

Optimal optical communication

Fiber optic communication, that is, the transmission of messages by light waves in special fibers, is becoming more of a practical technology. Systems that actually transmit messages in this way are under test in a number of the world's telephone systems. Their performance seems to be feeding the enthusiasm of those who advocate their use, and such people freely predict that fiber optics will be the best or the only way to provide the number of channels that future communications traffic will require.

It happens that light wavelengths between 1 and 1.6 micrometers (roughly red to infrared) experience optimum transmission through the silicon-based fibers that are being used. Attenuation of the power of the light waves by the fiber material reaches a minimum at 1.53 micrometers; dispersion or spreading of the pulses is at a minimum at 1.3 micrometers. Dispersion tends to govern the spacing of the repeaters, the circuit elements that periodically restore the shape of the pulses. Repeaters are costly and require maintenance occasionally. The fewer of them the better. 1.3 micrometers seems to be the optimal wavelength to use.

Yet, until recently the fiber optic systems under test used much shorter wavelengths, often about half that. The reason was that lasers capable of producing light of this wavelength and coupling it into a fiber were not available. Now they are, and two systems using 1.3 micrometer light have been successfully tested. One is in Japan, in the suburbs of Tokyo, the other in the United States, in the suburbs of Washington, D. C. First reports on both were delivered this week in San Francisco at the Third International Conference on Integrated Optics and Optical Fiber Communication. Eiji Iwahashi of Nippon Telephone and Telegraph's Yokusuka Electrical Communication Laboratory described the Japanese system. Whit Cotten of Digital Communications Corp. in Germantown, Md., speaking for himself, R. DeWitt of Continental Telephone Co. of Virginia in Middleburg, Va., J. Hwang of General Optronics Corp. in South Plainfield, N. J., and G. Gibbons of Plessey Research Limited in Caswell, Towcester, England, related the American experience.

The American system is what is called an inter office trunk. The Japanese line qualifies as a long haul in telephone system terminology. It runs from the Musashino Electrical Communications Laboratory to the Fourth Electrical Communications Laboratory by way of four central offices, Kokubunji, Hachioji, Sagami-hara and Atsugi, for a distance of 76 kilometers. The American line, installed for Continental Telephone Co. of Virginia, is 17.1 kilometers between a toll center in Woodbridge,

Va., and a central office in Triangle, Va., by way of the Dale City central office.

Installation for the Japanese line began in October 1980. The Virginia one is about contemporary with it. Both lines have operated with power loss and information loss at or below expectation. The American line has no repeaters in its length. The Japanese line averages about one every 20 kilometers. Even longer distances between repeaters seem possible.

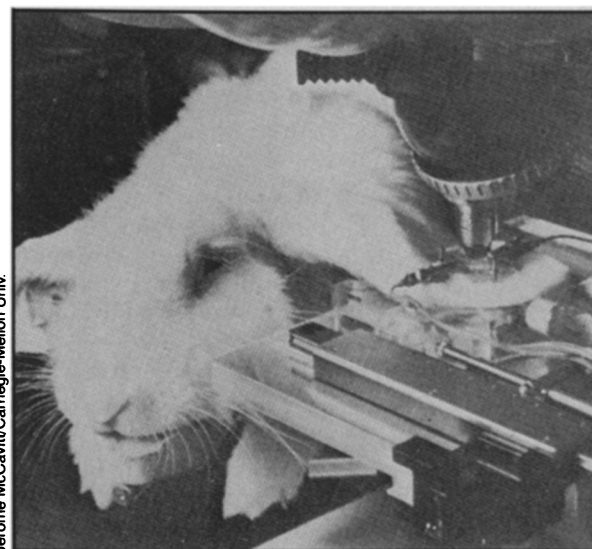
Light transmission of this character permits a high rate of information transmission. Higher rates of information transmission permit a larger number of channels for simultaneous transmission of messages in the same line. Information transmission is counted in "bits" per second. The Japanese installation is rated at 400 megabits per second, the American one at 44.7 megabits per second. The American figure is about the bit rate for this kind of inter office trunk in current practice. The Japanese figure is very large, but Nippon Telephone and Telegraph believes that it will need such a capacity in its future long haul line. It proposes to begin working this technology into its long line system by 1983.

