

Finding a role for extracellular RNA

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As a student of Dhaka University during 1968-74, we learned of only three functions of ribonucleic acids, abbreviated as RNA. They were messenger m and transfer t of information from DNA, and structural for ribosome r. RNA is a polymer of nucleic acids, called nucleotides.

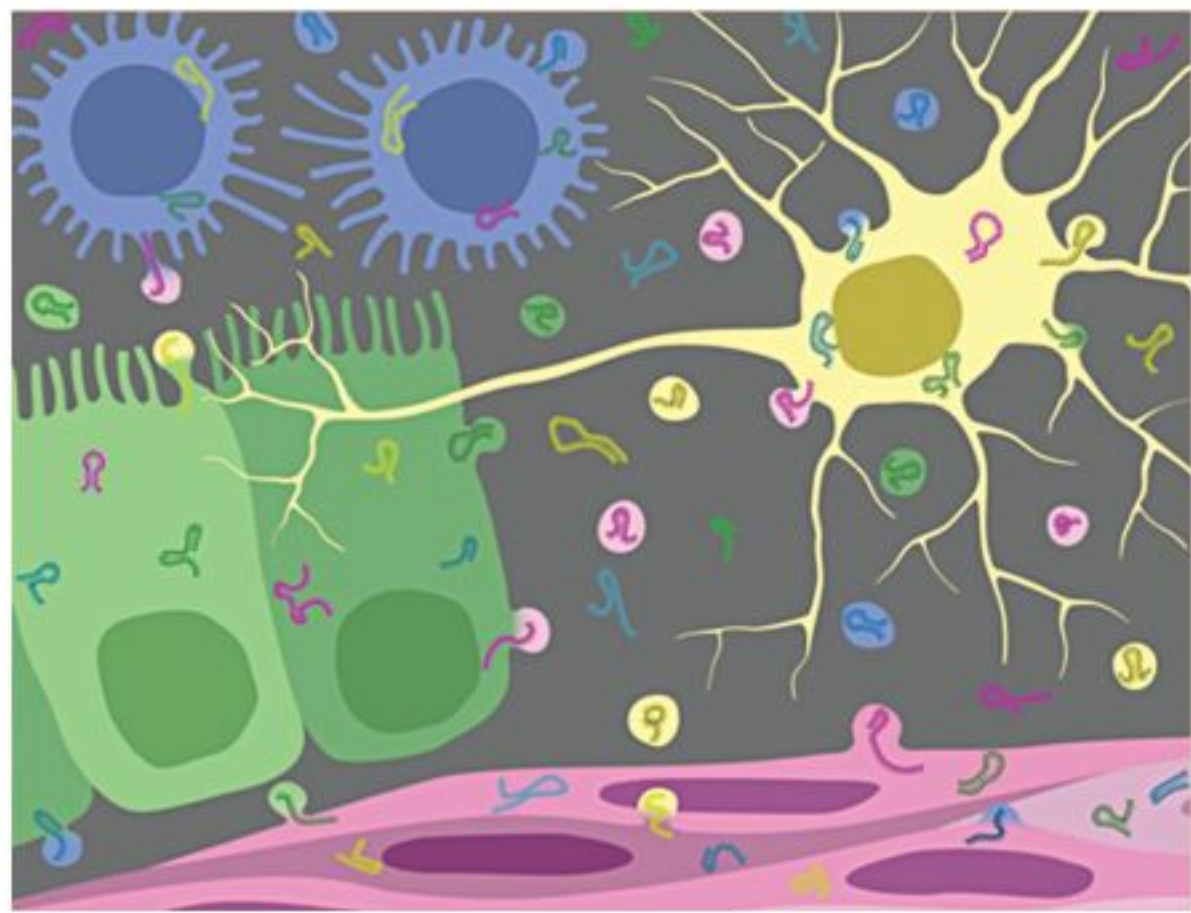
Then soon after joining as a post-doc in 1983 at the National Institute of Health (NIH) in Bethesda, Maryland, I was intrigued by the title of a seminar for an enzymatic, fourth function of RNA. Until then enzymatic function was reserved for proteins only, and nothing else. So I attended the seminar. The speaker was Sydney Altman from Yale University who later won a Nobel Prize for this discovery. At that time he called the RNA enzyme as RNase P. Being glued to the talk, I asked him a question on his use of a reagent called spermine. Soon upon return to lab, I made the reagent's pretty unconventional use in making protein crystals. The result was spectacular that partly shaped the rest of my research career! This coincidental connection permanently engraved RNase P in my memory although it was nowhere near my immediate research interest.

