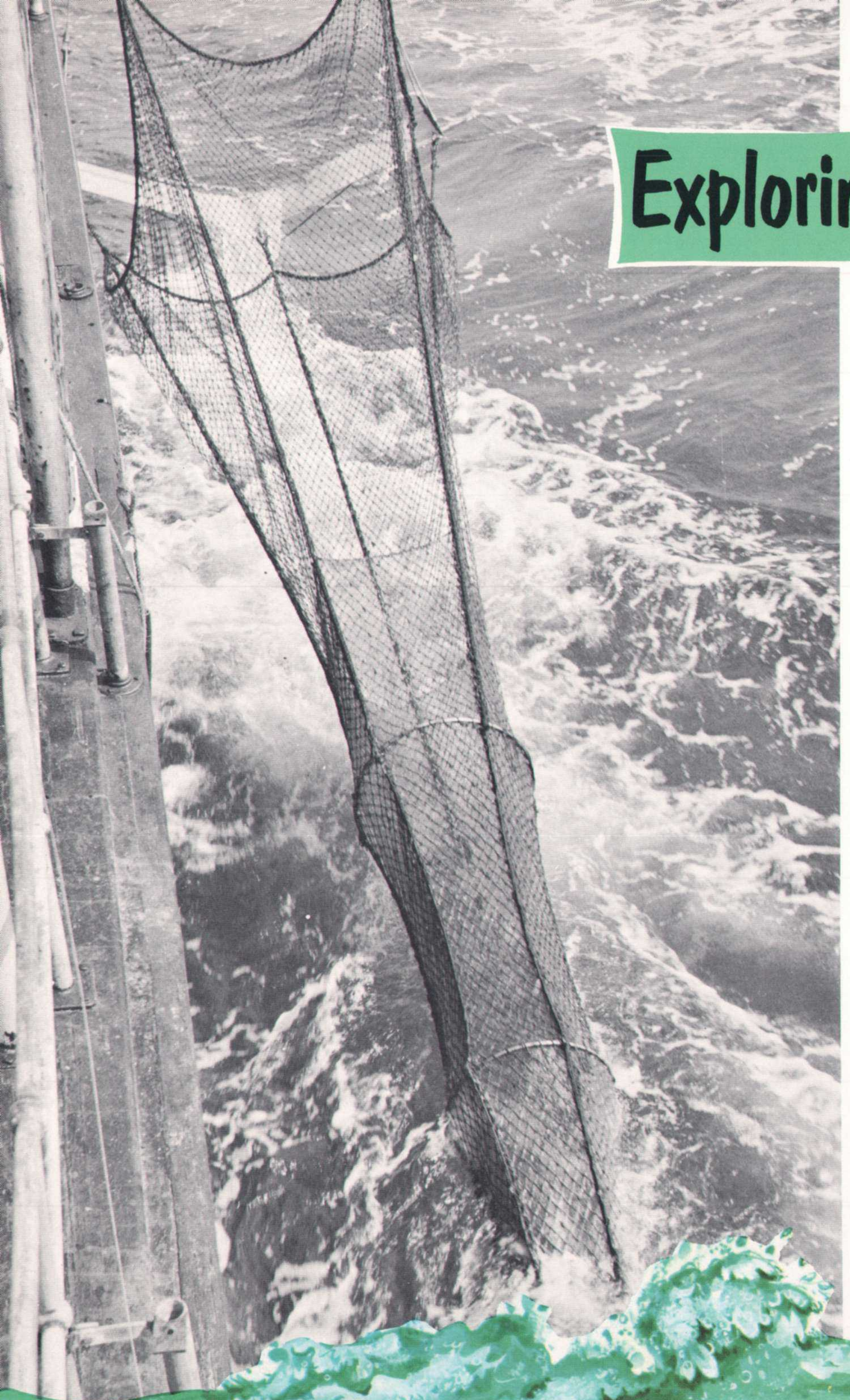


Exploring Ocean Depths

What's There? How Does It Affect Us?

The oceans, covering three-fourths of the earth's surface, hold enough food to feed the world population, and hold more gold and other minerals than ever have been mined on land.

They hold enough of the sun's heat to greatly affect air temperature, wind force, and cloud formation.

From prehistoric times they have been vital means of transportation; and now they make a hiding place for atomic submarines.

And yet, in spite of the influence oceans have on such things as weather, food, wealth, and military defense, not much is known about their mysterious depths — particularly those of the Pacific off Oregon's 350-mile shore.

But today, filling in gaps of knowledge, are members of OSU's comparatively new oceanography department, headed by Dr. Wayne V. Burt. With almost $550,000 a year from the Office of Naval Research, the National Science Foundation, the Atomic Energy Commission and the U. S. Air Force, these researchers work from an especially built $250,000 laboratory vessel, the *R. V. Acona*. They are cooperating in a 10-year national program to get basic information about deep ocean areas and water, the coastal shelf, and the ocean floor around the U. S.

The aim is to find out what is in the sea and how its contents affect us. They want to know:

- What the floor is made of and its shape.
- What the water temperature is at various levels and places.
- What amounts of salt, oxygen, silt, sawdust, industrial wastes, and sewage are at various levels and places.
- What plankton (tiny plants and passive, floating sea animals), fish, oysters, clams, and other sea life are present.

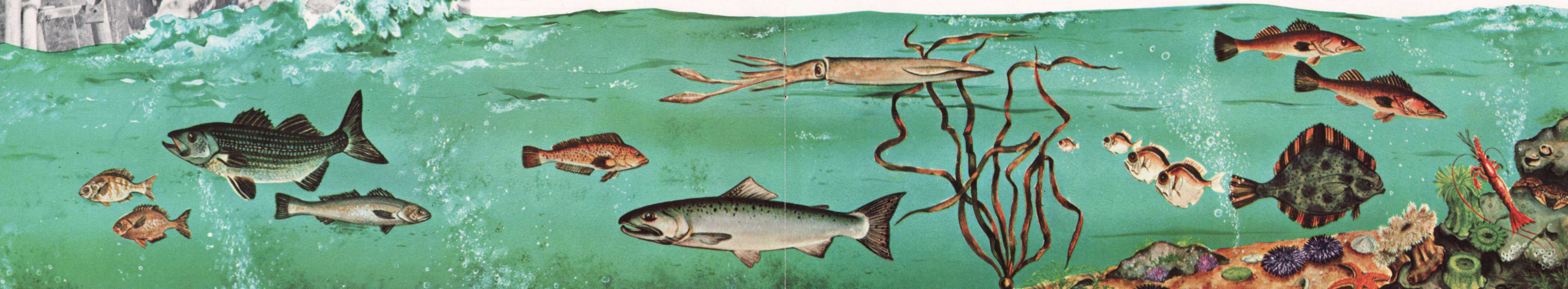
The oceanographers will organize their information into maps of the sea bottom, charts of water currents, and catalogs of contents. Then they hope to determine some of the causes of features observed.

Information obtained can be used by such fields as weather forecasting, defense, food, waste disposal, mining, and engineering.

