Biology

RNA world begins to add up

The essence of life is the ability of the individual organism to propagate or copy itself. Fans of the RNA world hypothesis, a scenario in which life began with RNA and later added DNA and proteins to its repertoire, are therefore seeking to create self-replicating RNA molecules to mirror those with which life on Earth might have originated. To self-replicate, an RNA strand would need to string together nucleotides, its subunits. In modern organisms, this job is handled by proteins called RNA polymerases.

Eric H. Ekland and David P. Bartel, both of the Whitehead Institute for Biomedical Research in Cambridge, Mass., now describe in the July 25 NATURE an RNA strand that performs like these polymerases. It "does the same thing, in a chemical sense, as the protein enzymes. . . . It's the same reaction we find in nature," says Bartel.

The RNA enzyme, or ribozyme, was identified in a soup of randomly generated strings of RNA nucleotides. The researchers first showed that the ribozyme can attach a single nucleotide onto a short strand of RNA called a primer. The nucleotide added—one of four types found in RNA—was determined by a template strand of RNA weakly bound to the primer. The ribozyme linked the correct nucleotide about 90 percent of the time, the researchers report.

Additional experiments demonstrated that the ribozyme can make use of longer templates to add three and even six nucleotides onto the primer RNA strand. The latter feat took 6 days in the test tube, notes Bartel. Since the ribozyme is some 100 nucleotides long, it can't copy itself, notes Bartel. "This is very far from self-replicating RNA. It shows RNA can catalyze the necessary reaction, but it doesn't yet show RNA can copy itself."

Honey, I shrank the hormone!

Researchers searching for small molecules that perform like the hormone erythropoietin (EPO), a 165-amino-acid-long protein that triggers the creation of red blood cells, have good news. Several recently isolated peptides, one of them just 14 amino acids long, can stimulate blood cell formation via the same cell signaling pathways as EPO, report Nicholas Wrighton of Affymax Research Institute in Palo Alto, Calif., and his colleagues in the July 26 SCIENCE.

The EPO-like peptides represent a major milestone in molecular mimicry and are "enough to reinstate one's belief in Santa Claus," James A. Wells of Genentech, a biotech company in South San Francisco, comments in SCIENCE.

The peptides may lead to the development of a drug that duplicates the effects of EPO but is small enough to be taken orally, suggest the scientists. The hormone, often used by AIDS and cancer patients, has become biotechnology's single biggest revenue producer, generating more than $1 billion in sales annually, even though it must be injected.

Panel embraces xenotransplants

Xenotransplantation, the transfer of animal cells, tissues, or organs into people, has become a respectable topic once again, now that investigators have largely figured out why the immune system ordinarily rejects such transplants from other species. The increasing need for donor organs has also highlighted the controversial field (SN: 11/4/95, p. 298).

In a report last month, a panel convened by the Institute of Medicine in Washington, D.C., to examine xenotransplantation concluded that the science has progressed far enough to justify limited trials in humans. The panel did acknowledge concerns about the transmission of infectious agents from animals to people, recommending that researchers voluntarily adhere to xenotransplantation guidelines soon to be released by government health agencies.

Earth Science

Mongolian quake lessons for Los Angeles

Los Angeles faces double jeopardy when it comes to seismic risks. The giant San Andreas fault looms just over the northern and eastern horizons, while smaller faults tick away right underneath the city. In the past, seismologists have not considered the possibility that both hazards could strike at once, but an earthquake 40 years ago in Mongolia teaches that trouble can come in a double dose.

In the July GEOLOGY, a team of U.S., Mongolian, and Russian scientists warns that the system of faults within the Gobi Desert bears a close resemblance to the faults haunting Los Angeles. Mongolia has an extremely long fault skirting the northern border of the Gobi-Altay Mountains, just as the San Andreas defines the northern border of the San Gabriel Mountains. These kindred geologic gashes are called strike-slip faults, because during earthquakes, land on one side slides horizontally past land on the other side.

Each region also has so-called thrust faults on the southern edge of its mountain range. During quakes, these faults move vertically, pushing up the mountain peaks.

In 1957, the two sets of faults in Mongolia combined to generate a great earthquake with a magnitude of at least 8.0. During the shock, land jerked forward along a 250-kilometer-long stretch of the strike-slip fault. At the same time, a string of thrust faults, measuring 50 km long, sprang into action, according to Peter Molnar of the Massachusetts Institute of Technology and his colleagues.

The scientists take the Mongolian earthquake as an indication that thrust faults along the San Gabriel Mountains could come to life during a large San Andreas earthquake. This team-up would compound problems because the smaller faults lie closer to the vast bulk of Los Angeles' population.

Other researchers have questioned the Mongolian analogy. One critical difference is that the Gobi-Altay faults accumulate strain at only one-tenth the rate of the San Andreas. What's more, Mongolia lies far from any boundary between tectonic plates, whereas Los Angeles sits at the junction between the Pacific and North American plates.

Ballooning over the Amazon

U.S. researchers had more than child's play on their minds when they headed off to the Peruvian Amazon this summer with balloons and a kite in tow. The atmospheric scientists used these inexpensive, low-tech tools to study the gases being exhaled by a pristine section of rain forest.

John Birks, a chemist at the University of Colorado in Boulder, and his colleagues spent 10 days at a remote site near the Marañón River. They collected samples of air at different altitudes and various times of day by attaching gas flasks to tethered balloons. They also raised the flasks on a large parafoil kite that they dragged behind a boat.

In previous experiments in Australia and Newfoundland, the team found that it pays to travel with both balloons and kites. "We have developed a complementary system. Kites are useful when the winds are high and balloons don't work well. When the winds are low, we use balloons," says Birks.

The Colorado scientists measured how the forest absorbs and emits greenhouse gases, such as carbon dioxide. Past atmospheric studies in the Amazon have focused on the Brazilian section, where intentional forest fires are common and the air is more polluted.

Birks and his coworkers also measured concentrations of ozone gas, which can be a pollutant in the lower atmosphere. "We found only 8 to 12 parts per billion. That's the lowest I've ever seen," says Birks. He suggests that gases emitted by the jungle actually scrub out ozone carried in from other regions.