful for testing theories about the cosmos.

For example, if one were present at the start of our universe, it could have allowed the universe to create itself.

Quantum mechanics and indeed, the nature of the universe itself might forbid wormholes and therefore prevent backward time travel.

Physicists just do not know yet if this is the case. (1509-68)

At the end of his life, Einstein tried to create a theory of everything, governing all forces in the cosmos.

He failed, in part because two of those forces, the weak and strong, had yet to be discovered.

Physicists are making the attempt again , starting with data on new types of particles and

fields. (1509-60)

Despite his immense powers of perception, Einstein repeatedly failed to grasp the meaning of some of his own most significant ideas or else overlooked their importance.

As a result, he dismissed the importance of gravitational lensing, initially doubted the reality of gravitational waves and failed to anticipate the discovery of the expanding universe. (1509 -50)

One of Einsteins enduring contributions to physics was his use of gedanken experiments, or thought experiments.

His intuition about falling elevators, for example, led to his greatest achievement, the general theory of relativity.

Today some of the most important questions in theoretical physics involve thought experiments about black holes.

Yet there is a problem: these thought experiments may be so far removed from empirical data as to be untestable. (1509-46)



Einstein's realization that gravity and acceleration are equivalent put him on an eight-year path to generalize his special theory of relativity.

He raced to discover the correct mathematical formulas for his theory before a rival, mathematician David Hilbert, could do so first.

Einstein simultaneously struggled on the home front, as he went through a divorce from his first wife and a separation from his sons while he courted a cousin whom he would later marry.

Despite these challenges, Einstein triumphed and delivered one of the world's supreme scientific works in his general theory of relativity. (1509 -38)

Einstein's first major achievements came in 1905, when he published four groundbreaking papers, including his completion of special relativity.

Ten years later he expanded that theory to include gravity, creating general relativity. The idea toppled Isaac Newton's physics and redefined our notion of space and time.

It launched new strands of research that scientists are still pursuing and made its creator

a star.

Over the past century Einsteins ideas have intermingled with culture and art and shaped our

world in infinite, indelible ways. (1509 -34)

Astronomers know of thousands of planets orbiting other stars but have imaged only a handful.

They have discovered and studied all the rest mostly through indirect measurements.

Imaging a planet allows researchers to learn more about its composition, climate and prospects for life.

But imaging is hard because planets are faint and close to much brighter stars. Imaging Earth-like planets is beyond the reach of current telescopes.

A new generation of instruments is now taking pictures of bigger, brighter worlds that resemble our own Jupiter.

These new instruments will help scientists learn how giant planets form and how they sculpt their surroundings, preparing the way for future facilities to take pictures of alien Earths. (1508-40)

Of all the human species that have lived on the earth, only Homo sapiens lived on the earth, only Homo sapiens managed to colonize the entire globe.

Scientists have long puzzled over how our species alone managed to disperse so far and wide.

A new hypothesis holds that two innovations unique to H. sapiens primed it for world domination: a genetically determined propensity for cooperation with unrelated individuals and advanced projectile weapons. (1508-32)

The largest proof in mathematics supports the notion that symmetry in the universe can be divided into four categories.

Its 15,000 pages provide the crucial evidence behind something called the Enormous Theorem.

The few aging people who understand the proof fear they will die before a younger generation takes over.

Mathematicians have launched a rescue project to streamline the proof and save it before the

knowledge vanishes. (1507-68)

The dog was the first domesticated species.

Yet despite years of research, scientists have struggled to figure out when, where and how it originated. Recent DNA studies have thrown new light on the dogs wolf ancestor and an ambitious project is now under way to nail down the timing and location of dog domestication.

Such insights will complement clues to how the human-dog relationship shifted in the millennia that followed. (1507-60)

Scientists know there must be more matter in the universe than what is visible.

Searches for this dark matter have focused on a single unseen particle, but decades of experiments have been unsuccessful at finding it.

Complex dark matter could form dark atoms and molecules and even clump together to make hidden galactic disks that overlap with the spiral arms of the Milky Way and other galaxies.

Experiments are under way to search for

evidence of such a dark sector. (1506-50)

Like we humans, members of many animal species spend their lives in complex social networks that influence their lives in complex social networks that influence their and the groups behavior.

Researchers are using techniques developed for the study of human social networks to analyze these animal systems.