In the nearly three years of research, the OSU oceanographers have found, among other things, that the ocean bottom off the Oregon coast is as rough as the nearby land. Also, they have found that the marine organisms are usually northern types (like those in the Gulf of Alaska), but that sometimes more southerly types are found like those near California.

This finding of both northern and southern types must be related to a curious thing that happens to the ocean currents off the Oregon-Washington coast. Here the drift of water eastward across the Pacific separates into two distinct currents, and each carries its own kind of water. Cold, diluted water flows north along British Columbia; warmer, saltier water flows south along California. This area of separation is a dynamic feature. It moves in position and its characteristics change from time to time, but no one knows yet just how much or why.

The *Acona* has a rich field for exploration right at her Newport harbor exit.



Molecular

What Is Matter?

Of what is the material world made? Of kinds of substances, or matter, say scientists.

But what is matter?

Usually it is combinations (molecules) of exceedingly small, chemical building blocks (atoms).

Scientists have identified and named over 100 kinds of atoms. Each element in the world is made up of only one kind of atom; that is, the element oxygen is made up only of O atoms, carbon is made of only C atoms, and so on.

The more than 100 elements combine with each other in seemingly countless ways, building little structures called molecules. Thus, for instance, when one C atom and two O atoms join they create a molecule of carbon dioxide; when six carbon atoms and six hydrogen atoms join they form a molecule of benzene, and so on.

Thus any substance, or matter, is made up of a great mass of identical molecules.

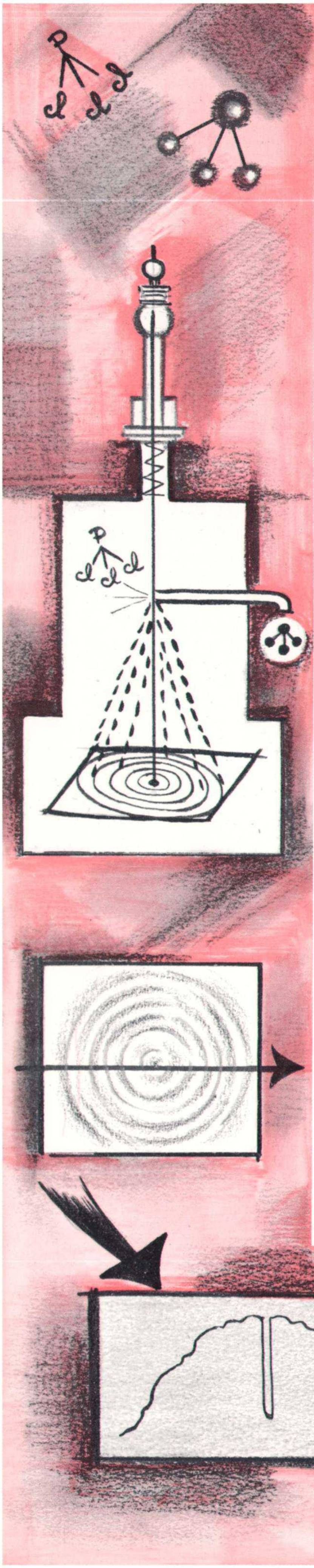
Investigation of molecules has not been easy because they are so small — much smaller than living cells. We can see cells, magnified through a microscope; but no person ever has been able, even with a microscope, to see a molecule.

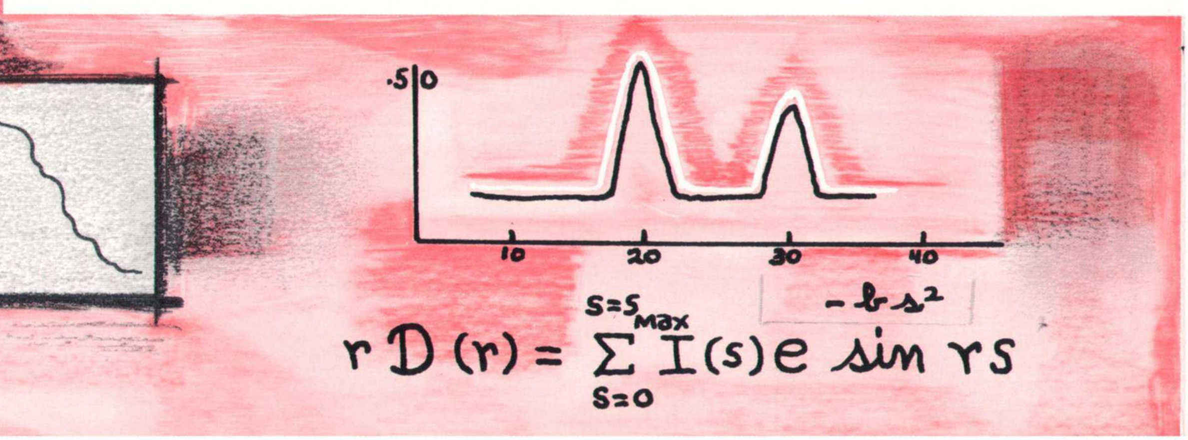
In spite of this, some scientists — including Dr. John C. Decius and Dr. Kenneth W. Hedberg, chemists at OSU — have a compelling curiosity to know more about how the world about us is made up out of atoms.

With newly developed laboratory equipment Dr. Decius is able to get molecular fingerprints (lines on a graph); and in another project Dr. Hedberg is able to get molecular shadow patterns on a photographic plate.

With information gained from the fingerprints and the shadow patterns, the chemists use mathematical analysis to locate — accurate to one-hundred-billionth of a centimeter — each of the atoms in a molecular structure. Also, with this information, the scientists are able to figure the strength of bonds between atoms.

Human eyesight is limited to the seeing of objects as large as or larger than the wavelength of visible light. Since a molecule is a thousand times smaller than this wavelength, it is not "picked" up by these waves. However, in the entire spectrum other waves do have small enough wave-





Architecture

Of What Does It Consist?

lengths to "pick up" separate molecules, and such waves are used by OSU apparatus.