Laser development makes it possible. Lasers have to be what is called heterostructures, alternations of different materials with different electronic qualities precisely put together. They have to be stable, reproducible, and they have to function at ambient temperatures. The American group credits the new technique proton implantation, whereby protons are fired into the material to come to rest in predetermined places and alter its qualities there, with making the lasers possible. So stable and reproducible are the lasers now that General Optronics, which provided the lasers for the American experiments, announced during the meeting that it is starting to market a commercial line of them. □

End to gene-splice rules?

A subcommittee has been set up to consider whether the regulations governing experiments using recombinant DNA should be made voluntary. At the recent meeting of the Recombinant DNA Advisory Committee of the National Institutes of Health, two biologists proposed removing all penalties for failure to comply with the NIH guidelines and reducing further the recommended precautions. Most members of the committee were in favor of the deregulation, but some worried that public distrust of genetic engineering persists. Representatives of the institutional biosafety committees have also recommended substantial decreases in safety requirements (SN: 12/6/80, p. 357). The advisory committee voted to study the proposed deregulation and solicit public comment. A decision is expected at its September meeting. □

Hyperthermia's hot spot is engineering



Jerome McCavit/Carnegie-Mellon Univ.

Rabbit's ear is window to tumor studies.

The hundreds — some say thousands — of years old practice of attacking cancer with heat, hyperthermia, is undergoing a renaissance (SN: 8/30/80, p. 141). Yet in many ways, how and why it works is still a mystery. In fact, until recently, thermal prescriptions — how much heat to apply, for how long, to which parts of the body and by which means — amounted to little more than educated guesses. But mathematical models are crafting a revolution in hyperthermia dosimetry. And this week, Rakesh Jain of Carnegie-Mellon University, a leader in developing those mathematical models, described tools his lab has developed for establishing baseline data being used to assess the safety and efficacy of hyperthermia treatment.

Blood supply in most solid tumors is only a fraction — perhaps a tenth to fortieth — of that in normal organs, Jain explains. So when heat is deposited in tumors, it is dissipated — cooled by blood flow — much less quickly than in normal tissues. Ideally, Jain says, hyperthermia treatment should be designed to capitalize on that. And that's one reason there has been interest in glucose therapy as an adjunct to hyperthermia.

"We know that when pH is lowered some tumors become more sensitive to heat," Jain explains. "We also know that when the blood flow rate is lowered, heat does not escape from a tumor as quickly. By injecting glucose, we have found that we can both lower the blood flow rate and increase the pH difference between normal and cancerous tissues, thus making the tumor much more sensitive to hyperthermia."

Tests of the glucose therapy showed that the technique works beautifully in helping shrink or eliminate the primary, or original, tumor in rats treated with hyper-

thermia. There is one major drawback, however, as Jain reported at the American Association for Cancer Research meeting this week: The animals' lifespans decrease. "What we found," Jain told SCIENCE NEWS, "is that metastases [cancer cells that split off from the original tumor to spawn new ones elsewhere] grow much more violently, much more easily, when you give glucose."

While the finding dampens prospects for using glucose in hyperthermia, it serves to showcase some of the engineering used to develop such data.

Take the thermal probe, a thermistor with attached wires. Tiny thermistor (resistor) beads are surgically implanted into the flanks of rats along with a slurry of cancer cells. Later, when a tumor forms the probe will be part of it, permitting monitoring of its changing thermal environment without traumatizing — such as bruising — surrounding tissue each time an experiment is conducted.

Probes can measure tumor temperature directly, or be heated to a temperature just above that of the ambient tissue. A reading of the power level needed to maintain the temperature gives an indication of the blood flow rate by signaling how fast the tumor gains or loses heat.

The Carnegie-Mellon team also pioneered use of glass slides in rabbit ears to view tumor growth in living animals. A half-centimeter hole is cut in a rabbit's ear and enclosed on either side with glass windows. Several million cancer cells are then inserted into the chamber. As they grow, a protein they produce induces nearby blood vessels to grow toward them. Jain calls the glass chambers "a very powerful tool. It allows us to observe directly how blood flow, mass flow and tumor growth are affected by drugs and heat in a living organism. We actually place the rabbit's ear under the microscope, videotape what is occurring and make detailed measurements which are analyzed by computer."

