# Largest viruses ever revealed

CHARLES CHOI

GIANT viruses, more than twice as big as the last largest known viruses, have now been unearthed from sludge across the world, researchers say.

Even more titanic viruses might await discovery, the scientists said, and they may have features that could blur the lines between life and viruses, which are not considered to be living things.

Ten years ago, researchers accidentally discovered mimivirus, what until now was the biggest, most complex virus known. Mimivirus -- a name derived from "mimicking microbes," chosen because the viruses were nearly the size of some bacteria -- and its relatives the megaviruses can reach sizes of more than 700 nanometers (a nanometer is one billionth of a meter), and possess more than 1,000 genes, features typical of parasitic bacteria. Typical viruses are maybe 20 to 300 nanometers large, and many viruses, such as influenza or HIV, get along very well with 10 or fewer genes.

Now the research team that discovered those giant viruses have unearthed two more that are even bigger. The shape of these new viruses, which resemble ancient Greek jars, reminded the scientists of the myth of Pandora's box, giving the germs their name -- pandoraviruses.

"The opening of the box will definitively break the foundations of what we thought viruses were," researcher Chantal Abergel, research director at the French National Center for Scientific Research in Marseille, told LiveScience.

The new record-breaking viruses are visible with a traditional light microscope, being a full micrometer or millionth of a meter in size, or approximately a hundredth the width of a human hair. They also each possess a whopping roughly 2,500 genes.

"We were prepared to find new viruses in the 1,000-gene range, but not to more than double that figure," Abergel said. "This really indicates than we don't know what are the possible limits anymore."

Megaviruses, which initially were mistaken for bacteria, were discovered in amoebas, and the investigators found pandoraviruses by also looking at amoebas. One virus, named Pandoravirus salinus, was unearthed at the mouth of the Tunquen River off the coast of central Chile, while the other, called Pandoravirus dulcis, dwelled at the bottom of a shallow freshwater pond near Melbourne, Australia. (Pandoravirus-like particles were actually first observed about 13 years ago, but were not recognized as viruses at the time.)

Two to four hours after amoebas engulf these pandoraviruses, the nucleus of the amoebas begins transforming radically, ultimately vanishing. When the amoebas finally die, they each unleash about 100 pandoraviruses. [Tiny Grandeur: Stunning Photos of the Very Small]

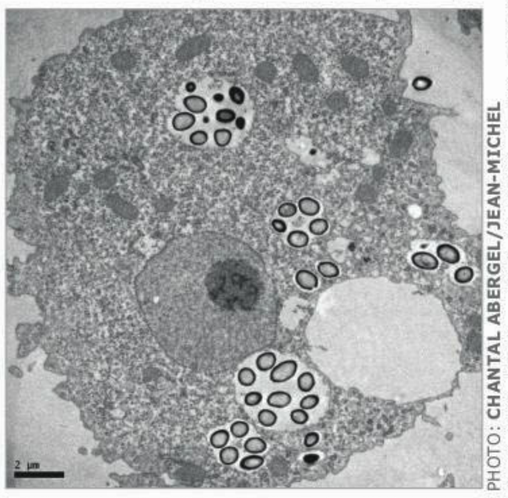

PHOTO: CHANTAL ABERGEL/JEAN-MICHEL

**Electron microscopy image of an amoeba (Acanthamoeba) filled with Pandoravirus particles.**

The amoebas the researchers used in their experiments are probably not the natural hosts for these viruses; rather, the main targets of these viruses may be protozoa or algae that are typically very difficult to grow and maintain in labs.

The scientists used amoebas instead because they can grow in labs, and gorge on their surroundings in a very indiscriminate way, sweeping most anything into themselves as they look for potential food. "This is why they are a very good target for capturing giant viruses," Abergel said.

More than 93 percent of pandoravirus genes resemble nothing known. This makes their origins a mystery -- analysis of their genomes suggests pandoraviruses are not related to any known virus family.

"These viruses have more than 2,000 new genes coding for proteins and enzymes that do unknown things," Abergel said. "Elucidating their biochemical and regulatory functions might be of tremendous interest for biotech and biomedical applications. We want to propose a full large-scale functional genomics project on the pandoravirus genomes."