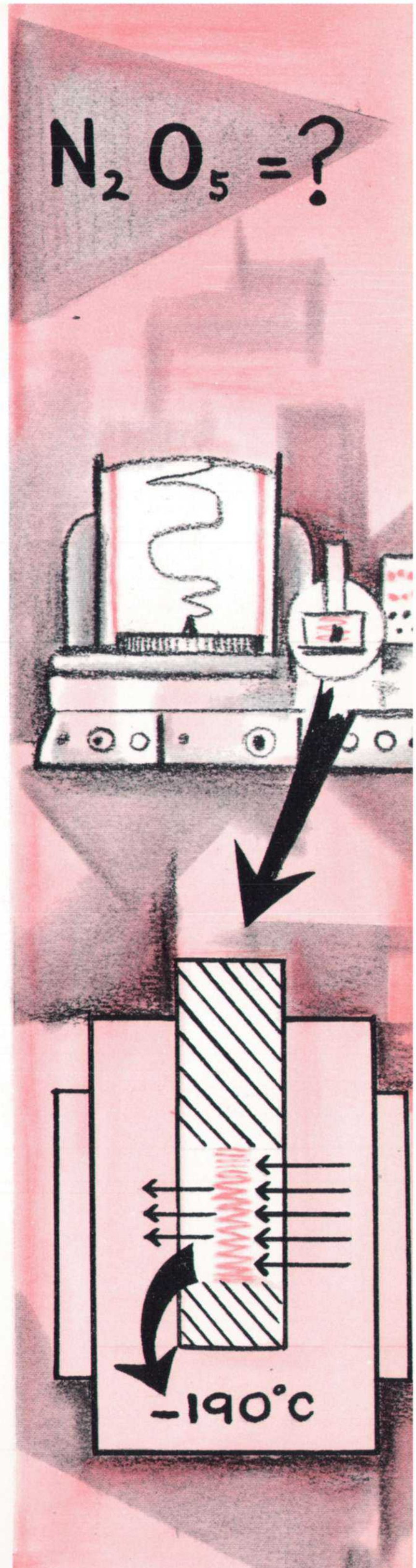
Dr. Decius uses a newly purchased $16,000 infrared spectrometer, beaming infrared light waves at samples placed in the instrument. Different rays are absorbed by each kind of molecule, and the absorption is recorded as a line on a graph. Valleys, peaks, plateaus, and squiggles of the line always take the same pattern (fingerprint) for the same kind of molecule.

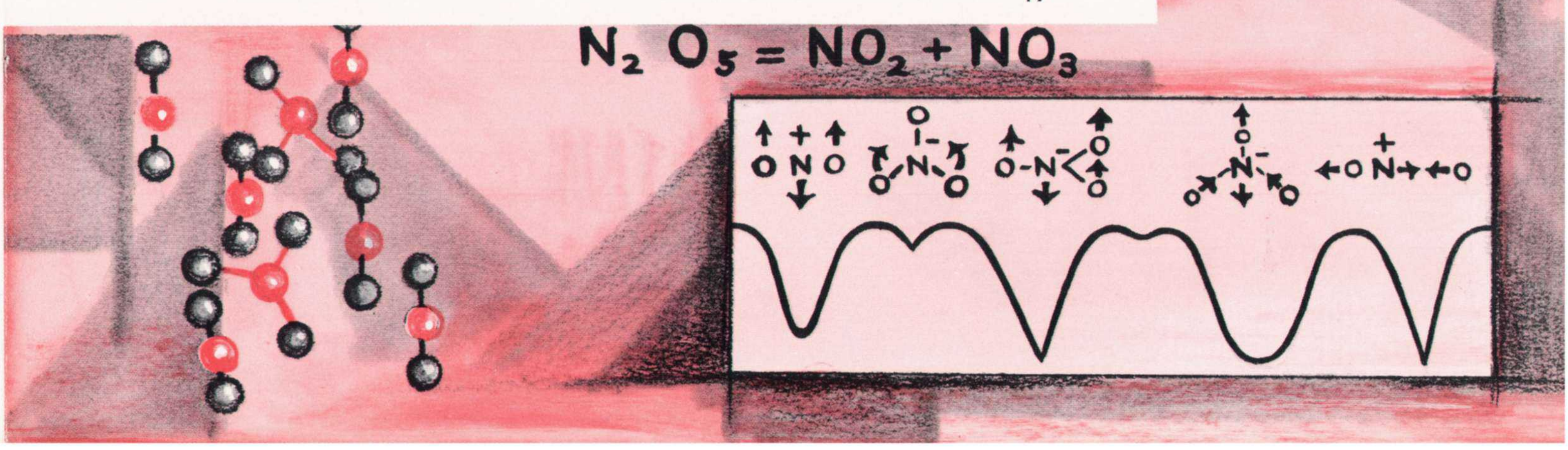
Different rays are absorbed by various molecules, points out Dr. Decius, because of the differences in masses of the atoms and of the stiffness of bonds that join the atoms. Therefore, each distinct molecule (collection of atoms and bonds) will have certain natural frequencies of mechanical vibration and these frequencies will be the same as the frequencies of the infrared rays which are absorbed.

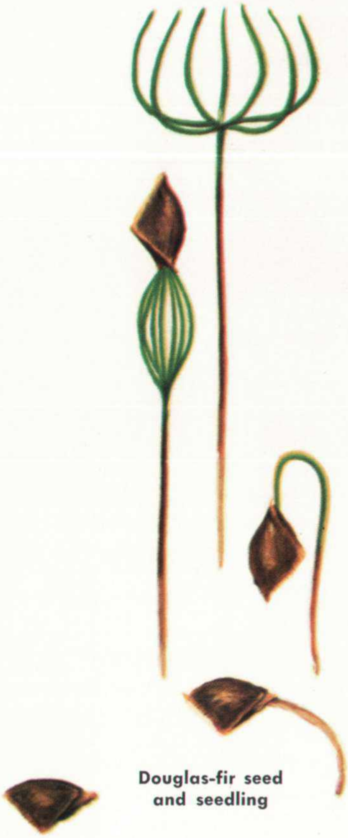
Dr. Hedberg uses electron diffraction equipment, built at OSU for about $20,000. He bombards a molecular specimen in the instrument with an electron beam, accelerated by 40,000 volts and having a wavelength a hundred times smaller than a molecule. The molecule scatters the beam, but each kind of molecule always scatters the beam in a certain way, and the specific pattern shows up as a series of shadowy rings on a photographic plate. The pattern has meaning to scientists, who deduce from it the position of the atoms in the molecule.

Although this research done by Dr. Decius and Dr. Hedberg is basic, not intended to solve particular problems, other investigations of molecular structure have had highly practical results. For instance, scientists have determined the molecular structure of some substances, such as rubber and fabrics, and then have been able to create similar structures with the right proportions of elements, coming up with synthetic rubber and fabrics. Such research also has had important byproducts, such as the processing of high energy fuels for rockets and the manufacturing of transistors.

Dr. Hedberg and Dr. Decius have had research grants from the Research Foundation, the Alfred P. Sloan Foundations, the Air Force Office of Scientific Research, Office of Naval Research, and the National Science Foundation.







Douglas-fir seed and seedling

Better, Faster Growing Forests

Best Traits Being Bred Into Trees of the Future

Although the days of Oregon's vast virgin forests are almost over, the production of timber must be doubled in the next 40 years if the needs of an anticipated 100,-000,000 people in the U.S. are to be met. The needs will be not only for more lumber, but also for more forest recreation space and for more usable water from forest watersheds.

How, though, can we expect to get more timber from dwindling timber resources?

OSU forest scientists have been concerned with this problem for some time and are working on research programs expected to produce faster growing forests with superior trees.

Dr. W. K. Ferrell, forest management department, heads this research on forest growth, and is assisted by forest geneticist Dr. Helge Irgens-Moller and several graduate students. The work is aided by grants from the National Science Foundation and private foundations.

Douglas-fir seed from British Columbia, Canada, to the Mexican border and from the Pacific Coast to Montana has been collected, and seedlings from this seed are being studied in a number of ways.