The structures of animal networks can play a large part in mating opportunities, the spread of disease and information, and the teaching of survival skills. Analyses of these networks show that certain individuals play outside roles in maintaining the overall well-being of the community. (1506-50)

The night sky may look dark, but it is actually filled with the accumulated light of all the galaxies that have shone in the universes history.

This extragalactic back ground light is difficult to detect because it has spread out throughout

the expanding cosmos and because it is outshone by brighter nearby sources of light.

Astronomers have finally been able to measure this light by observing how gamma rays from distant bright galaxies called blazars are dimmed when they collide with photons of the extragalactic background light.

Studying the background in this way allows scientists to examine the record of cosmic history that the light preserves. (1506-38)

MRI studies show that the teenage brain is not an old child brain or a half-baked adult brain ; it is a unique entity characterized by change ability and an increase in networking among brain regions.

The limbic system, which drives emotions, intensifies at puberty, but the prefrontal cortex, which controls impulses, does not mature until the 20s.

This mismatch makes teens prone to risk taking but also allows them to adapt readily to their environment.

Earlier onset of puberty in children worldwide is expanding the years during which the mismatch occurs.

Greater understanding of the teen brain should help parents and society better distinguish typical behavior from mental illness while helping teens become the people they want to be. (1506-32)

Paleontologists have known about T. rex and other giant tyrannosaurs for decades.

But they were unable to piece together when the tyrannosaurs originated and what they evolved from because they lacked the fossils to do so.

Recent fossil finds have gone a long way toward filling those gaps in scientists understanding of this iconic group.

Together these discoveries reveal that tyrannosaurs have surprisingly deep and humble evolutionary roots. Furthermore, the group encompasses a far greater diversity of forms than experts had anticipated including some with truly bizarre anatomical features. (1505-34)

Cichlid fishes are the most diverse family of vertebrate animals on record, with more than 2,500 species.

The recent sequencing of several cichlid

genomes has begun to furnish clues to their astounding to their astounding diversification.

Cichlid genomes exhibit a number of special features that may have accelerated the evolution of this group.

Other genome traits may explain cichlids tendency to independently evolve the same adaptations repeatedly. (1504-70)

Thirty years ago psychologists mistakenly regarded cultivation of self-esteem as a panacea for personal problems and social ills.

Self-control, not self-esteem, turned out to be the real deal. The ability to regulate impulses and desires is key to living and working with others.

The dynamics of self-control are, in fact, quite complex.

Willpower can be depleted through overuse as if it were a repository of energy.

Research on self-control is now extending in new directions to provide insight into the roots of addiction and how to combat it. (1504-60)

Stephen Hawkings discovery that particles leak



out of black holes revealed a fissure in scientists understanding of physics.

These escaped particles seem to imply that information is destroyed inside black holes something quantum mechanics forbids.

An attempt to resolve this quandary using string theory looked promising, but recent calculations show that black holes are even more perplexing than was thought.

Barriers of high-energy particles called firewalls surround black holes, according to calculations by the author and his colleagues.

Such firewalls may represent the end of space itself. Resolving the paradoxes of firewalls could offer a path toward unifying quantum mechanics and general relativity. (1504-36)

Intense heat and light near the young sun largely confined water to the outer solar system during planet formation, leading to relatively dry inner worlds.

Earth's water probably arrived late in the planets development, via showers of asteroids or comets. But the data in hand leave room for alternative ideas.

Exactly how our water got here could remain an unsolved mystery for some time, pending the questions of when and if we will commence more robust exploration of the rest of the solar system. A one-size-fits-all solution for the source of Earth's water may never be found. (1503-36)

Long-standing view of Neanderthals, our closest relatives, holds that they lagged far behind anatomically modern Homo sapiens in terms of cognitive ability.

Studies show that they did differ from H. sapiens in their brain anatomy and DNA, but the functional significance of these differences is unclear.

Cultural remains provide clearer insights into the Neanderthal mind and narrow the supposed mental gap between them and us.

The findings suggest that factors unrelated to intelligence drove Neanderthals to extinction and allowed H. sapiens to flourish. (1502-36)

A major question in neuroscience, in philosophy and in broader public debate is whether the assumption that we have free will is fundamentally misconstrued.

If it is, many legal and moral precepts that are the basis for our social institutions are subject to challenge.

Doubts exist because of sophisticated experiments in recent decades that have shown that the brain initiates at least some actions before we become consciously aware that a decision has been made. If this is so, what role, if any, does free will play?