Over the years RNA was found scattered all over, cytoplasm, nucleus and mitochondria, very large to very small. With confirmation of RNase P as an enzyme, scientists were curious in finding specific roles for many types of the ubiquitous RNA in addition to those which were known by then.

Thus, we now have pre-mRNA from which a mature RNA is produced. As the name implies, small nuclear RNA or snRNA occurs in the nucleus, and functions both as an enzyme and in maintaining the structure of something called 'spliceosome'. Signal recognition particle RNA or SRP RNA recognizes signal peptide sequences for guiding the protein into specific cellular locations. Small nuclear RNA or smRNA helps processing of pre-rRNA for the assembly of ribosome subunits in the nucleolus. Small interfering RNA or siRNA and micro RNA or miRNA regulates gene expression.

Traditionally, RNA was thought to reside only inside cells. That notion started to change about fifteen years ago when scientists demonstrated that plant cells release RNA that travel throughout the body until it reaches a target cell. So these are extracellular RNA or exRNA.

In human and other mammals, exRNA has been detected in saliva, tear, blood and other body fluids encased in small bubble-like sacs called exosomes or in association with proteins and lipids. Like miRNA, exRNAs are small, ~22 nucleotides long.



A cartoon representation of the environments in which extracellular RNAs have been discovered.

Reports are there that (1) mammalian tumor-derived exRNAs can promote tumor growth, (2) endothelial cell-derived exRNAs regulate gene expression in smooth muscle cells, (3) rice exRNAs found in human circulation modulates LDL levels, (4) microbes secrete RNAs via extracellular vesicles; this may be a mechanism by which the microbiome may influence host cell function at a distance.

To find a definite answer on the role of exRNA in humans, last month the NIH announced a 17 million dollar 5-year exRNA Communication Initiative. Fund recipients will try to probe if exRNA plays a role of communication between different cell types, disease conditions, or any other biological role. One group of dentists will try to find a common exRNA in the saliva for diagnosis of diabetes and many types of cancer. One group will screen the blood of 3000 patients for diagnosis of any cardiovascular conditions. Other groups will investigate if exRNA can be utilized to fight certain diseases like multiple sclerosis, Huntington Disease, and cancer. A group will manipulate cells to produce a liver-specific endosome with ability to deliver miRNA into cancer tissues. One bioinformatics group will construct an "exRNA atlas" a public website resource for all researchers in the field.

Bangladesh scientists may start thinking if the emergence of any of the country's many prevalent diseases can be predicted beforehand by analyzing exRNA.

The writer, a former Dhaka University teacher, is a biomedical scientist working in the USA



BIRTHSMOKE

Pristine gas from nascent universe

THE cold gas is flowing, they said, into a galaxy that is now seen as it looked about 11 billion years ago, due to the time its light takes to get here.

Profuse gas flows like this are thought to be key to explaining that early era, when galaxies were copiously forming stars from the gas. A similar flow could have contributed to the creation of our own galaxy.

The astronomers – led by Neil Crighton of Swinburne University in the U.K. – published the findings Oct. 2 in the research journal *Astrophysical Journal Letters*.

The distant hydrogen usually can't be detected. But in this case it was, thanks to a coincidental lighting arrangement provided by a distant, extremely bright object known as a quasar, according to Crighton's group.

The findings came from a systematic survey using the Large Binocular Telescope on Mount Graham, Arizona and an instrument called a spectrograph on the Keck I telescope on the summit of Mauna Kea, Hawaii.

Cosmologists believe early galaxies received their material from a vast reservoir of pristine hydrogen floating between galaxies. About 10 billion years ago when the universe was one-fifth its current age, studies have found, fledgling galaxies were forming new stars at nearly 100 times their current rate. This activity would require some fuel in the form of gas, since that is what makes up stars. In the past decade, supercomputer simulations of galaxy



formation have predicted that this gas funnels into galaxies along thin "cold streams" which, like streams of snow melt feeding a mountain lake, channel cool gas from the surrounding area onto galaxies. Testing these predictions isn't easy, as such gas at the edges of galaxies is very dark. Instead, the team of astronomers searched for places where quasars could provide helpful light. Quasars are galaxies that briefly shine as the brightest objects in the universe as their central object, a black hole, sucks up material in a violent process.

