Paleontology

Prehistoric syphilis

Syphilis-causing organisms, called treponemes, have long plagued certain scientists, but not in the usual sense. Rather, historians of disease are unsure how and where treponemes originated.

Noting that the earliest reports of syphilis and related diseases did not appear in the Old World until after 1500, many scientists have suggested that Columbus's crew and other voyagers might have carried treponemes back with them when they returned from from the New World. Several decades ago, this theory received support from the discovery of 3,000-year-old human bones from the New World that seemed to show signs of treponemal disease.

However, in the last 20 years, medical historians have suggested that syphilis did indeed affect Europeans in the Middle Ages, but was misdiagnosed as leprosy at the time. Before 1500, say these researchers, people believed that leprosy spread by sexual contact, was highly contagious and responded to mercurial compounds. Yet all of these factors fit syphilis more than leprosy.

Now, immunological tests on bones from a Pleistocene-epoch bear prove that treponemal infections in the New World date back at least 11,000 years. In the Sept. 3 NATURE, scientists report that, using antibodies specific to treponemes, they successfully identified treponemal material on the bear's bones. This is the first successful use of immunology to detect an ancient disease-causing organism, says Bruce Rothschild of St. Elizabeth Hospital Medical Center Hospital in Youngstown, Ohio, who worked with William Turnbull of the Field Museum of Natural History in Chicago.

According to Rothschild, this finding "pushes back the history of any identifiable treponemal disease substantially."

Although the new finding does not resolve the debate about the origin of treponemal infections, the immunological technique will help scientists trace the history of these and other infections. While paleopathologists could previously only *diagnose* ancient infections, this new technique allows a direct identification of the infectious organism itself. Using the appropriate antibodies, says Rothschild, scientists might apply this technique to the history of smallpox or tuberculosis.

Adult amphibian in Antilles amber


SCIENCE

If an 11,000-year-old-bear with syphilis isn't bad enough, what about a 40-million-year-old frog with several broken limbs? Scientists from the University of California at Berkeley have found this remarkably well-preserved creature encased in amber, which is a fossilized form of tree resin.

As an explanation for the frog's trauma, the researchers suggest that some predator, possibly a bird, caught the frog and stashed it in a nest in a resin-producing tree. Then, before the predator could feast, resin seeped out of the tree and covered the frog.

Discovered in an amber mine on the island of Hispaniola, the frog will help resolve a debate over the origin of the island's fauna, say the Berkeley researchers in the Sept. 4 SCIENCE. According to early theories, animals from the North American continent established themselves quite recently (geologically speaking) on the islands of the West Indies by swimming, flying or floating on debris. However, say the researchers, the great age of the frog fossil supports a rival theory—that animals were carried along by the islands themselves when these land masses broke off from the mainland.

Physics

Dietrick E. Thomsen reports from Princeton, N.J., at the International Symposium on Feasibility of Aneutronic Power

Antimatter, antichemistry

Until recently, antimatter—which has the same properties as ordinary matter, but with the opposite electric charge — has made only fleeting appearances in our part of the universe. It is hard to contain, because an antiparticle tends quickly to meet its opposite in a collision that annihilates them both. Lately, however, physicists have managed to keep antiprotons in traps and in storage rings for hundreds of seconds at a time. This has led to several proposals for making anti-elements and anti-molecules. Bogdan Maglich of AELabs, Inc., in Princeton, N.J., presented one proposal that uses his migma device.

The migma device is designed for ordinary nuclear fusion. It has a magnetic field that constrains atomic nuclei to move in a rosette-shaped orbit that crosses itself many times so that nuclei traveling along it have many opportunities to meet each other. In the normal use of migma such meetings can produce nuclear fusions. In this case, Maglich proposes loading the migma with protons and then with an equal number of antiprotons from the antiproton storage ring at the Fermi National Accelerator Laboratory in Batavia, Ill. Meetings of antiprotons and protons would produce not fusions but annihilations. The annihilations, however, produce other particles, and ultimately, after about 2 minutes, the migma cell would contain an "ambiplasma," a mixture of protons, antiprotons, electrons and positrons. (The term "ambiplasma" was invented about 30 years ago by the Swedish physicist Hannes Alfvén, who proposed that the universe began as an ambiplasma, a theory no longer very popular.)

An ambiplasma made in a migma, Maglich suggests, could become a factory of the simpler antinuclei. As time went on, antineutrons would be produced, and gradual fusion processes could be used to make antideuterium and antitritium as well as antihydrogen molecules. With this beginning, scientists could go on to do what Maglich calls "antichemistry."

Gone with fission

Both fission and fusion reactions involving atomic nuclei throw off energetic debris in the form of fragments of nuclei. For some time scientists and technologists have wondered whether such flying fragments could be used to provide thrust for rocket engines. George Chapline of Lawrence Livermore (Calif.) National Laboratory said that he hated to be the bearer of bad news at a meeting of fusion enthusiasts, but he thinks a fusion rocket is impossible. However, he described a *fission* rocket that he thinks would work.

To do it, the reactor fuel has to be arranged so that the fission fragments can escape. Thus he suggests using layers of thin wires of americium — an uncommon metal, but more efficient than the more common plutonium — spaced out in a volume 10 meters by 10 meters by 1 meter. The fuel area would be surrounded by electric currents producing a magnetic field in the shape of a "magnetic mirror," which would gather up the fission fragments and bounce them back and forth.

This would be a leaky mirror, and some of the fragments would escape out the end — at least 50 percent, and Chapline hopes possibly 90 percent—producing a thrust that could have a specific impulse up to 1 million seconds. However, the wires of fuel would have to be mounted on wheels and rotated to dissipate the tremendous heat produced. Otherwise the arrangement would have to be too large for a practical spacecraft.

Such an engine might be useful for deep-space missions. For example, for a 50-year trip to Alpha Centauri, the nearest star, Chapline calculates it would take 200 tons of americium. The reactor fuel would last for 25 years, accelerating the spacecraft to one-eighth the velocity of light in that time. The craft would then be about 3 light-years from Alpha Centauri (or 1 light-year from earth). It would coast for 25 more years to finish its trip.