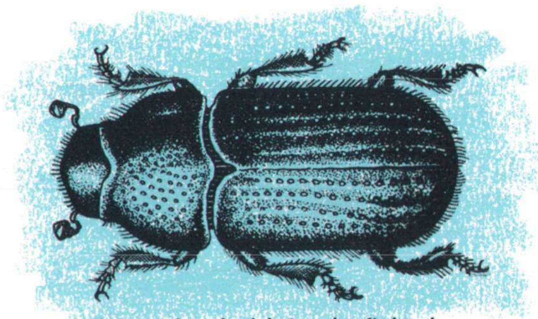
Seedlings, for instance, are grown in growth chambers under a variety of climatic conditions—such as different lengths of day, various combinations of day and night temperatures, and various moisture conditions. Large hereditary differences in response to many of these conditions have been found among seedlings of different origins. One of the goals of this research is to be able to match the right type of seedlings with the proper planting site.

Seedlings from these collections also are being planted in OSU forest land near Corvallis for use in a long-range breeding program attempting to combine desirable traits — such as drought tolerance, fast growth, good form, and wood quality — into trees of the future.

Selection of outstanding trees is proceeding on a regional scale for preservation by vegetative propagation (grafting) for use in later breeding programs.

The production of better trees to meet the increasing demands of our forests requires intensive and time-consuming research in a number of related fields. Forest scientists point out that forests of the future cannot and will not be left to chance if we are to meet the challenge presented by the ever-increasing population.

Tunnels made by Douglas-fir beetles beneath tree bark



One species of adult Douglas-fir beetle. Actual size is one-quarter of an inch.

Expensive Forest Enemy

Quarter-Inch Beetle Destroys Valuable Trees

On 2-inch Douglas-fir branches growing inside clear plastic boxes, forest insects are protected and coddled. In larger, screened areas insects are encouraged to live on a small group of potted, 3-foot trees. Elsewhere in the OSU Forest Insect and Disease Laboratory, in log chunks kept in ideal conditions, Douglas-fir beetles live out their life cycles, tunneling in their characteristic way beneath the bark.

While these various insects are thus being pampered, forest entomologists, directed by Dr. Julius Rudinsky, keep careful records of the insects' every move—hoping to find better and more economical ways of controlling them out in the forests.

Such control could mean enormous savings, since forest insects in only one year in the U. S. kill enough timber to build 600,000 5-room houses. The amount is five or six times that lost by fire. Oregon, the nation's leading forestry state, suffers great loss. For instance, during a 1951-1954 outbreak of the Douglas-fir beetle more than 3 million board feet of green merchantable timber was killed in western Oregon and Washington.

The reddish to dark brown Douglas-fir beetle is only a quarter of an inch long, but is Oregon's most serious forest pest. The population of this beetle—like those of most species of bark beetles — can reach almost unbelievable numbers. Severe windstorms, blowing down many Douglas-firs, give the Douglas-fir beetle ideal conditions for producing large broods that go from felled to growing trees.

Beetles are tough. They have made prompt comebacks after intensive fell-peel-burn control experiments. They took only two years to regain their population loss after 54° F. below zero weather killed 80% of them in one area. Chemical spray applications do not have much effect, as the spray seldom reaches the beetles beneath the bark.

So far, the best way to keep Douglas-fir beetle population down has been the constant use of good management practices—logging of windblown, infested, or weak trees. However, scientists in the OSU Forest Insect and Disease Laboratory are experimenting with several other methods of control.

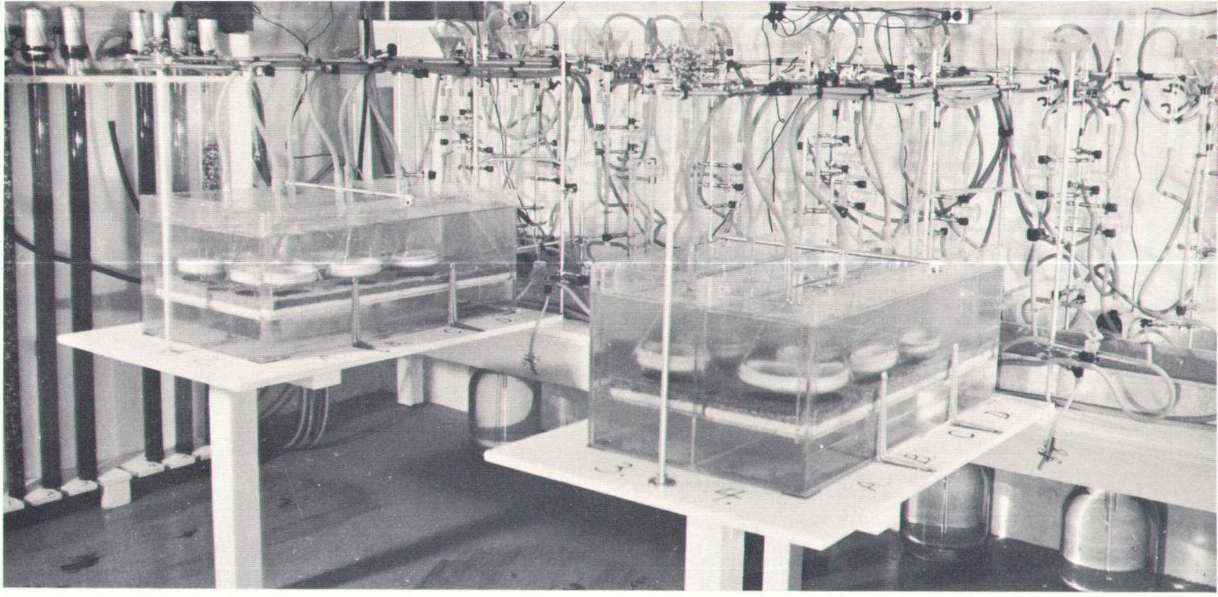
In one experiment they are using a natural parasite of the beetle, a certain kind of wasp. The wasp lays its eggs in the beetles' tunnels, where later the wasp larvae kill the beetle larvae. In another experiment the scientists are trying systemic poisoning. Insecticides are drawn into the inside of trees, through roots or trunk, and once inside they come in contact with some of the beetles.

Cooperating with OSU on the insect work are the Pacific Northwest Forest and Range Experiment Station, Portland, and the Boyce Thompson Institute for Plant Research, Grass Valley, California. The research is being supported by the National Science Foundation and by the Foundation for American Resource Management, San Francisco, as well as by the state of Oregon.

Top—Apparatus for rearing salmon embryos with different water flows and amounts of oxygen.

Center—Silver salmon fingerlings.

Bottom—Part of 1,500 feet of controlled experimental stream, used as an outdoor laboratory. Here life can be studied in its natural setting.



Clean Waters for Salmon

Are Valuable Fish Doomed by Man-Made Changes?

The gleaming, graceful salmon—one of the most exciting of sport fish and most valuable of commercial varieties—thrived in clean Oregon streams.

