BOTANY

Algae missing link is too far out

The missing link in the study of microbial evolution would be an intermediate between prokaryotes (bacteria and blue-green algae) and eukaryotes, the assumed forerunners of higher organisms. A good candidate for the transition organism has been dinoflagellate algae, which include the species causing red tide (SN: 8/2/75, p. 75). The structure, gross composition and reproduction of dinoflagellate chromosomes suggest they are more primitive than those of other eukaryotes.

But now there is evidence that the dinoflagellate chromosomes are well out of the main line of evolution. They have a rare component in their DNA.

The DNA of both prokaryotes and eukaryotes consists almost entirely of four standard nucleotides. When Peter M. M. Rae of Yale University examined DNA from five diverse species of dinoflagellate, he found that 12 to 68 percent of the expected thymidine nucleotide was actually hydroxymethyldeoxyuridylic acid (HOMeU). In this novel nucleotide, a hydroxyl group substitutes for a hydrogen of thymidine.

Previously, HOMeU had only been seen in DNA of a few virus types. Rae examined DNA from nine nondinoflagellate species of algae and analyzed available data on a wide variety of other organisms. He reports in the Dec. 3 SCIENCE that HOMeU was not found in any of those species.

Rae suggests HOMeU in dinoflagellate chromosomes results from enzymatic modification of thymidine nucleotides in specific short sequences of DNA.

Secret winter life of plants

When the lake froze over, limnologists traditionally called it quits on field observations until spring. But scuba equipment has made it possible to prolong the scientific season. Continued healthy plant growth under winter ice cover is surprisingly common, researchers report in the Nov. 19 SCIENCE.

Divers measured the densities of 26 species of submerged, rooted plants in Lake George, N.Y., over a three-year period. Ten of the species did not die in autumn, but were metabolically active all winter in 2°C water. Plants gathered during the winter exhibited at that temperature 10 to 20 percent their midsummer photosynthetic activity, report Charles W. Boylen and Richard B. Sheldon of Rensselaer Polytechnic Institute. Even under the ice, enough light reached the plants to saturate their photosynthetic apparatus. However, Boylen cautions, the last three winters did not have heavy snow.

The same species of plants at the edge of the lake fruit in the fall and then die. The year-round underwater growth, Boylen says, is one type of plant adaptation to variability in environment.

Looking into plant cell membranes

Cellulose, the most abundant macromolecule on earth, is the predominant component of plant cell walls. For the first time, in the Nov. 26 SCIENCE, the sites where cellulose may be synthesized have been demonstrated microscopically in the inner cell membrane of a higher plant.

Freeze-fracture electron microscopy by Susette C. Mueller, R. Malcolm Brown Jr. and Tom K. Scott of the University of North Carolina revealed cellulose microfibrils in the membrane of corn root cells. Attached to the fibrils were globules that seemed to be composed of subunits. This observation supports the hypothesis that cellulose is synthesized by a complex of enzymes which moves along the nascent fibril. The cellulose would then be oriented, grouped into bundles and added to the inner surface of the thickening cell wall.

BIOMEDICINE

Immunity and chronic miscarriages

Why is it that some women chronically have miscarriages? Ross E. Rocklin and his team at Harvard Medical School report an explanation in the Nov. 25 NEW ENGLAND JOURNAL OF MEDICINE: These women lack a factor that normally blocks a mother's immunological rejection of the fetus inside her body.

The fetus posseses proteins and other chemicals that are not only like its mother but like its father, and hence "antigenic" or "foreign" to the mother's body. Yet the fetus usually survives gestation without being rejected by the mother's immune system. Rocklin and his colleagues searched for an immunological mechanism that might explain why most women are "tolerant" of the fetus they carry and why some others are not.

Such a mechanism can indeed explain the difference, they have found. A woman with no trouble carrying a child has a certain factor in her blood, an IgG antibody, that blocks the production of maternal lymphocytes (immune fighter cells) against paternal antigens (those chemicals inherited by the fetus from the father). However, women who chronically miscarry do not have this factor, so that their lymphocytes can proceed to react against the paternal antigen in the fetus and hence reject the fetus.

Steaks, diet and drug metabolism

What we eat and drink can alter the way our bodies make use of drugs and other foreign chemicals. A protein deficiency, for instance, decreases the liver enzymes' ability to get rid of toxic pesticides. Unsaturated fats protect against foreign chemicals by priming the liver enzymes. So do vitamin C, possibly vitamin A, zinc, magnesium, copper and calcium (SN: 7/19/75, p. 43). Now it looks as if charcoal-broiled steaks can also influence the way our bodies metabolize foreign compounds.

E.J. Pantuck and K.-C. Hsiao of Columbia University College of Physicians and Surgeons and their colleagues fed charcoal-broiled beef to human volunteers. The volunteers were then given, orally, an analgesic called phenacetin. The beef sped up the metabolism of the drug in the intestine or during its first pass through the liver, or both. Other studies have shown that Brussel sprouts or cabbage can stimulate the intestinal metabolism of this drug in rats.

"That foods can influence the metabolism of a drug is important," the researchers conclude in the Dec. 3 SCIENCE, "because changes in an individual's diet or differences between the diets of different individuals can contribute, respectively, to intraindividual and interindividual variability in the bioavailability and, consequently, in the biological effect of the drug."

Caffeine and coffee intake

How important is caffeine, really, in determining people's coffee-drinking habits? Lynn T. Kozlowski of Wesleyan University in Middleton, Conn., had 12 regular coffee-drinking subjects drink a packet of coffee containing different amounts of caffeine over three consecutive days. The subjects were asked to rate how the coffee tasted and how it made them feel.

She reports in the Nov. 25 NATURE that the subjects did not taste the caffeine manipulation, but they did drink more coffee when little caffeine was present, apparently to achieve a sense of well-being that caffeine imparts. In two subsequent studies conducted for three and four weeks, she had 12 and 25 subjects drink from an institutional coffee pot that contained varying amounts of caffeine. Again she found that the less caffeine that was present, the more coffee the subjects tended to drink.