People may have less free will than they think, but that does not mean they have none at all.

A number of recent experiments by social psychologists have shown that conscious reasoning and intentions have shown that conscious reasoning and intentions have a significant impact on our actions. (1501-76)

Astronomers are searching for twins of Earth orbiting other sunlike stars.

Detecting Earth-like twins remains at the edge of our technical capabilities. Larger super-Earths orbiting smaller stars are easier to detect and may be the most common type of planet.

New thinking suggests that these systems, along with massive moons orbiting gas-giant planets, may also be super habitablemore

conducive to life than our own familiar planet.  
(1501-32)

Mimicry is a phenomenon in which one species evolves to resemble another.

Species that masquerade as ants are the most common kind of mimic. Yet they have been the least understood.

But recent studies have pulled back the curtain on ant impersonators and in so doing have revealed that mimicry is far more complex than once was thought. It turns out that animals exploit mimicry for many reasons and they pay a price for the advantages it affords. (1412-86)

An excavation in the ancient Maya city of Holmul in Guatemala has revealed an elaborate frieze that is elucidating a critical chapter of Maya history.

The frieze is thought to show the founder of the dynasty that ruled Holmul, which lay at the center of a major conflict between two superpowers.

Rich in symbols and inscriptions, the artwork holds long-sought clues to Maya governance during this important period.  
(1412-76)

As dwarf galaxies orbit the Milky Way, our own galaxy's gravity slowly rips them apart into long tails called stellar streams.

Astronomers who think of themselves as galactic archaeologists use these fossils of lost galaxies to study the Milky Way's past.

Astronomers discovered the first evidence of an extended stellar stream around our galaxy in 2003 and have found about a dozen more since then.

Analysis of these streams supports the theory that the Milky Way grew in pieces by swallowing smaller galaxies.

Future studies of stars' orbital and chemical characteristics could reveal the constituents of stellar streams that have long since dissolved.

Ultimately galactic archaeology could clarify not just the history of the Milky Way but also the way galaxies in general evolve over time. (1412-54)

Birds, mammals, fish, social insects and many other animals construct a wide variety of intricate nests and homes.

Researchers have long known that genes and behaviors must have evolved to enable creatures to build these structures.

Only in recent decades have scientists started to reveal the genetics of animal architecture, the physics that holds their creations together and the surprisingly simple behavioral rules that allow many small-brained critters to build empires.

One day we may be able to create computer programs that follow the same architectural rules as social insects to design more efficient cities. (1411-72)

The Kuiper belt is a band of billions of icy asteroids beyond Neptune that are nearly pristine examples of the solar systems ingredients.

Two spacecraft are on missions to probe the belts secrets.

One, called Rosetta, is orbiting a comet that was born in the Kuiper belt. The other, New Horizons, is en route to Pluto, the regions largest resident.

By studying the makeup of the Kuiper belt, these missions could hold the key to the solar

systems origins. (1411-46)

Meditation is an ancient pursuit that, in some form, is a part of nearly every world religion. In recent years its a part of nearly every world religion.

In recent years its practice, derived from various branches of Buddhism, has made its way into the secular world as a means of promoting calmness and general well-being.

Three common forms of meditation focused attention, mindfulness and compassion are now practiced everywhere, from hospitals to schools, and have increasingly become an object of scrutiny in scientific laboratories worldwide.

Physiological changes in the brain an altered volume of tissue in some areas occur through meditation. Practitioners also experience beneficial psychological effects: they react faster to stimuli and are less prone to various forms of stress. (1411-38)

Earlier this year scientists announced that they had found gravitational waves that emanated from the first moments after the big bang.

If confirmed, the discovery would allow

researchers to study the first instants of time potentially providing a way to unify quantum mechanics and gravity.

It could also provide indirect evidence for the existence of the multiverse an infinite bubbling of physically separate universes. (1410-58)

Methane hydrates are massive deposits of gas trapped in vast, icy structures underneath the coastal seafloor .

They may hold more energy than all known reserves of oil, coal and natural gas worldwide. Scientists are probing hydrate outcroppings to determine how easily the gas can be tapped for energy.

They are also examining how readily the methane can escape on its own when heated by warming seawater.

Deposits could potentially release enormous quantities of greenhouse gases. In another hazard, deposits can expand rapidly when disturbed by earthquakes, setting off tsunamis. (1410-82)

Some scientists and science communicators have claimed that humans are no longer subject to natural selection and that human evolution



has effectively ceased.