Today, as we plow land, cut trees, build cities, expand industries, we are changing our streams. We can't always help doing this. From many streams we take water we need. Into them we accidentally or purposely put silt, sawdust, sewage, industrial wastes. The excuse often has been that—after all, we must live.

But can we live in such a way that our salmon and trout can live, too? Or must these fish—like the buffalo—be lost because of civilization?

What kind of stream conditions must salmon have to stay healthy and produce young?

If we had exact answers to this question perhaps we could do more—through education and legislation—to save our salmon; for there *are* known ways to reduce the damage to streams.

Oregon State University scientists are seeking exact answers to this problem.

For this purpose they have a well-equipped laboratory, including indoor artificial streams; and they have 1,500 feet of controlled experimental stream—probably the only setup of its kind in the world—for use as an outdoor laboratory.

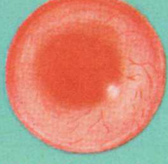
The controlled outdoor stream, Berry Creek, a few miles northwest of Corvallis on forest land owned by Oregon State University, has a dam and diversion ditch for controlling water flow; self-cleaning fish screens; traps, various recording instruments, and much other equipment. Here stream life can be studied in its natural setting.

Many things affect stream life, point out Dr. Charles E. Warren and Dr. Peter Doudoroff, fishery biologists coordinating the study. Salmon—and their eggs or embryos—for instance, need to live in cold water mixed with oxygen. But some wastes use a great deal of oxygen as they break down, robbing the salmon. Silt can smother the eggs deposited in gravel on stream bottoms.

Salmon also must have food—usually insects in the stream. These insects, in turn, need other food—such as tiny algae and other water plants, leaves, and twigs. But some wastes upset the food supply; they may, for instance, keep algae from growing and destroy insects. They may even poison the salmon.

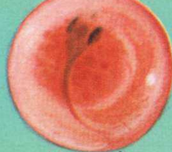
Scientists, then, are trying to find out:

- How much oxygen salmon and their eggs or embryos need not only to stay alive but also to remain active and to grow normally.
- What amounts of various wastes may be harmful to them.

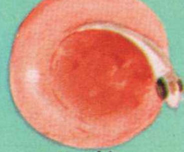


Chinook salmon embryo, two weeks

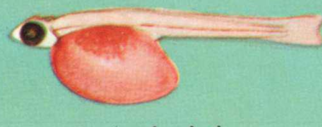
Four weeks



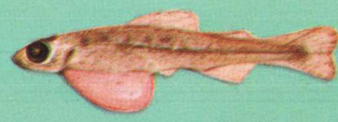
Six weeks



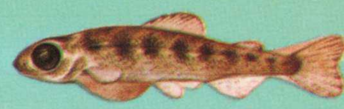
Hatching



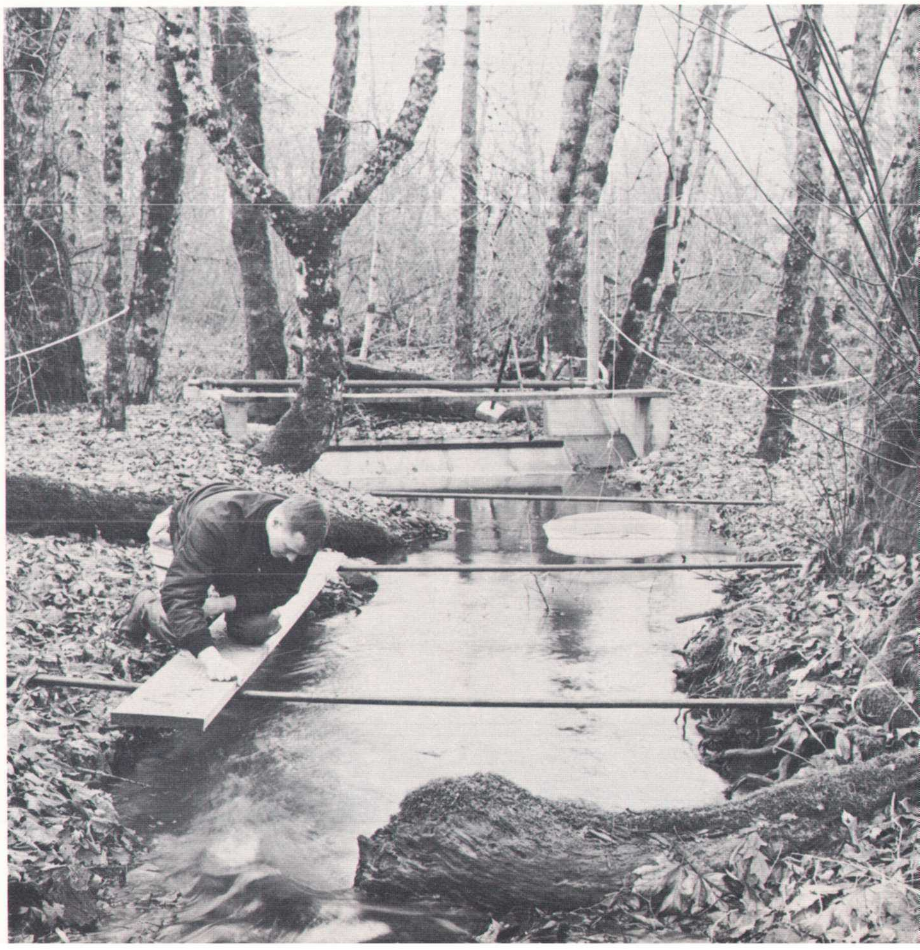
Fry, just hatched



Fry, two weeks old

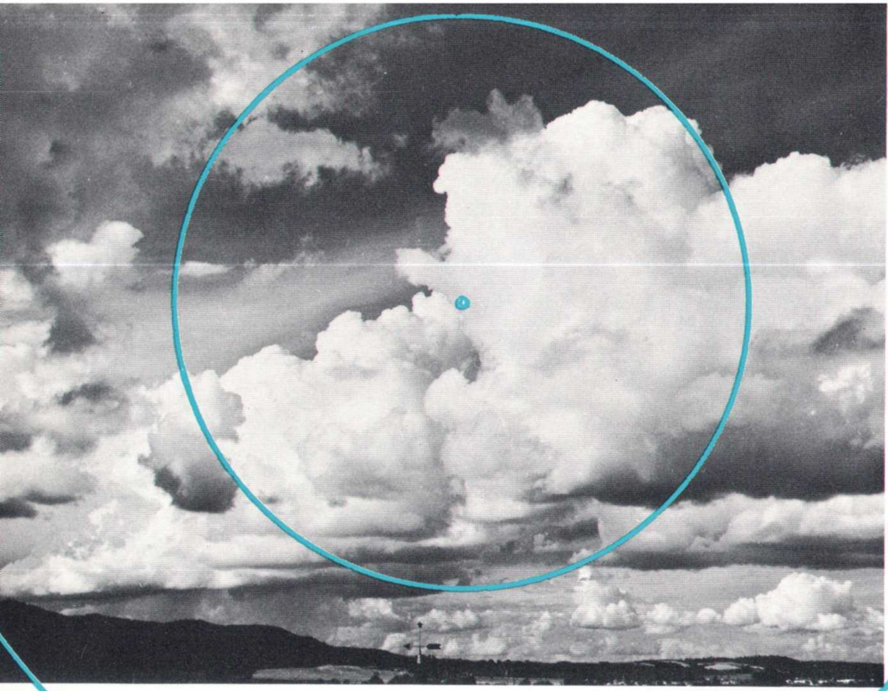


Fry, four weeks old



• How their food supply may be affected by such things as temperature and chemical quality of the water, physical condition of the stream bottom, and amount of sunlight.