Source: World Science



SCIENCE BRIEF

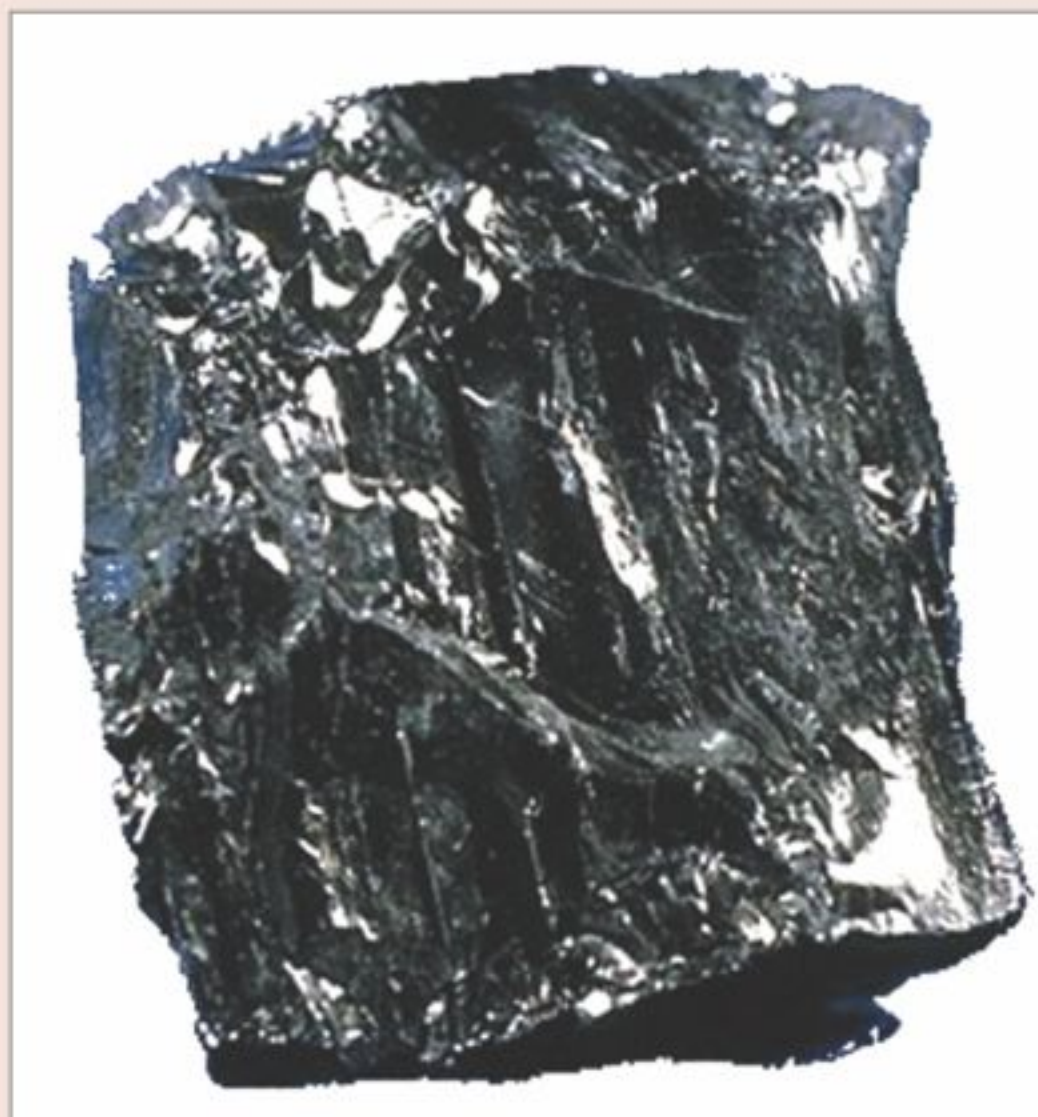
How to use coal

AZADI HOSSAIN

PEOPLE have used coal for cooking and heating for thousands of years. During the 19th century, coal was the world's most important fuel. It powered the steam engines that made the Industrial Revolution possible. Today, coal is still used in vast amounts. Most coal is burned at power stations to produce electricity, and burning coal meets much of the world's energy needs. Coal is also an essential raw material for making many products, the most important of which are iron and