In fact, humans have evolved rapidly and remarkably in the past 30,000 years.

Straight, black hair, blue eyes and lactose tolerance are all examples of relatively recent traits.

Such rapid evolution has been possible for several reasons, including the switch from hunting and gathering to agrarian-based societies, which permitted human populations to grow much larger than before.

The more people reproduce within a population, the higher the chance of new advantageous mutations. Humans will undoubtedly continue to evolve into the future.

Although it may seem that we are headed toward a cosmopolitan blend of human genes, future generations will likely be striking mosaics of our entire evolutionary past. (1409-86)

Humans it was once thought differed from other animals by their use of tools and their overall superiority in a range of cognitive abilities.

Close observation of the behaviors of

chimpanzees and other great apes has proved these ideas to be wrong.

Chimpanzees score as highly as young children on tests of general reasoning abilities but lack many of the social skills that come naturally to their human cousins.

Unlike humans, chimps do not collaborate in the large groups needed to build complex societies.

Comparison of human and chimp psychology reveals that an essential source of the differences in humans may be the evolution of the ability to intuit what another person is thinking so that both can work toward a shared goal. (1409-42)

Human beings have a unique ability to cooperate in large, well-organized groups and employ a complex morality that relies on reputation and punishment.

But much of the foundation for this cooperation including empathy and altruism can also be observed in our primate cousins.

Homo sapiens unique cooperative abilities are what have allowed the species to become the dominant one on the earth. (1409-68)

A new theory credits a combination of cultural advances and unpredictable climate change for the exceptionally fast rate of evolution in early humans.

Climate change repeatedly led to fragmentation of hominin populations, creating small groups in which genetic and cultural novelties were rapidly cemented, accelerating speciation.

Our own species, the anatomically distinctive *Homo sapiens*, was born out of such an event in Africa around 200,000 years ago.

About 100,000 years later an African isolate of our species acquired the ability to use symbols.

It was almost certainly this unique symbolic cognition that made it possible to eliminate all hominin competition in little time.  
(1409-54)

Changes in climate are emerging as elements that shaped human evolution over millions of years, as scientists learn that such alteration coincided with the extinction of some of our ancestors and the success of others.

Evidence from ancient soils in East Africa, deep-sea sediments and fossil teeth from our forerunners combines to reveal rapid swings between wet and dry environments, as well as two distinct periods when grasslands replaced more wooded areas.

The emergence of our own genus, Homo, our varied diet, advances in stone tool technology and the very human trait of adaptability in the face of ongoing change may be tied to these episodes, according to one theory. (1409-48)

Tracing the evolutionary ancestors of Homo sapiens was once thought to be a relatively straightforward matter: Australopithecus begat Homo erectus, which begat Neandertals, which begat us.

Over the past 40 years fossil finds from East Africa, among other things, have completely shattered that hypothesis.

The latest evidence shows that several different hominin species shared the planet at different times.

Figuring out how they are all related and which ones led directly to us will keep paleontologists busy for decades to come. where we came from. (1409-42)

HUMAN FAMILY TREE used to be a scraggly thing.

With relatively few fossils to work from, scientists best guess was that they could all be assigned to just two lineages, one of which went extinct and the other of which ultimately gave rise to us.

Discoveries made over the past few decades have revealed a far more luxuriant tree, however one abounding with branches and twigs that eventually petered out. (1409-40)

Earth orbits one of the hundreds of billions of stars in our galaxy, which in turn is one of hundreds of billions our galaxy, which in turn is one of hundreds of billions in the observable universe.

This apparent insignificance fits with the Copernican principle that our planet is not the center of the cosmos but simply a mediocre member of a mediocre solar system.

Meanwhile there are reasons to think Earth and its life are special, perhaps even singular.

Some evidence comes from the details of our planetary circumstances, as well as from the

observation that certain fundamental constants of nature appear to be finetuned for life's existence.

Scientists must reconcile these conflicting ideas to understand where we fit and whether we are alone in the cosmos. (1408-74)

Researchers are conducting hundreds of experiments in an effort to bring more rigorous science to U.S. schools.

The movement started with former president George W. Bush's No Child Left Behind Act and has continued under President Barack Obama.

Using emerging technology and new methods of data analysis, researchers are undertaking studies that would have been impossible even 10 years ago.