The Department of Fish and Game Management and the Agricultural Experiment Station have combined their resources with those of the Robert A. Taft Sanitary Engineering Center, U. S. Public Health Service, in establishing the Pacific Cooperative Water Pollution and Fisheries Research Laboratories for conducting jointly this and related studies. Also cooperating in the study are the departments of botany, entomology, chemistry, civil engineering, and the Engineering Experiment Station. Financial support for the study comes from the Public Health Service, the National Science Foundation, and industry, as well as from the state of Oregon.



Seeking Weather Secrets . . .

Radar, Satellites Are Used to Understand Northwest Weather

Storms sweeping into the Northwest from across the vast Pacific Ocean don't seem to follow any orderly pattern. Sometimes weather perversities surprise even well-seasoned weathermen — who long have claimed the Pacific Northwest to be a weather forecaster's "nightmare."

When even weathermen are surprised, ordinary citizens are taken unawares, too, of course. Which could mean lack of preparation —from failing to have an umbrella in a rainstorm to failing to reach a shelter quickly during radioactive fallout.

Few observations have been made in the past on cloud and storm patterns across the Pacific. Now, however, observations are being made by Dr. Fred Decker, in charge of the meteorology branch of OSU's Science Research Institute. Assisting him have been John F. Tatom, Kenneth H. Shreeve, William P. Lowry, and a series of graduate students.

Using a $150,000 radar installation, loaned by the U.S. Army Signal Corps, the meteorologists have kept records of case histories of storms from as far away as 300 miles out over the Pacific until they reach the Cascade Mountains.

With the radar equipment, located atop McCulloch Peak, seven miles northwest of Corvallis, scientists actually can see storm clouds on a screen and follow their course. A large, saucer-shaped, rotating antenna on the peak shoots out cloud-piercing radar beams as fast as the speed of light. The beams reflect rain cells in the distant storm, then quickly bounce back to the receiving part of the antenna, where they are converted to electrical impulses and show up on a screen.

The scientists have taken pictures of the cloud patterns as they show up on the radar screen, and recently have compared them with pictures of cloud patterns of the same area taken from above by Tiros TV weather satellites.

As meteorologists learn more about how and where storm clouds form over the Pacific and of which way the upper and lower winds are likely to blow at various times, they will be able to forecast more accurately where rain or hail may fall, freezes occur, cyclones or other severe storms hit. Such forecasting will help individuals, businesses, and industries plan with more confidence for seasons ahead.

And, of course, it will help with more accurate forecasting of just where and when radioactive fallout could take place in case of atomic bombing.

Radar equipment also has helped OSU scientists understand various local puzzling weather phenomena — such as why the east side of Marys Peak gets an average of 75 inches of rain a year and the west side gets an average of 40, although most storms come from the west.

They have found that the lower layers of rain clouds rise at an angle up the west side and just over the peak before beginning to drop again. Just before they begin to drop they spill the most rain.

Grants for the meteorology research have been made by the National Science Foundation and by the U.S. Army Signal Research and Development Laboratories.

Story From Rocks

Microfossils Give Evidence of Central Oregon Sea

Fossil shells of single-celled animals that lived about 220 million years ago are important clues to the location and nature of a former sea that covered part of northwestern North America.

The fossils have been found by OSU geologist Dr. D. A. Bostwick in small masses of limestone near John Day and Baker. Dr. Bostwick dates the fossils as late Permian in age, a time of submergence beneath shallow seas of parts of Oregon, Washington, and British Columbia.

Little of this ancient rock is exposed in Oregon. Most of it has been covered by sediments and thick lava flows of much younger age. Most of the well-known plant and animal fossils found in Oregon date from less than 50 million years ago.

Dr. Bostwick explains that the fossils he has found in central and eastern Oregon are those of a group of extinct protozoans termed fusulines, whose complex shells are useful to geologists in dating certain ancient marine sediments. Fusulines similar to those that occur in Oregon have been found by other scientists in Japan and China, which, with other fossil evidence, strongly suggests that these bottom-living animals were able to migrate readily over a shallow sea floor between known occurrences on the two continents.

Finding and identifying fusulines, as well as many other fossils, often has led to the locating of petroleum and other mineral resources, since there is commonly an association between certain minerals, sediments, and fossils.

Just as important to geologists, however, as the search for petroleum is the search for knowledge of the earth's history.

Dr. Bostwick wants to know what Oregon was like in Permian time. He states that his own information alone means little, but when it is combined with the findings of other geologic studies something of the former geography, climate, and life can be reconstructed.

Evidence indicates that areas of central and eastern Oregon in late Permian time were submerged beneath shallow marine waters that were part of the southern limits of a sea that extended north across British Columbia and Alaska. The great quantity of volcanic ash and coarser debris in the late Permian rocks indicates that many volcanoes were active in the region at this time, many of them on adjacent land areas, but some probably erupting from the sea floor.

In late Permian time the invertebrate animals of the warm shallow Oregon sea were unlike those of today, and were limited in kind to those resistant to the smothering effect of intermittent falls of volcanic ash. During frequent periods of freedom from volcanic activity the waters cleared, and molluscs, brachiopods, byozoans, and fusulines locally became sufficiently abundant to form shelly accumulations in reefs.

Many fossils of these animals mentioned can be found in the Permian limestone of Oregon, but generally the shells of fusulines are best preserved. These shells, many no larger than a grain of wheat and none larger than a hazelnut, ordinarily are overlooked by amateur collectors. Dr. Bostwick brings specimens from the field to his laboratory on campus, where he saws the rock into thin slices, using a diamond-set blade. He examines the slices under a microscope and marks fusulines and other microfossils for freeing from the slab and mounting for further microscopic study.

With low magnification, the thinly sliced, spindle-shaped fusuline appears as a series of coiled chambers, whose various complexities can be assigned with geologic dates. Many of these shells apparently have suffered very little physical and chemical change since they were formed more than 200 million years ago.

Although shells of larger invertebrates are more conspicuous as fossils and often are better known to geologists, protozoan fossils are equally important links in our knowledge of ancient life.

Blue Lake pole bean vine

Rebuilding the Bean

Must Retain High Quality but Must Be Machine Pickable

In this age of mechanization even the green bean must accommodate itself to a machine.

It is easier when the machine can be accommodated to the crop. This is the usual situation and has resulted in a variety of equipment, which picks tough ears of corn, gathers tiny seeds, sorts fragile eggs, and so on. Even the delicacy of the ripe raspberry is considered by engineers who are working on a machine that may use ultrasonic soundwaves, too high to be heard by human ears, to cause the fruit to drop from the vines.

