A LITTLE SCIENCE WITH A BIG FUTURE

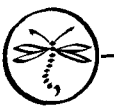
By O. A. Battista

MICRURGY is a little science with a big future. It's small because it deals exclusively with things that can't be seen with the naked eye. It's potentially big because it deals with things that affect health and life and comfort. And it's interesting because it takes man into a Lilliputian world.

Micrurgy is the science of using super-midget tools to explore the little things of life that can be seen only with a microscope. You can ruffle the hairs on a human hair with micrurgy. You can shoot a hypodermic into a living cell or do a surgical job on a bacterium. Treacherous microbes may be captured and held in place as they wriggle desperately in a vain attempt to escape the dissecting scalpel of the micrurgist. Splitting hairs is an easy job with the new pint-sized pigmy tools. A complete chemical analysis may be performed on a pinpoint of blood, or a sample of a new synthetic vitamin or hormone which would take up about as much space as one good sip of nectar by a thirsty honeybee. A whole kit of micrurgy tools would fit into an eyewash cup. And the lightest direct human touch would be like a hammer blow in their operation.

Men who have written love letters on the back of a postage stamp, or scratched the national anthem on a pinhead with a tempered steel needle, used capital letters in comparison with some of our modern scientists. The micrurgist uses chisels, hammers, saws, magnets, hypodermic needles, scalpels, brushes and rakes in conjunction with an instrument called a micromanipulator. This machine holds the tiny tools and moves them delicately by screw adjustments.

Entirely new species of fruit flies, grasshoppers, fruits and flowers have



been initiated on an experimental scale by these new techniques. Many new botanical and zoological hybrids or monstrosities will be brought into being by the application of microsurgery on germ cells. There seems little doubt that someday scientists will be able to tailor a plant to meet certain requirements; cultivate a three-colored rose, a seedless apple, or a stingless bee!

The bread of tomorrow is expected to be smoother tasting, more uniform in texture, and have greatly improved, all-round palatability thanks to the work of a young researcher in the laboratory of a large yeast manufacturing company. With a pair of microtweezers and a micromanipulator, this young scientist recently succeeded in capturing a single cell of yeast from a highly refined culture.

Ordinarily, yeast consists of millions of hybrid cells whose individual diameters are measured in millionths of a meter. A genuinely thoroughbred strain of yeast was never developed because it had not been possible to start out with a single yeast cell. Micrurgy now makes possible the manufacture of newer, purer strains of yeasts which are expected to play an important role in improving the "staff of life."

On a recent weekend, I stopped in to see Dr. Robert Chambers, Emeritus Research Professor of Biology at New York University. I made the visit because Dr. Chambers is a micrurgy pioneer. He is one who uses his naked eye only to gaze at the outside world, knowing that this organ can see things only if they are about 1/200th of an inch or more in size. Under the ordinary microscope, Dr. Chambers and his associates in micrurgy can see an invisible world. This world is magnified about 2,000 times by an ordinary microscope. With microscopes using ultra-violet light, it is magnified up to about 5,000 times. And with the new electron microscopes, it is magnified about 100,000 times!

To the micrurgy scientist this expansion of vision isn't enough. He wants to poke and probe and cut and generally work with magnified material. Using the latest micrurgical equipment, it now is possible to tear apart single particles of dust, to study the toxicity of chemicals on any given type of body tissue, to perform chemical analysis on pinpoint specimens or to help track down criminals by digging for clues on a suspect's clothing.

Of course, as Dr. Chambers points out, these are just a few of the things for which this new science may be used. "The full value of micrurgy," he says, "as applied to biological and industrial problems is yet to be appreciated. But it undoubtedly will assume ever-increasing importance to investigators of the microscopic worlds. I dare say that eventually the new techniques may become as important to

the microspecialist as a pole which would reach the surface of the moon would be to an astronomer."

MICRURGY already has helped to solve many problems. For example, Dr. Chambers and his associates have devoted much of their efforts to exploration of the life processes. Until recently, the little packets in each life cell holding the hereditary factors of an individual have remained beyond the reach of man. Nature sealed them in an almost tamper-proof package. Now micrurgists try to isolate individual cells and to dissect them so that their 48 chromosomes can be altered.

Using a micrurgical hypodermic needle, Dr. Chambers already has demonstrated that each life cell is covered with a tough membrane. He demonstrated this fact (long known to science) by injecting dye into the cells with a tiny needle. The color remained locked in the cell; it refused to diffuse to adjacent cells. This membrane which protects the cell is extremely tough. Often it is difficult to cut even with micrurgical scalpels or needles.

"At one time," Dr. Chambers explains, "I thought of using a bee's stinger to inject chemicals into certain cells. But after I assembled this natural hypodermic needle in my micromanipulator, it proved to be much too blunt."

Valuable information is being obtained by breaking membranes of cells and examining their rate of repair under the stimulation of various chemicals. This, obviously, will lead to knowledge in healing medicines. Similarly the toxicity of foods can be determined by watching the effect of the food on the individual cells. Cells try to eject a toxic substance. Micrurgical science studies this ejection, tries to discover just how much poison a cell can take.

With microneedles, hooks and scalpels, the micrurgists perform delicate surgical feats. They operate on delicate eye tissue and on brain tissue. They even hold bacteria in check mechanically while these operations are being performed.

Micrurgy has been used by some microspecialists to win patent suits, to measure the elasticity of gels, to study the surface of metals, and in many other ways.

"As the value of working with tiny tools under the microscope becomes universally recognized, micrurgy will grow," says Dr. Chambers. "At present the specialized equipment and techniques are fostered only by a handful of experts."

Some day the work of the micrurgist will parallel that of the astronomer, only at the other end of the dimensional scale. Instead of exploring stars, which are hundreds of millions of miles away, with powerful telescopes, the men behind the microscopes will examine the little things in life. But their work, in the end, should be of far greater importance to man.

THOSE FABULOUS SPINNERS

By Vance Hoyt

PERHAPS you do not like spiders; most of us don't. But much can be learned from the wonders they perform and the good they do in destroying vast numbers of harmful insects.

Although more abundant and diversified in the Tropics, spiders range far into the Arctic regions and are found almost everywhere that earthly conditions will sustain life. Two tiny eight-legged mites, primitive relatives, were recently discovered thriving on lichen moss in the Boreas area of Queen Maud Land in the Antarctic. Even far up on Mount Everest, at an elevation above 22,000 feet, small black species of spiders have been found living among the wind- and snow-swept rocks, making them the world's highest thriving land animals.

Spiders constitute a large family of some 25,000 described species. They are not insects but arachnids, possessing lungs and eight legs in place of six. Originally all spiders had eight eyes but many lost one or more pair. Some cave-dwelling species are even blind.

The big South American tarantula, *Theraphosa leblondi*, is the giant species of spiderdom. It is almost three and one-half inches long, and large enough to capture a fair-sized bird. Its bulk is more than 100,000 times that of the smallest of the spider clan, *Olgunius obectus*, which is barely one-twenty-fifth of an inch in length. This spider is also a South American inhabitant.

Our only native poisonous spider is the black widow, *Lactrodectus mactans*, whose nonsticky and elastic thread, when split to measure about .00005 inch in diameter, is used as "crosshairs" in such precision instruments as bombsights and telescopic gunsights. The average life span of the Black Widow is about one year; and not until adulthood does the female become either black or a widow. It is then that the ominous hourglass-shaped red or yellow spot appears on the underbelly and the female becomes highly poisonous. Her bite, however, is not necessarily deadly. To some persons the venom is almost entirely harmless. Others may die if proper treatment is not given immediately.