The new research is challenging widely held beliefs, such as that teachers should be judged primarily on the basis of their academic credentials, that classroom size is paramount, and that students need detailed instructions to learn. (1408-68)

Rising Arctic temperatures are helping pathogens spread and thrive where they had not been before.

Parasites in the far north are sickening musk oxen, ticks are transmitting viruses to people, and Atlantic seals may have transmitted a lethal virus to Pacific seals as vanishing sea ice allows their worlds to mix.

Changing climate could help some species, but researchers fear it will hurt more of them, raising the need for nations to find ways to improve biosecurity. (1408-58)

Rain Man, the movie starring Dustin Hoffman brought to popular attention the existence of savant syndrome in which people with autism display exceptional intellectual or artistic gifts from birth.

Acquired savantism is an alternative form of the condition in which a person develops the ability to paint, play music or do mental calculations after experiencing some form of brain injury.

An inner savant may exist in most people if the proper brain circuits are activated or switched off through electrical stimulation technologies or even through focused practice of a particular skill. (1408-52)

Cosmologists have detailed a remarkably

accurate description of the history of the universe.

But a few profound questions seem to defy all attempts at understanding. One of these mysteries is the nature of the big bang itself the sudden, violent origin of our universe from a point of infinite density.

The authors have developed ideas that would explain how the big bang came to be.

They imagine that it emerged as a consequence of the formation of a black hole in a higher-dimensional universe. This theory provides answers to a number of difficult questions. It could also be tested. (1408-36)

Archaeologists have puzzled over the mysteries of the ancient Mexican city of Teotihuacán for decades.

Yet an understanding of this society eluded them.

Recent discoveries have furnished new clues to the lives these people led and the reach of their empire and in so doing kindled debate over their politics.

One theory holds that Teotihuacán was ruled by



a single all-powerful king; another pictures several elite families competing for control. (1407 -48)

The Fermi Gamma-ray Space Telescope has revealed massive structures that tower tens of thousands of light-years over the galactic center.

These lobes have been named the Fermi bubbles.

Astronomers do not understand the processes that created the Fermi bubbles, but they suspect that the bubbles are evidence of recent, violent events at work in our galaxy.

Two leading explanations exist.

The bubbles may be inflated by a jet of energy coming from our galaxy's central black hole or the accumulated wind of a swarm of supernovae. (1407-42)

The modern world is filled with network-connected electronic sensors, but most of the data they produce are invisible to us, siloed for use by specific applications.

If we eliminate those silos and enable sensor data to be used by any network-connected

device, the era of ubiquitous computing will truly arrive.

Although it is impossible to know precisely how ubiquitous computing will change our life, a likely possibility is that electronic sensors embedded in the environment will function as extensions of the human nervous system.

Wearable computing devices could become, in effect, sensory prosthetics. Sensors and computers could make it possible to virtually travel to distant environments and be there in real time, which would have profound implications for our concepts of privacy and physical presence. (1407-36)

In the past decade an increasing number of neuroscientists and philosophers have argued that free will does not exist.

Rather we are pushed around by our unconscious minds, with the illusion of conscious control. In parallel, recent studies suggest that the more people doubt free will, the less they support criminal punishment and the less ethically they behave toward one another.

But science-informed doubt of free will could actually help us improve our legal system by focusing less on doling out jail time solely for

the sake of retribution and more on discouraging further crime. (1406-76)

Con artistry of the kind in which the scammer robs Peter to pay Paul has likely been a fixture of economic activity at least since the Dickensian world of the 19th century.

A new look at Ponzis reveals that they are a more ubiquitous feature of modern economies than had been previously believed and that financial regulators are ill equipped to deal with them.

Boom-and-bust activity of financial bubbles takes on a Ponzi-like quality. Meanwhile ordinary business practices awarding of stock options may be used to camouflage a pyramid scheme. (1406-70)

No mission to Mars has searched for life since the Viking program in the 1970s.

Those missions did not find convincing evidence for life, and we now know that their experiments were doomed to fail.

A modern search for life on Mars could employ biological tests that we commonly use on Earth.

Such experiments could be included on a

number of missions that are scheduled to travel to Mars by the end of this decade. (1406-44)

For more than a century paleontologists have used geologic and topographic information to inform their search for fossils.

Yet the discovery of fossils is still largely a matter of luck. New computer models that look for hidden patterns in satellite images can generate maps of where fossils are likely to be located, thus helping fossil hunters narrow their search.