The fact that pandoraviruses are totally different from the previously known family of giant viruses may suggest even more families of giant viruses remain to be discovered, said researcher Jean-Michel Claverie, head of the Structural and Genomic Information Laboratory in Marseille, France.

"Our knowledge of the microbial biodiversity on this planet is still very partial," Claverie said. "Huge discoveries remain to be made at the most fundamental level that may change our present scenario about the origin of life and its evolution."

It remains a mystery why pandoraviruses have more than 2,500 genes while most viruseshave far less, the researchers said. One controversial suggestion the researchers make is that giant viruses and other viruses that depend on DNA as their genetic material may be the shrunken descendants of living, cellular ancestors.

"Parasites of any kind are submitted to the universal process of 'genome reduction' -- that is, they may lose genes without harm, because the host can always provide the missing function," Claverie said. DNA viruses small and giant may all have degenerated from the same or similar cellular ancestors, "but only differ by the rate by which they lost genes from the starting ancestral genome," he said.

Future research could turn up "even more intermediary life forms between viruses and cells, establishing a continuity between the two," Abergel said. "How should we define the boundaries between cells and viruses?"

Source: **Live Science.**

PAUPERIZED

# How Mars' atmosphere got so thin?

A pair of new papers report measurements of the Martian atmosphere's composition by NASA's Curiosity rover, providing evidence about loss of much of Mars' original atmosphere.

Curiosity's Sample Analysis at Mars (SAM) suite of laboratory instruments inside the rover has measured the abundances of different gases and different isotopes in several samples of Martian atmosphere. Isotopes are variants of the same chemical element with different atomic weights due to having different numbers of neutrons, such as the most common carbon isotope, carbon-12, and a heavier stable isotope, carbon-13.

SAM checked ratios of heavier to lighter isotopes of carbon and oxygen in the carbon dioxide that makes up most of the planet's atmosphere. Heavy isotopes of carbon and oxygen are both enriched in today's thin Martian atmosphere compared with the proportions in the raw material that formed Mars, as deduced from proportions in the sun and other parts of the solar system. This provides not only supportive evidence for the loss of much of the planet's original atmosphere, but also a clue to how the loss occurred.

"As atmosphere was lost, the signature of the process was embedded in the isotopic ratio," said Paul Mahaffy of NASA Goddard Space Flight Center, Greenbelt, Md. He is the principal investigator for SAM and lead author of one of the two papers about Curiosity results in the July 19 issue of the journalScience.

Other factors also suggest Mars once had a much thicker atmosphere, such as evidence of persistent presence of liquid water on the planet's surface long ago even though the atmosphere is too scant for liquid water to persist on the surface now. The enrichment of heavier isotopes measured in the dominant carbon-dioxide gas points to a process of loss from the top of the atmosphere -- favoring loss of lighter isotopes -- rather than a process of the lower atmosphere interacting with the ground.

Curiosity measured the same pattern in isotopes of hydrogen, as well as carbon and oxygen, consistent with a loss of a substantial fraction of Mars' original atmosphere. Enrichment in heavier isotopes in the Martian atmosphere has previously been measured on Mars and in gas bubbles inside meteorites from Mars. Meteorite measurements indicate much of the atmospheric loss may have occurred during the first billion years of the planet's 4.6-billion-year history. The Curiosity measurements reported this week provide more precise measurements to compare with meteorite studies and with models of atmospheric loss.

The Curiosity measurements do not directly measure the current rate of atmospheric escape, but NASA's next mission to Mars, the Mars Atmosphere and Volatile Evolution Mission (MAVEN), will do so. "The current pace of the loss is exactly what the MAVEN mission now scheduled to launch in November of this year is designed to determine," Mahaffy said.

The new reports describe analysis of Martian atmosphere samples with two different SAM instruments during the initial 16 weeks of the rover's mission on Mars, which is now in its 50th week. SAM's mass spectrometer and tunable laser spectrometer independently measured virtually identical ratios of carbon-13 to carbon-12. SAM also includes a gas chromatograph and uses all three instruments to analyze rocks and soil, as well as atmosphere.

