

space) over a wider bandwidth. This, in turn, would make the signal seem "noisier" at any given part of the band, making it difficult to extract a possible message without unreasonably long monitoring times to "integrate" the signal into a cleaner picture. A better bet, the researchers suggested, would be millimeter wavelengths, which would be less refracted by the ionized clouds, and thus less Doppler-shifted and smeared at the receiver. A wavelength of about 4 mm, says Drake, would be an optimum balance between low noise and narrow bandwidth.

But what about some symbolic significance that might prompt the sender to choose a given particular wavelength? The constraints on differing wavelengths are matters of degree, so there would seem to be some room for choice.

One candidate has now been suggested by N. S. Kardashev of the Soviet Space Research Institute in Moscow, writing in the March 1 NATURE. His proposal is the wavelength of 1.47 mm, corresponding to a frequency recently calculated to be 203.3849 gigahertz. This, says Kardashev, represents a spectral line that could be seen as even more fundamental than the 21-cm hydrogen line. It corresponds to the splitting of the ground state of what Kardashev calls "the lightest atom" — positronium. "Positronium," he says, "forms by recombination of an electron and a positron, and is about 1,000 times lighter than a hydrogen atom. Laboratory investigation of positronium provided some of the basic evidence for the validity of quantum electrodynamics." Furthermore, he adds, "the lifetime of this atom is very short because of the annihilation process, so a high concentration could hardly be expected in natural cosmic conditions."

Besides singling out a specific candidate wavelength, Kardashev adds other reasons for liking the millimeter region in general. First, he says, it represents a spectral region of minimum brightness temperature. "For lower frequencies [the longer wavelengths]," he says, "the temperature increases due to synchrotron radiation, [and] for higher frequencies, due to radiation of dust and stars." Second, he adds, it is a spectral region of minimum absorption and scattering. This would be of advantage to senders hoping to make the most of their transmitter power by sending in a narrow beam.

Some equipment already exists that is capable of searching for millimeter-range signals, Kardashev points out. However, such searches have been on limited scales at any wavelengths, and the National Aeronautics and Space Administration's proposal for a coordinated facility to do the work was cut from the FY 1979 budget by Congress and does not appear in the FY 1980 plan. Without some such all-sky, all-wavelength approach, strategies like those of Kardashev and others are likely to play a significant role in guiding the ears of earth. □

New therapies, new forms of an old vitamin

The sunshine vitamin, turned hormone, is offering dramatic results in therapies for bone-destroying diseases. Vitamin D and its derivatives produced in the body are a new endocrine system based on an old vitamin, Hector F. DeLuca told a science writers' seminar in New York sponsored by the Endocrine Society. In his laboratory at the University of Wisconsin, DeLuca and collaborators have just discovered three new vitamin D metabolites, and clinicians around the world are investigating therapeutic uses of previously identified metabolites.

Perhaps the most important current clinical investigations are trials of a vitamin D derivative as a treatment for the bone breakdown disease osteoporosis. Promising early results suggest that the vitamin D compound may replace estrogen as treatment for the disease, suffered by more than 20 million persons in the United States.

Vitamin D, either produced in the skin by sunlight or acquired from food, is required in the calcification of bones. In children, a deficiency of the vitamin interferes with bone growth, and in adults deficiency prevents the continual bone remodeling that mends "microfractures." However, simply adding vitamin D to the diet does not cure all bone disease. The body must convert the vitamin to its active forms, and some diseases result from defective processing. In addition, a hormone from the parathyroid gland, together with a vitamin D metabolite, governs release of calcium from bone. By administering laboratory-synthesized vitamin D metabolites, clinicians are bypassing problems of hormonal deficiencies and defective metabolite production.

The Food and Drug Administration has recently approved the use of 1,25-vitamin D (1,25-dihydroxyvitamin D) to promote bone growth and maintenance in patients with bone disease due to kidney failure. In healthy persons, that metabolite results from two processing steps in the body. Vitamin D is first converted in the liver to 25-hydroxyvitamin D, the form that circulates in the blood. Then the kidney changes that compound into the active hormone 1,25-vitamin D. Thus, vitamin D by itself cannot help the 200,000 Americans with chronic kidney failure; but long-term oral therapy with 1,25-vitamin D can have a dramatic effect. In children with kidney failure, the treatment tripled their growth rate (SN: 2/25/78, p. 123).

The 1,25-vitamin D is also being examined in two double-blind clinical trials on older patients with osteoporosis. With age, ability to absorb calcium decreases, as do the blood levels of 1,25-vitamin D. Researchers find, in addition, that post-menopausal women who have small bone fractures have lower blood levels of the hormone than those with intact bones. In the

clinical trials, small doses of 1,25-vitamin D improved the calcium absorption and balance in post-menopausal women with small fractures. A new treatment for osteoporosis is particularly welcome because the current treatment, estrogen therapy, has been associated with an increased uterine cancer risk (SN: 12/2/78, p. 389).

Premature infants, as well as elderly women, may benefit from therapy with 1,25-vitamin D. Such babies are born with immature systems for calcium absorption, and they generally show low calcium levels and slow bone growth. Although the result has not yet been firmly established, DeLuca says, two studies show 1,25-vitamin D effective in promoting bone growth in premature infants.

Other patients who eventually may be helped by the metabolite are those taking glucocorticoid hormones for various diseases and patients on blood dialysis. Both treatments can decrease calcium absorption leading to thin bones. Glucocorticoids lower 1,25-vitamin D levels in the blood, and in a trial now underway the vitamin D derivative is being administered to patients taking glucocorticoid hormones.

Israeli researchers led by Shmuel Edelstein of the Weizmann Institute report another metabolite, 24,25-dihydroxyvitamin D is also required for bone formation. They believe that metabolite may be useful in promoting healing in elderly fracture patients. However, DeLuca contests their conclusions, saying they have not clearly demonstrated an effect separate from that of 1,25-vitamin D.

The researchers continue to look for other vitamin D metabolites and actions. Among the latest findings are a lactone of vitamin D, made from the circulating blood form. That lactone was found during vitamin D intoxication and may be an excretory product. Other recently discovered compounds are carboxylic acids, one (24-carboxylic acid vitamin D) made in the kidney and the other (1-alpha-hydroxy, 23-carboxylic acid vitamin D) in the liver and intestine. The latter compound has now been synthesized in DeLuca's laboratory, and the biochemists are beginning tests to find its biological function.

When rickets was prevented by vitamin D fortification of foods more than 50 years ago, scientists thought they knew everything concerning the vitamin, DeLuca says. But the more recent work reveals a complex system, interrelating with other hormone systems. DeLuca explains, "We are just beginning to learn in which disease states the vitamin D system is disturbed and in which disease states the judicious administration of the synthetic sources of the active hormone 1,25-vitamin D or its precursor 25-vitamin D could be beneficial." □