Ground truthing of such predictive maps in the American West has shown that they do indeed improve the odds of finding fossil sites.

In theory, this approach could be used anywhere in the world. (1405-46)

Supersymmetry postulates that every known particle has a hidden superpartner.

Physicists love supersymmetry because it solves a number of problems that crop up when they try to extend our understanding of quantum mechanics.

It would also potentially solve the mystery of

the universes missing dark matter. Physicists hoped to find evidence of supersymmetry in experiments at the Large Hadron Collider (LHC).

To date, they have not.

If no evidence arises in the next run of the LHC, supersymmetry will be in trouble.

The failure to find superpartners is brewing a crisis in physics, forcing researchers to question assumptions from which they have been working for decades. (1405-34)

In the 17th century Italian mathematician Bonaventura Cavalieri proposed that every plane is composed of an infinite number of lines and every solid of an infinite number of planes.

One could use these indivisibles, he said, to calculate length, area and volume an important step on the way to modern integral calculus.

Swiss mathematician Paul Guldin, Cavalieri's contemporary, vehemently disagreed, criticizing indivisibles as illogical.

But the men argued for more than purely mathematical reasons.

They were members of two religious orders with similar spellings but very different philosophies: Guldin was a Jesuit and Cavalieri a Jesuat.

The former believed in using mathematics to impose a rigid logical structure on a chaotic universe, whereas the latter was more interested in following his intuitions to understand the world in all its complexity. (1404-82)

A mammoth effort to create a genetic atlas of the human brain has succeeded in mapping the activity of all genes throughout the entirety of six typical adult brains.

The new atlas reveals profound differences between mice and human brains that raise questions about the widespread use of mice as experimental proxies for people.

The atlas, along with other projects under way to map the detailed structure of the brain, will serve as landmark references in the search for the causes and cures of neurological disease. (1404-70)

For decades researchers have been locked in debate over how and when human hunting began and how big a role it played in human evolution.

Recent analyses of human anatomy, stone tools and animal bones are helping to fill in the details of this game-changing shift in subsistence strategy.

This evidence indicates that hunting evolved far earlier than some scholars had envisioned and profoundly impacted subsequent human evolution. (1404-46)

The universes very first stars and galaxies were not like the objects we see today.

Astronomers are reaching back in time to probe how the first objects in the universe came to be.

They are particularly interested in what caused the so-called reionization of the universe, when the neutral hydrogen atoms pervading the cosmos were broken up by light.

Observations and computer simulations suggest that the objects driving reionization could be millionsolar-mass stars or the gaseous belches of enormous black holes. (1404-38)

The Einstellung effect is the brains tendency to stick with the most familiar solution to a problem and stubbornly ignore alternatives.

Psychologists have known about this mental phenomenon since the 1940s, but only now do they have a solid understanding of how it happens.

In recent eye-tracking experiments, familiar ideas blinded chess players to areas of a chessboard that would have provided clues to better solutions. (1403-74)

By mining the medical literature with textual analysis software, the author found evidence of widespread plagiarism and potential fraud.

Now, he argues, the proliferation of dubious journals has made it easier to publish plagiarized work.

Textual analysis is a useful tool for detecting plagiarism.

But it may be time to consider a new model for scientific publishing perhaps one in which researchers continually edit a single Wikipedia style electronic corpus. (1403-64)

Rocks recently retrieved along the northeastern edge of Hudson Bay in Canada may be the oldest ever found, but scientists are arguing whether the age is 3.8 billion or 4.4 billion years.



The older date would put the rocks close to the time when Earth formed.

Resolving the debate depends on improving methods for dating atoms on small rock samples formed from the primordial Earth.

If the rocks are 4.4 billion years old, they may provide strong clues about how Earth's surface took shape, when the oceans arose and how soon after those events life began. (1403-58)

Theories of galaxy formation say that our Milky Way should be surrounded by a spherical halo of small satellite galaxies.

Yet searches for these satellites have come up short, leading some to question basic tenets of cosmology. The satellites that astronomers have found tend to align in a plane that cuts across the Milky Way.

New simulations explain the lack of galaxies and their alignment by appealing to a large web of dark matter. (1403-46)

The brain and the way it gives rise to conscious thought remains one of the great mysteries in all of science.

To better understand the brain, neuroscientists need new tools for analyzing the functioning of neural circuits. Technologies that either record or control the activity of brain circuits may address these needs.

