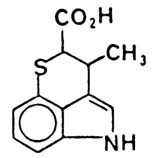
CHEMISTRY

Chuangxinmycin: Doing the nitro bump

Chuangxinmycin, an antibiotic found by Chinese researchers to be effective in the treatment of blood poisoning and urinary and biliary infections, rocked the organic chemistry boat when its structure was discovered: No other known indole alkaloid — the class of compounds to which this antibiotic belongs — sports a sulfur (S) atom at the carbon-4 position.



Now, chuangxinmycin, naturally produced by soil microorganisms, continues to make waves: Its synthesis requires a unique chemical reaction, researchers at the University of Pittsburgh have discovered. Alan P. Kozikowski and co-workers, whose work is detailed in the Jan. 30 JOURNAL OF THE AMERICAN CHEMICAL SOCIETY, describe the unique reaction as a "novel nitro group displacement."

Chuangxinmycin synthesis begins with a six-carbon ring that bears two nitro (NO_2) groups. In the course of the synthesis, sulfur is introduced to replace one of the nitro groups. This particular substitution is unusual because of the position of the two nitro groups on the antibiotic precursor. Generally, because of certain chemical tenets, chemists expect substitution of a dinitro compound to most easily occur when the nitro groups are attached to adjacent carbons (ortho) or carbons directly opposite each other (para) on the ring. In the case of chuangxinmycin synthesis, however, sulfur substitution occurs on a ring with meta-oriented nitro groups — nitro molecules attached to two carbons situated with a "non-nitro-bearing" carbon in the middle.

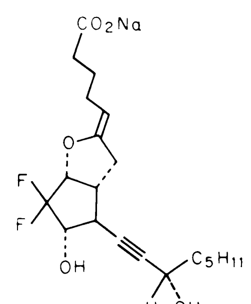
Bivalve barometer: A new standard

The oyster recently came out of its shell to sit on the shelves of the National Bureau of Standards. The freeze-dried mollusk, at $65 per 30-gram sample, is hardly for oyster epicures, though; instead, the cryogenically ground, homogeneous bivalve tissue is intended for use as a base measurement in validating analytical determinations and calibrating instruments.

The oyster tissue is one of about 900 Standard Reference Materials prepared by NBS. The reference material, analyzed for concentrations of 30 elements, was requested and partially funded by the Food and Drug Administration out of a growing concern about contamination of marine animals used as food. Accurate data on pollution levels in bivalves now can be obtained by analyzing samples relative to the oyster reference.

PGI_2 synthesis: Fluorine to the rescue

Since the discovery in 1976 of prostacyclin (PGI_2), researchers have struggled to perfect synthetic analogs of this potent coronary vasodilator and inhibitor of platelet aggregation (SN: 8/12/78, p. 104). While a number of analogs have been prepared, none so closely resemble the potency and biological properties of natural PGI_2 as does the recently synthesized 10,10-Difluoro-13-dehydroprostacyclin.



Josef Fried of the University of Chicago, whose synthesis of this new PGI_2 is described in the March JOURNAL OF MEDICINAL CHEMISTRY, attributes his success to the introduction of fluorine. Fried's fluorine analog not only mimics "the powerful biological properties of natural prostacyclin," but it also boasts a half-life 150 times longer than nature's own PGI_2.

EARTH SCIENCES

Notes from earth

The U.S. Geological Survey offers a few items to reacquaint you with this rock we call home:

- The weight of the earth (defined as its own gravitational pull on its substance) is estimated at 6.588×10^{21}, or 6.588 billion trillion, tons. This is a revised estimate based on improved measuring techniques (SN: 6/16/79, p. 393). About 5.7 quadrillion tons of air hang around the earth's surface, which measures 197 million square miles.
- Though Christopher Columbus was right that the earth is not flat, it also is not perfectly round—it is more egg-shaped, called an "oblate spheroid". The rotation of the earth has forced more material toward the middle so that the equatorial diameter is almost 7,927 miles while the poles are slightly flattened and the polar diameter is 7,900 miles.
- Oceans cover nearly three-quarters of the earth's surface and account for about 97 percent of the world's water. All the earth's water — in the oceans, ice fields, lakes, rivers, soils, rocks and atmosphere — comes to about 326 million cubic miles. (One cubic mile equals 1.1 trillion gallons.) The single largest amount of water is tied up in the 6-million-square-mile Antarctic ice cap. If it were to release its 6.5 million cubic miles of water, scientists speculate that places like Washington, D.C. would be a puddle.
- Humans have literally only scratched the surface of our planet. The deepest drill hole to date is about 5 miles — only 0.00125 percent of the way to the center of the earth, which lies 4,000 miles beneath us.
- Unable to drill far enough, scientists have only indirect evidence of the nature of the earth's interior. From various sources, including rocks and minerals, the behavior of seismic waves and comparisons with meteorites and other celestial bodies, they have decided that the earth has three main parts: the crust, which varies from four miles thick beneath the ocean to 30 miles thick beneath mountains; the mantle, which extends from the crust halfway down to the center; and the core. The composition of the core is much debated but it is believed to be from 80 percent to 85 percent iron.
- The earth is believed to be at least 4.5 billion years old.

Oxygen portrait in charcoal

Oxygen probably did not exist in the early earth's atmosphere. Just when it did appear has been a point of considerable debate: Depending on the source of oxygen production they stress, different theories reconstruct widely varying oxygen levels. Now, English researchers M. J. Cope and W. G. Chaloner describe a way of checking the likelihood of those theories: charcoal.

Charcoal is formed by the incomplete combustion of woody tissues and depends on the burning of carbon monoxide and methane. The burning of these gases, in turn, is limited by the amount of atmospheric oxygen. Specifically, carbon monoxide combustion is limited by an oxygen level about 0.3 of the present atmospheric level — or about 24 percent — while burning of methane is limited by 0.6 of the present level. The presence of charcoal in sediments therefore indicates an oxygen level of at least 0.3 of the present level, the researchers say in the Feb. 14 NATURE. Available sediment records show that charcoal first appeared about 350 million years ago and has been present in the geologic record ever since. This evidence disputes one current theory that states that oxygen dropped below the charcoal-making level between 140 million and 250 million years ago, the Bedford College researchers say. Other reconstructions, however, are more compatible with the charcoal record. "Thus the recognition of charcoal in sediments offers a useful quantitative indicator of the oxygen content of the atmosphere from [350 million years ago] onward."