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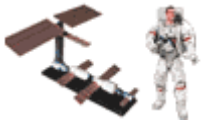



SPACEDAILY EXPRESS
Feb 27, 2003
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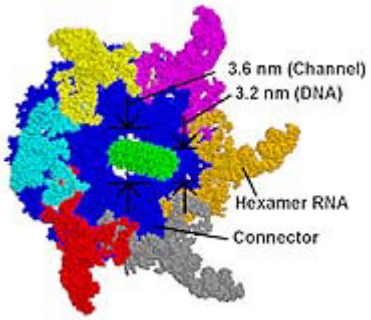
EXO LIFE

# Purdue Researchers Connect Life's Blueprints With Its Energy Source




One promising application of RNA-ATP binding is this microscopic motor, assembled by Peixuan Guo's team at Purdue University. The motor, only a few nanometers wide, is formed by six strands of RNA surrounding an "axle" made of DNA. When fed a supply of ATP as fuel, the RNA molecules kick against the DNA in succession, much like the pistons in a conventional motor. (Graphic/Guo Laboratory)

West Lafayette - Feb 06, 2003

The Purdue University research team that recently created a tiny motor out of synthetic biological molecules has found further evidence that RNA molecules can perform physical work, a discovery that could advance nanotechnology and possibly solve fundamental mysteries about life itself.

Purdue's Peixuan Guo has discovered how viral RNA molecules bind an energy-bearing organic molecule known as ATP. While linking these two substances might seem to create no more than a longer string of letters, the upshot is that now one of life's most mysterious and ancient storehouses of information can be moved by one of its most important fuels. The discovery could shed light on the fundamental role RNA plays in the creation of living things.

"RNA could be even more of a key player than we realize," said Guo, professor of veterinary pathobiology in Purdue's School of Veterinary

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ROCKET SCIENCE

## ESA Signs Up For Demonstration Of Vega Small Launcher

Paris - Feb 26, 2003

Today ESA signed a contract with the ELV company for completion of the development phase of the Vega European small launcher programme, and CNES signed, on behalf of ESA, a contract with FiatAvio for development of the P80 advanced solid propulsion stage and demonstrator.

OPINION SPACE

## Why We Fly

Scottsdale - Feb 26, 2003

Post-Columbia punditry has formed up into two camps: mystically pro-human and reductionistically

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Medicine. "The fact that it can be made to bind ATP in the phi29 virus could imply that these two molecules were among the first to partner in Earth's dance of life."

On a more practical level, the discovery could have immediate technical applications – such as driving a Lilliputian motor of the sort Guo's team has recently constructed.

"I think RNA can be made to do mechanical work," he said. "ATP binding could power a motor made of six strands of RNA, and we are now exploring the myriad possible applications of such a tiny mechanism."

The research appears in the February Journal of Biological Chemistry.

DNA, RNA and ATP are substances long known to be central to life's processes, but knowledge about their many functions in living things is still emerging.

Several years ago, scientists were stunned by the discovery that some forms of RNA – well-known as the "messenger molecule" that carries instructions between DNA strands in a cell's nucleus – could serve as a catalyst for important chemical reactions in the body.

The discovery of these RNA catalysts, called ribozymes, convinced many scientists that RNA probably existed on earth before DNA or complex proteins, the two other ingredient molecules necessary to create life.

"There are thousands of kinds of RNA in your body," Guo said. "Most varieties have an unknown function. When ribozymes were discovered, it taught us that RNA was probably responsible for the creation of other complex biological molecules. RNA might be more significant to life on earth than we imagined a few years ago."

Guo's group has discovered another way that RNA might be the keystone for biological processes: they have found that it is able to bind adenosine triphosphate, or ATP, which is the crucial substance used to transfer metabolic energy in living things.

"You couldn't live for one second without ATP," Guo said. "Your muscles, for example, are able to flex because an enzyme called ATPase binds the ATP molecule, breaking one of ATP's chemical bonds and

pro-robot. Before the isolated sparring turns into a general melee, we should look up from our conflicting means to examine the question of ends. If any of us are to be effective, in water-cooler conversation, op-ed high-noon showdowns or Congressional testimony, we'll need a good firm grip on our own answer to the root question: why do we want to go to space?, asks John Carter McKnight.

NANO TECH

## Hundreds Of Molecules Unite In Self-Assembled Liquid Crystal Lattice

Philadelphia - Feb 25, 2003

A new liquid crystal lattice created by scientists at the University of Pennsylvania and University of Sheffield may be invisible to the naked eye, but it's a giant in its own way.

ROCKET SCIENCE

## Flying With Nature's Own Fuel

Pasadena - Feb 24, 2003

Hundreds of years ago, early discoverers used the Sun as a compass. Turns out the light of the Sun can do more than just guide us; it can actually propel us farther and faster into the vast realm of space than we've ever been able to go.

ROCKET SCIENCE

## Potential For Ultrafast Detonations Revealed By New Simulation

University Park - Feb 25, 2003

Explosive detonations at speeds faster than current theories predict have been shown to be possible in a powerful new computer

releasing the energy you use when walking or talking."

Guo theorizes that because RNA can also bind ATP, it might be not only life's original seed molecule, but also able to direct the release of the energy needed to create life from that seed.

"We are just beginning to learn about RNA's many functions," he said. "But it is possible that it plays a crucial role in metabolism, too. In that case, RNA would play a more central role in biology than we originally thought. We are seeking fundamental knowledge here."

It is uncertain whether the RNA in living things has ever directed any of ATP's actions, but for the moment, Guo's group has already found a way to make ATP move RNA around.

His team has learned to assemble several strands of RNA into a hexagonally-shaped "engine" with a strand of DNA functioning as the axle. When fed a supply of ATP fuel, the RNA strands kick against the axle in succession, much like pistons in a combustion engine. Such minuscule motors could find applications in nanotechnology.

"The world's smallest machines will need equally small motors to propel them," Guo said. "Ours uses organic molecules as fuel, so no special power source would need to be developed."

The motors could also be used not only to spin the DNA strand, but also as potential gene delivery vehicles. Guo's team had already found that the motor could drive its axle into a virus' protein shell, and has recently also learned that the ATP-binding RNA derived from the phi29 virus can deliver a ribozyme that destroys Hepatitis B. A paper detailing this work is forthcoming in the journal Gene Therapy.

"Delivering healthy genes or therapeutic molecules into damaged cells is the goal of gene therapy," Guo said. "With some modifications, we hope our research will enable us to deliver therapeutic molecules to cancerous or other virus-infected cells as well."

Guo's current research is headed in this direction, but he emphasizes that more work also needs to be done on RNA's fundamental capabilities.

simulation developed by a physical chemist and an aerospace engineer at Penn State.

"We would like to find other examples of how RNA operates in the body," Guo said. "We know from our research that RNA can be made to perform physical work in a viral system and in the laboratory, so it is possible that it is also involved in the transportation of components within cells."

Such ideas remain speculative for the moment, but Guo said that naturally occurring hexagonal loops of other RNA have been found performing protein transport in drosophila fly embryos.

"The RNA loops in these developing flies are similar to the loops we assembled," he said. "It's a clue that we may be on the right track."

Funding for this research has been provided in part by the National Institutes of Health and the National Science Foundation.