The Obama administration has a large scale initiative under way to promote development of these technologies. (1403-34)

What we think of as extremely unlikely events actually happen around us all the time.

The mathematical law of truly large numbers as well as the law of combinations help to explain why.

With only 23 people in a room, the probability that two of them share the same birthday is 0.51 greater than 50 percent.

The Bulgarian lottery randomly selected the winning numbers 4, 15, 23, 24, 35, 42 on September 6, 2009.

Four days later it selected the same numbers again.

The North Carolina Cash 5 lottery produced the same winning numbers on July 9 and 11, 2007. Strange?

Not according to probability. (1402-72)

Mounting evidence indicates that the common chicken is much smarter than it has been given credit for.

The birds are cunning, devious and capable of empathy.

And they have sophisticated communication skills.

That chickens are so brainy hints that such intelligence is more common in the animal kingdom than once thought.

This emerging picture of the chicken mind also has ethical implications for how society treats farmed birds. (1402-60)

Some 14 years ago an individual claiming to possess extraordinary recall of the distant past came forward.

Publicity about the case brought out hundreds of others who made similar assertions about their ability to remember.

Testing confirmed that a few dozen among this group can recite details of a specific date decades later.

Neuroscientists are now exploring the biological underpinnings of highly superior autobiographical memory. (1402-40)

A new experiment to measure the proton radius has found it to be much smaller than expected.

The difference suggests that physicists do not understand something important about either the proton itself or the theory of quantum electrodynamics until now the best tested and best-understood theory in all of science.

With any luck, the anomaly could lead to a fundamental revision of the laws of physics. (1402-32)

New research shows that video games have great educational potential.

A good game can exercise higher-order skill-evidence-based reasoning, problem solving, collaboration in ways that traditional pedagogy often does not.

But at the moment the hype exceeds the reality.

Game developers must work with educators and scientists to design games for inside and outside

the classroom that deliver educational benefits and that kids want to play. (1402-54)

Copernicus's revolutionary theory that Earth travels around the sun upended more than a millennium's worth of scientific and religious wisdom.

Most scientists refused to accept this theory for many decades even after Galileo made his epochal observations with his telescope.

Their objections were not only theological. Observational evidence supported a competing cosmology—the geoheliocentrism of Tycho Brahe. (1401-72)

X-ray lasers have long been a staple of science fiction, but the first one employed for scientific use began operation at Stanford University as a Department of Energy Office of Science facility only four years ago.

Known as the Linac Coherent Light Source (LCLS), it is powered by the world's longest linear particle accelerator at the SLAC National Accelerator Laboratory.

Exotic states of matter that occur nowhere else in the universe have been created by subjecting atoms, molecules and solids to high-intensity x-

ray pulses.

Acting as a kind of strobe light, the laser has frozen the motion of atoms, captured high-speed images of proteins and viruses, and recorded physical and chemical transformations that take less than a trillionth of a second.  
(1401-64)

The major global energy transitions from wood to coal to oil have each taken 50 to 60 years.

The current move to natural gas will also take a long time.

There is no reason to believe that a change to renewable energy sources will be exceptionally fast.

In rich countries, old renewables such as hydroelectricity are maxed out, so growth will have to come from new renewables such as wind, solar and biofuels, which provided only 3.35 percent of the U.S. supply in 2011.

But, the author argues, certain policies could hasten the rise of renewables.

These include funding research into many technologies, ending unneeded subsidies,

making sure prices reflect the environmental and health costs imposed by energy sources, and improving energy efficiency worldwide. (1401-52)

Astronomers are searching for rocky moons that may circle distant exoplanets.

Such exomoons could be a haven for life, provided that the moon is large enough to hold on to an atmosphere.

These moons might be detectable using existing data sets, but their presence would impart such a subtle signal to the data that massive amounts of processing power would be required to find them. (1401-38)

Decision making often occurs without people giving much conscious thought to how they vote, what they buy, where they go on vacation or the way they negotiate a myriad of other life choices.

Unconscious processes underlie the way we deliberate and plan our lives and for good reason. Automatic judgments, for one, are essential for dodging an oncoming car or bus.

Behaviors governed by the unconscious go beyond looking both ways at the corner.

Embedded attitudes below the level of awareness shape many of our attitudes toward others. Sigmund Freud meditated on the meaning of the unconscious throughout his career.

These newer studies provide a more pragmatic perspective on how we relate to a boss or spouse. (1401-30)









development of these technologies.





