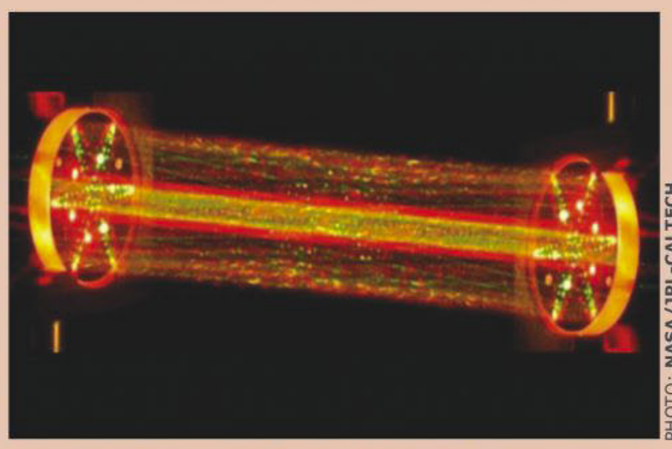

PHOTO: NASA/JPL-CALTECH

**This picture shows a lab demonstration of the measurement chamber inside the Tunable Laser Spectrometer, an instrument that is part of the Sample Analysis at Mars investigation on NASA's Curiosity rover.**

"Getting the same result with two very different techniques increased our confidence that there's no unknown systematic error underlying the measurements," said Chris Webster of NASA's Jet Propulsion Laboratory, Pasadena, Calif. He is the lead scientist for the tunable laser spectrometer and the lead author for one of the two papers. "The accuracy in these new measurements improves the basis for understanding the atmosphere's history."

Curiosity landed inside Mars' Gale Crater on Aug. 6, 2012 Universal Time (on Aug. 5 PDT). The rover this month began a drive of many months from an area where it found evidence for a past environment favorable for microbial life, toward a layered mound, Mount Sharp, where researchers will seek evidence about how the environment changed.

Source: **Science Daily**

TRIBUTE

# Tajuddin Ahmed . . . our lost leader

SYED BADRUL AHSAN

HAD Tajuddin Ahmed been alive, he would be eighty-eight today. He was not destined to live to a ripe old age. Any chances he might have had of taking charge of the country after the assassination of Bangabandhu Sheikh Mujibur Rahman and any possibility of his eventually transforming himself into an elder statesman were ruined the night he and three of his political associates were murdered in jail.

Tajuddin was fifty when he was murdered. He was as young as Syed Nazrul Islam and AHM Quamruzzaman and not much younger than M. Mansoor Ali. Bangabandhu was a mere fifty-five when the soldiers mowed him down.

Tajuddin Ahmed was five years younger. And yet in that brief space of time, he had become an indelible part of Bangladesh's history. To those who knew Tajuddin in the 1960s, the man was destined for a bigger role than what his demeanour chose to reveal. You only have to go looking for some of the men who once enjoyed the reputation of being young, educated Bengali idealists responsible for much of what subsequently came to be known as the Six Points. They will inform you, perhaps to your great surprise and then to your usual expectations, how on a moonlit night on the Sitalakhya it was Tajuddin Ahmed who threw the toughest questions at the men gathered to explain the core of the Six Points to Bangabandhu. A quiet man is always the keenest of observers. It was the silence in Tajuddin Ahmed that betrayed his eloquence every time he decided to ask a question here or seek a clarification there.

In the forging of Bengali nationalism, Tajuddin Ahmed's role was as crucial as Sheikh Mujibur Rahman's. Where Bangabandhu was the inspirational leader, Tajuddin was the theoretician of the party. The relationship between the two men was in a very important sense akin to the ties that bound Mao Zedong and Zhou En-lai to each other. Tajuddin's courage was of the quiet kind. It rested on a perception of hard realities. Just how tough he could be came through almost immediately after the unfolding of the Six Points in early 1966. Zulfikar Ali Bhutto valiantly challenged Mujib to a public debate at Paltan Maidan on the Six Points. Tajuddin Ahmed accepted the challenge on behalf of his leader. In the event, Bhutto never turned up, an early sign of the dread in which he held Tajuddin Ahmed. In the remaining years of united Pakistan, Bhutto would remain conscious of the power that Tajuddin exuded in political dialectics. He squirmed every time Tajuddin chose to speak at the eventually abortive political negotiations in March 1971. He would warn his party men as also members of the Yahya Khan junta to watch out for Tajuddin.

