Lasers will reduce the risks in surgery and aid cancer treatment

by Marsha Freeman

For the past few years, intense, narrowly focused beams of laser light have been used by surgeons to perform the most delicate and high-risk operations. Using as a cutting tool the laser, which is always "sharp" and also perfectly sterile, doctors have been able to treat various disorders on which conventional surgery cannot be used due to the high risk to the patient.

Glaucoma—the build-up of fluid in the eye—has been treated by using bursts of laser-generated light. To treat this eye disorder, doctors have made up to 2,000 tiny laser burns through the pupil of the eye and the back portion of the retina. The fluid drains from the eye, relieving the built up pressure. This procedure can be done in the doctor's office in about twenty minutes, using a local anesthetic.

But the most exciting experimental medical applications of lasers are not those based on the intensity of the laser radiation, but those which use the laser specifically as a source of light.

Using laser light

Photo-radiation is a method for treating cancer with lasers, now under investigation in the United States, Australia, and Japan. The patient is injected with a "photo-toxic" chemical called hematoporphyrin (HPD) which, when exposed to light of a particular wavelength, produces a poison which destroys the cancerous tissue. The HPD lodges preferentially in the malignant tissue, which is then irridated with the appropriate light and destroyed. Unlike the radiation therapy used widely today, photo-radiation therapy harms only the diseased tissue and does not produce unwanted side-effects.

According
Memorial Institute in Buffalo, New York, this treatment is especially effective on patients on whom every other kind of treatment has been tried without success, "and on patients who simply cannot tolerate any more radiation therapy because of the side effects."

Another experimental medical application of laser light is its use in the diagnosis of disease. Animals have been used to test a "laserscope" which could locate diseases of the lungs. This technique would combine laser medical technology with laser communcations technology. Fiber optic cables could be used to pipe light into the body for complete diagnostic use.

The patient is injected with a chemical that is photo-sensitive, that is, it fluoresces or glows when hit by light. This photo-sensitive chemical is preferentially absorbed by diseased tissue and the doctor can locate this tissue by simply "looking" for the glowing light.

Last September Dr. Garrett Lee of the University of California at Davis announced a technique of using laser light to destroy fatty deposits of cholesterol that block arteries. The light was delivered through a laserscope, made up of a bundle of optical fibers. This technique has already been used successfully on animals.

The laser future

As in the case of using laser energy for the cutting of metals, rubber, plastics and other materials, it is likely that lasers will eventually replace the cutting tools in medicine. Intense coherent laser radiation is used today to destroy cysts, remove life-threatening tumors and growths, vaporize blisters, and perform other delicate surgical tasks. Not only does the laser cut more finely than conventional methods, it also cauterizes as it cuts. The heat from the laser beam seals off small severed blood vessels, reducing the amount of bleeding. Doctors report that, if used properly, the laser can be the safest form of surgery. While it is still a matter of speculation to consider specific future uses of lasers, one conceivable option is for totally "non-metallic" surgery for virtually every operation.

Laser chemistry is a field still in its infancy. It involves the use of finely tuned laser light (requiring a "tunable" laser) to stimulate one particular atom or molecule to react in a chemical reaction. The laser industry is developing tunable lasers that use liquid dyes, similar to the dyes used for fabrics.

These dye lasers can be made to produce very pure laser light of different wavelengths, allowing one laser to shine light of different colors into chemicals at alternating times, to stimulate specific chemical reactions and recombinations. It is possible that these kinds of controlled chemical reactions will create new classes of medicines and organic chemicals for medical uses that do not now exist.