steel. Coal is often called a fossil fuel because it is formed from the fossilized remains of plants that are millions of years old. Sometimes a piece of coal bears the imprint of a prehistoric plant or insect. The Earth contains reserves of coal which, with careful use, may last for hundreds of years. But many people are concerned that coal burning adds to global pollution.

A few steam-powered trains still burn coal, and some homes have open fires or coal-fired heating systems. The main use for coal is in the production of electricity.



Anthracite coal

BIG WHY



RESURRECTOR

Pinocchio Lizard is alive

THIS ain't no lie: The Pinocchio lizard was thought to be extinct for 50 years, but has been rediscovered in the cloud forests of Ecuador.

After searching for the long-nosed animal for three years, a team of photographers and researchers found the lizard recently in a stretch of pristine cloud forest in the northwest part of the country, said Alejandro Arteaga, a co-founder of the educational and ecotourism company Tropical Herping, which conducted the search for the lizard.

Also called the Pinocchio anole (an anole is a type of lizard), the animal is named after a certain dishonest wooden puppet and was first discovered in 1953, Arteaga said. But wasn't seen between the 1960s and 2005, when an ornithologist saw one crossing a road in the same remote area in northwest Ecuador. This is only the third time scientists have spotted it since 2005, Arteaga added.

Source: Live Science



Pinocchio anoles are an endangered species.

Climate puzzle over life's origin



The ancient air was trapped in old and well-preserved rocks in north Australia.

SCIENTISTS at the CRPG-CNRS University of Lorraine, The University of Manchester and the Institut de Physique du Globe de Paris have ruled out a theory as to why the planet was warm enough to sustain the planet's earliest life forms when the Sun's energy was roughly three-quarters the strength it is today.

Life evolved on Earth during the Archean, between 3.8 and 2.4 billion years ago, but the weak Sun should have meant the planet was too cold for life to take hold at this time; scientists have therefore been trying to find an explanation for this conundrum, what is dubbed the 'faint,

young Sun paradox'.

"During the Archean the solar energy received at the surface of the Earth was about 20 to 25 % lower than present," said study author, Dr Ray Burgess, from Manchester's School of Earth, Atmospheric and Environmental Sciences. "If the greenhouse gas composition of the atmosphere was comparable to current levels then the Earth should have been permanently glaciated but geological evidence suggests there were no global glaciations before the end of the Archean and that liquid water was widespread."

Source: Science Daily

MUMMIFIER

Lake that turns them into stone

LAKE Natron in Tanzania is one of the most serene lakes in Africa, but it's also the source of some of the most phantasmagorical photographs ever captured — images that look as though living animals had instantly turned to stone.

The alkaline water in Lake Natron has a pH as high as 10.5 and is so caustic it can burn the skin and eyes of animals that aren't adapted to it. The water's alkalinity comes from the sodium carbonate and other minerals that flow into the lake from the surrounding hills. And deposits of sodium carbonate — which was once used in Egyptian mummification — also acts as a fantastic type of preservative for

those animals unlucky enough to die in the waters of Lake Natron.

Despite some media reports, the animal didn't simply turn to stone and die after coming into contact with the lake's water. In fact, Lake Natron's alkaline waters support a thriving ecosystem of salt marshes, freshwater wetlands, flamingos and other wetland birds, tilapia and the algae on which large flocks of flamingos feed. Now, photographer Nick Brandt has captured haunting images of the lake and its dead in a book titled "Across the Ravaged Land" (Abrams Books, 2013).

Source: Live Science



The body of a flamingo on Lake Natron, as captured by photographer Rick

BEETLE BAILY

by Mort Walker



HENRY

by Don Trachte



QUOTABLE Quotes

"We have to choose between a global market driven only by calculations of short-term profit, and one which has a human face."

Kofi Annan

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