Once Pakistan went on the rampage in Dhaka on 25 March, 1971, Tajuddin lost little time in making his way across the border and linking up with Indira Gandhi. He was perspicacious enough to see, even at that early stage of national predicament, the need for outside assistance in an armed struggle he envisioned developing for Bangladesh's freedom. The man of substance in Tajuddin saw little alternative to the formal shaping of a governmental structure for a struggling nation. The whereabouts of his colleagues remained shrouded in mystery. That was a stumbling block, but he did get around it by doing the necessary thing of announcing the formation of a government, the first ever in the history of the Bengalis.

He came under political assault the moment he took that considered step. The younger elements in the Awami League, typified by the likes of Sheikh Fazlul Haq Moni, thought they had been upstaged. Tajuddin, they thought and indeed propagated the message, had gone beyond his remit. He was not, said these angry young men, qualified or empowered to establish a government because he had not been authorised by Bangabandhu to do so. It was an unfased Tajuddin who went ahead with what he saw as his historic mission of bringing Bengalis together. The socialist in him was unwilling to cave in to fate or human machinations. The intellectual in his being was prepared to withstand onslaughts of the kind his fellow Awami Leaguers were throwing his way. He emerged from the experience a sadder man but a necessarily stronger man.

In a free Bangladesh, Tajuddin Ahmed ought to have played a bigger role in the transformation of society. That role could have come through his holding on to the position of head of government. As minister for finance, though, he demonstrated a tremendous degree of courage in warding off evil spirits, both in the form of international donor agencies and local opportunists. It was his conviction that a development strategy for Bangladesh did not have to include thoughts of aid from nations which had opposed its birth. Such a position, naturally, did not endear him to the right-wingers in the government; and these men kept up their noisy complaints against him before the Father of the Nation.

But what hurt Tajuddin Ahmed more than the whispering campaign against him was his sad, shocking realisation that Bangabandhu Sheikh Mujibur Rahman was listening more to men like Khondokar Moshtaque and Sheikh Moni than to him. Decent almost to a fault, Tajuddin never complained in public. In private, though, he found it inexplicable that Sheikh Mujibur Rahman, the leader and political soul mate with whom he had shaped the political course of the Bengali nation, never once sought to ask him about the events leading up to the formation of the provisional government and the war of liberation that such a government waged.

The differences between these two giants of Bengali history only grew wider. Tragedy was bound to follow. It remains a curious, almost macabre tale in Bangladesh's history that Tajuddin Ahmed was instructed by Bangabandhu Sheikh Mujibur Rahman to leave the cabinet in the very month -- October 1974 -- when Henry Kissinger, prime architect of the Nixonian policy of backing Pakistan in its repression of Bengalis in 1971, came calling. That visit was a sign that Bangladesh was ready to pass into the American orbit. We as a people are still paying the price for the rudeness of overturning Tajuddin Ahmed's socialism and replacing it with unfettered capitalism. The robber barons in our midst, since that October day, have multiplied in number many times over -- and do so every livelong day.

Tajuddin Ahmed was a principled man, one inclined to self-effacement and extraordinary humility. Not many were or have been able to command the intellectual heights of political leadership that he so easily was symbolic of. And few have been the individuals in our history who have so effortlessly cast the personal to the winds in the interest of the welfare of a toiling, battered nation. Self-abnegation was part of his character. As prime minister in 1971, he kept thoughts of family aside as he shaped the tortuous map of battlefield strategy. After October 1974 and till his murder in November of the following year, he went into exile of a kind. He internalised his pain, brooded in loneliness over the future of a country he had guided to freedom. And then he paid the price.

(Tajuddin Ahmed, Bangladesh's first prime minister, was born on July 23, 1925. He was murdered in prison on November 3, 1975).

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