The green bean in Oregon, however, presents a special problem. The Blue Lake bean that is big business in the state (over $13 million a year to growers, about another $10 million to laborers and processors) is a type that grows tall, twining on a pole.

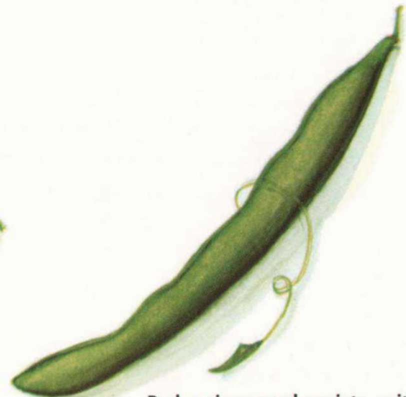
OSU horticulturists Dr. W. A. Frazier, Dr. J. R. Baggett, and Dr. H. J. Mack have worked for years, along with other projects, improving this bean through scientific breeding. Today it yields well and has a pod that is truly superior in tenderness, taste, color, size, shape, texture, firmness, lack of strings and spurs. This bean grows especially well in the soils, sun, and temperature of the Willamette Valley, and does not grow as well in most of the other bean growing areas of the U.S. Consequently, Oregon bean growers supply at least one-fourth of all the green beans for processing in the nation, leading all other states.

Now, however, Oregon growers need to pick their beans by machine!

Handpicking is their biggest cost factor in production and must be cut down if growers are to compete favorably with those in other areas, who grow beans not as high in quality but of a bush type that can be harvested by machine.

In spite of industry efforts, it has not been possible to develop a satisfactory machine to harvest pole beans completely. Therefore, Oregon growers are finding that they must switch to bush beans, but if they choose varieties that have been available their crop will lose its unique quality — and thus growers and processors may lose a good part of their market.

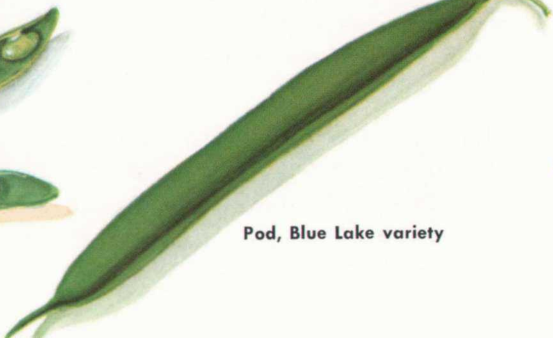
It has been up to the horticulturists, therefore, to rebuild the bean itself, changing it into a bush type that has all the desirable qualities of pole Blue Lake.



Pod, unimproved variety, with string

Half pod, unimproved variety

Half pod, Blue Lake variety



Pod, Blue Lake variety

After 10 years of shuffling a "gene card deck" numbering several thousand units and with countless possible combinations, OSU scientists have developed a bean close to the type they desire, although further goals of heavier yields and resistance to disease are being pursued. Use of greenhouses to obtain seed in winter has made possible the compression of 20 years of work into these 10 years.

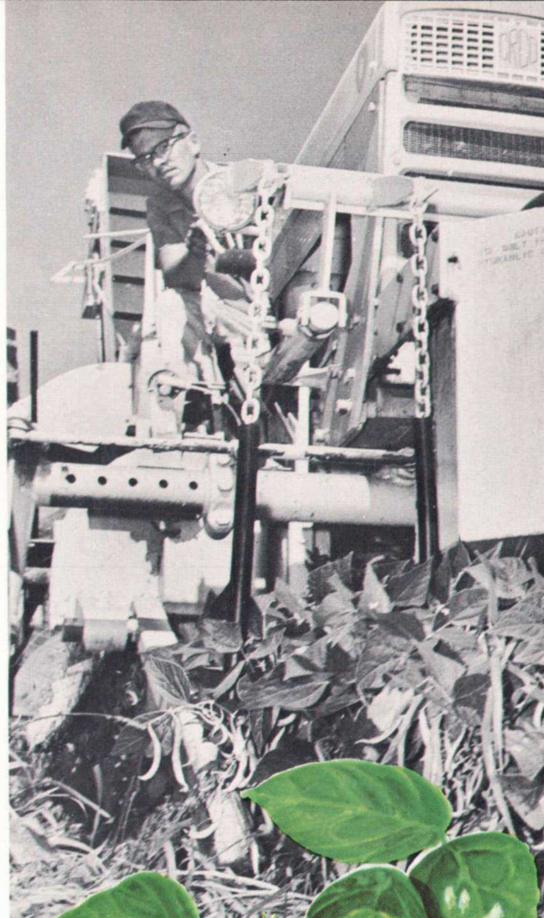
During the breeding program the scientists have had to consider many factors and have not overlooked bean plant susceptibility to its common disease enemies — rust, root rot, common and yellow mosaic viruses. Dr. E. K. Vaughan and Dr. F. P. McWhorter, plant pathologists at OSU, have worked closely with the horticulturists, isolating virulent strains of the organisms and developing faster methods for testing plant seedlings for disease susceptibility.

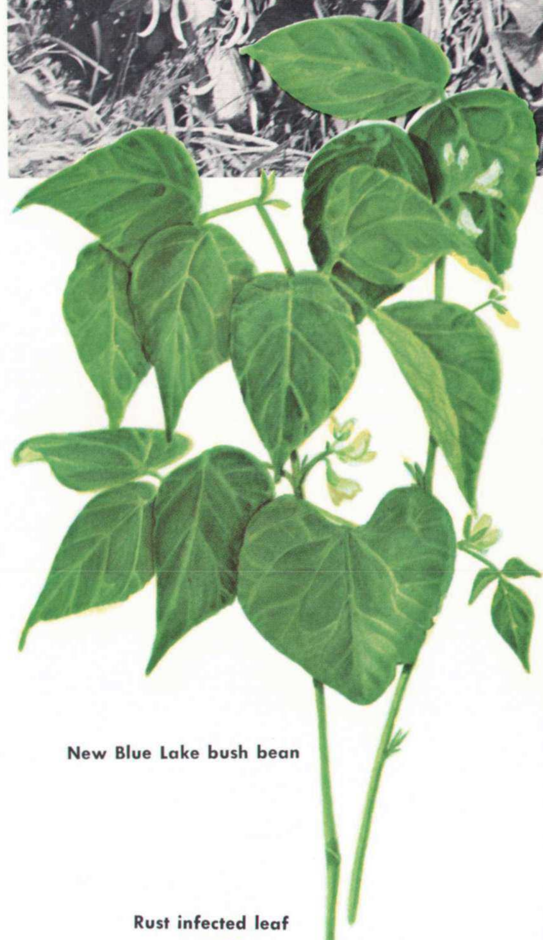
Also working closely with the plant breeders have been OSU food technologists and agricultural engineers. Dr. W. A. Sistrunk and Dr. R. F. Cain, food technologists, have tested pod quality of new selections; how quality is affected by irrigation, mulching, fertilization, and other management practices; how best to can and freeze green beans. Dr. J. B. Rodgers, head of Agricultural Engineering, and others in his department have demonstrated the feasibility of mechanical harvest of the new type of bush beans.