The goal of this and related work is better data from which to computer-model effective, and more important, safe hyperthermia treatment — something perhaps no more than a few years away. □

Interferon in another bug

A third microorganism has been genetically engineered to produce human interferon. The Cetus Corp. of Berkeley, Calif., has announced that interferon is being made in the soil bacterium *Bacillus subtilis*. This bacterium is considered more useful industrially than the widely used *Escherichia coli*. And it may be safer because it is not naturally associated with mammals as is *E. coli*. Human interferon genes were first shown to function in *E. coli* last year (SN: 1/26/80, p. 52) and more recently in yeast (SN: 3/7/81, p. 148). □

Sexual development and teen drinking

Chronic use of alcohol may delay sexual maturity in male adolescents. That's this week's sobering news for the increasing number of high school-age youths who drink.

Robert A. Anderson Jr., assistant professor of physiology and biophysics at the University of Illinois at Chicago, reported his findings at this month's meeting of the Federation of American Societies for Experimental Biology in Atlanta. Anderson put 18-day-old mice on a liquid nutrient diet and after two days added a five percent ethanol solution to the diet of an experimental group. After 29 days of the liquid diet one-half of the mice in both groups were examined. Significant deficiencies in sexual maturation were found among the mice who regularly ingested alcohol. They had smaller reproductive organs than the control group and their sperm showed a higher incidence of ab-

normalities and were less effective at fertilization. The age period under study, from 20 to 49 days of age, is roughly comparable to adolescence for mice.

The rest of the mice continued to undergo treatment for a total of 43 days. It was found that the alcohol-fed mice reached the same levels of sexual maturity as the control group and all measurements of fertility were approximately the same.

A few experiments have studied the relation of alcoholism to male infertility (SN: 11/4/78, p. 311), but Anderson said that there are no studies on the effects of continued alcohol use from adolescence through adulthood. "All we can say at this point," he told SCIENCE NEWS, "is that the use of alcohol during adolescence may delay sexual maturity."

Certain enzyme and hormonal changes are necessary for males to reach sexual maturity. Anderson says he plans to study how alcohol acts on the production of the male sex hormone testosterone. Chronic drinking may slow testosterone production and delay maturity. □

Court restricts rights of retarded

In an April 20 decision, the Supreme Court ruled that federal law does not give mentally retarded persons the right to be treated outside large state hospitals. The 6 to 3 decision overturned a lower court decision in favor of a group of patients at the Pennhurst State Hospital in Spring City, Penn. The patients argued that the Developmentally Disabled Assistance and Bill of Rights Act of 1975 had been violated by inhumane conditions at the hospital.

The law, which last year channeled \$65 million to the states for care of the retarded, contains a "bill of rights" section that describes the right of a retarded person to an "appropriate treatment" in an environment "that is least restrictive of the person's liberty."

But the Court ruled that Congress, in passing the law, had done no more than provide funds "to encourage, rather than mandate, the provision of better services" to the mentally retarded. The Pennhurst patients demanded relocation to local treatment facilities, but the Court said that Congress did not impose a requirement of care outside of state hospitals as a condition of eligibility for federal money. The opinion added that the law did not create any new constitutional rights for mentally retarded persons in state institutions. The justices stressed that they were not forbidding Congress to strengthen the 1975 law by designating specific types of treatment as a condition of federal financial help.

The dissenting justices argued that Congress had laid down clear requirements on the right of the mentally retarded to treatment in settings that give them maximum personal freedom. The

"bill of rights" section "cannot be treated as only wishful thinking on the part of Congress or as playing some fanciful role in the implementation of the act," the dissenters continued.

The decision is likely to affect other lawsuits by advocates for the retarded against New York, New Jersey and Connecticut. The Supreme Court has asked the Federal Court of Appeals for the Third Circuit to consider several further issues in the Pennhurst case, including whether the 1975 law gives disabled persons the right to bring private lawsuits in the first place and what penalties may be imposed on a state for failing to meet the law's conditions.

Vincent Gray, executive director of the Association For Retarded Citizens Inc. of D.C., a Washington-based organization, said that he is disturbed by the Court decision although its impact will vary. Some states, along with Washington, operate under federal court decisions that mandate the right to local treatment for retarded persons. These decisions are not based on the contested Developmentally Disabled Assistance Act and will not be affected by the new Supreme Court ruling. "But states with no laws specifying local treatment for the retarded are in deep trouble now," said Gray.

In another controversial case, the Supreme Court agreed to hear an appeal by the State of Massachusetts of a 1979 federal court ruling that patients who are involuntarily hospitalized for illness have a constitutional right to refuse medication (SN: 4/11/81, p. 230). The case, *Okin v. Rogers*, grew out of a suit by seven patients at Boston State Hospital. □