Exacting methods are used in testing beans. Food technologists measure the color by a special instrument, standardized to the values for SKC-15 "kitchen green" color plaque supplied by the National Bureau of Standards. Crude fiber and seed percentages are obtained by the Food and Drug Administration method. Shear press determination, or firmness of pod, is obtained with a Maryland Shear Press. Taste is determined by testers in scientifically conducted taste panels.

The new bush-type beans have passed satisfactorily all the tests made by food technologists in comparing them to Blue Lake pole beans. It now looks as if the day is fast approaching when Oregon growers can switch at least part of the acreage to the new variety types. Thus the growers and the state as a whole may be able to maintain the lead in the green bean business.

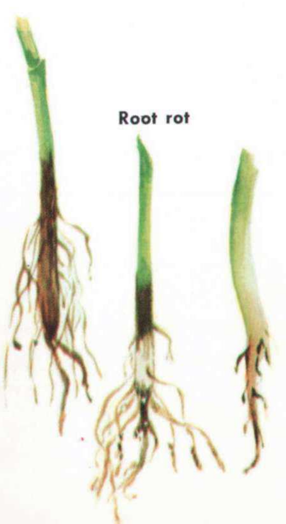
Thus, too, consumers will continue getting green beans of extremely high quality. . . . Quality that did not happen just by accident, but was fashioned by horticulturists in years of scientific plant breeding; by plant pathologists who developed short cuts to test plants for resistance to disease; by food technologists who used highly scientific tests to determine color, texture, tenderness, and flavor; by engineers who developed or tested new machines for harvesting; by seedsmen who also have made major plant breeding contributions and have aided in seed multiplication; and by growers and processors, themselves, who have run and now are running many tests of the new types of beans.



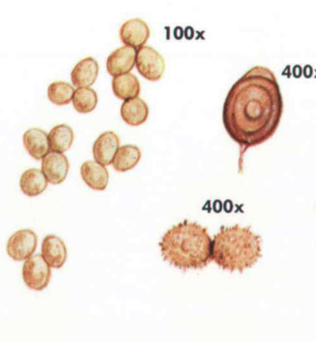


New Blue Lake bush bean

Root rot

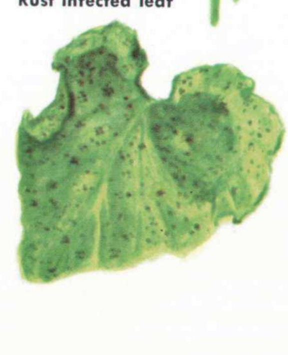


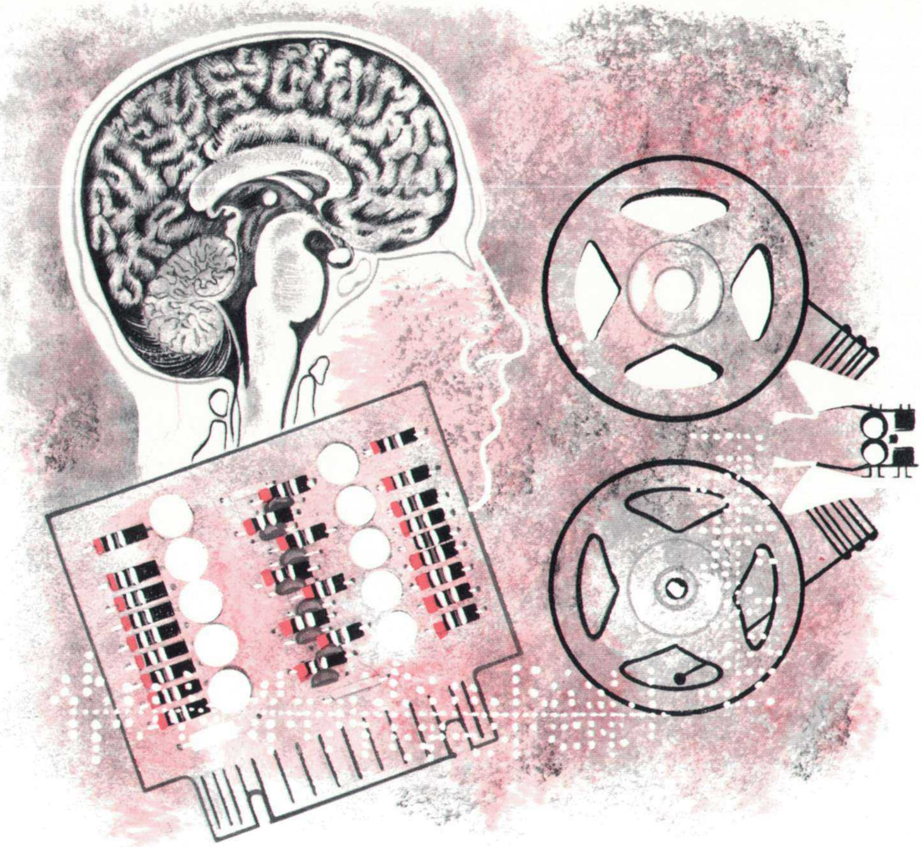
Beanrust spores



Beanrust, 30x

Rust infected leaf





Creating Electronic Brains

OSU Scientists Building Fabulous Computer

Many of today's seemingly miraculous building feats, medical discoveries, outer-space and under-ocean explorations began as mathematical formulas in men's minds. But as each accomplishment has become more and more amazing its mathematics have grown more complex; so staggeringly complex, in fact, that they would take a man's whole lifetime if he did the figuring by pencil.

But man has solved this problem by inventing electronic machines, largely to take the place of the pencil. Now the scientist can feed into an electronic brain his original mathematical figures on a project, and from there on the many other necessary computations can be done automatically — in minutes.

At OSU a computer, ALWAC III-E, which was up to date in 1957 when it was bought, usually operates the clock around, seven days a week doing mathematical figuring on numerous research projects.

Used this way the computer has been a tool of research.

Now, however, OSU mathematicians and engineers are going further than just using computers as tools. They are using some of their own original mathematical formulas in designing and building a fabulous new computer — the GALAXY — able to operate 1,000 times faster than the ALWAC.

The new machine, which will take three years to complete, will be patterned after the computer, MANIAC III, at the University of Chicago, but it will have several OSU original features at the start, as well as improvements as they are developed later by OSU scientists. It will be comparable in speed and capacity to computers now selling for from $2 to $5 million, although its cost will be approximately $500,000. Most of the funds will be furnished by the National Science Foundation.

Heading the project are Dr. A. T. Lonseth, head of OSU mathematics department, and L. N. Stone, head of the electrical engineering department.

The machine will be the core of a Computer Research Center at OSU, to serve all the institutions of the State System of Higher Education, other state agencies, businesses, and industries.

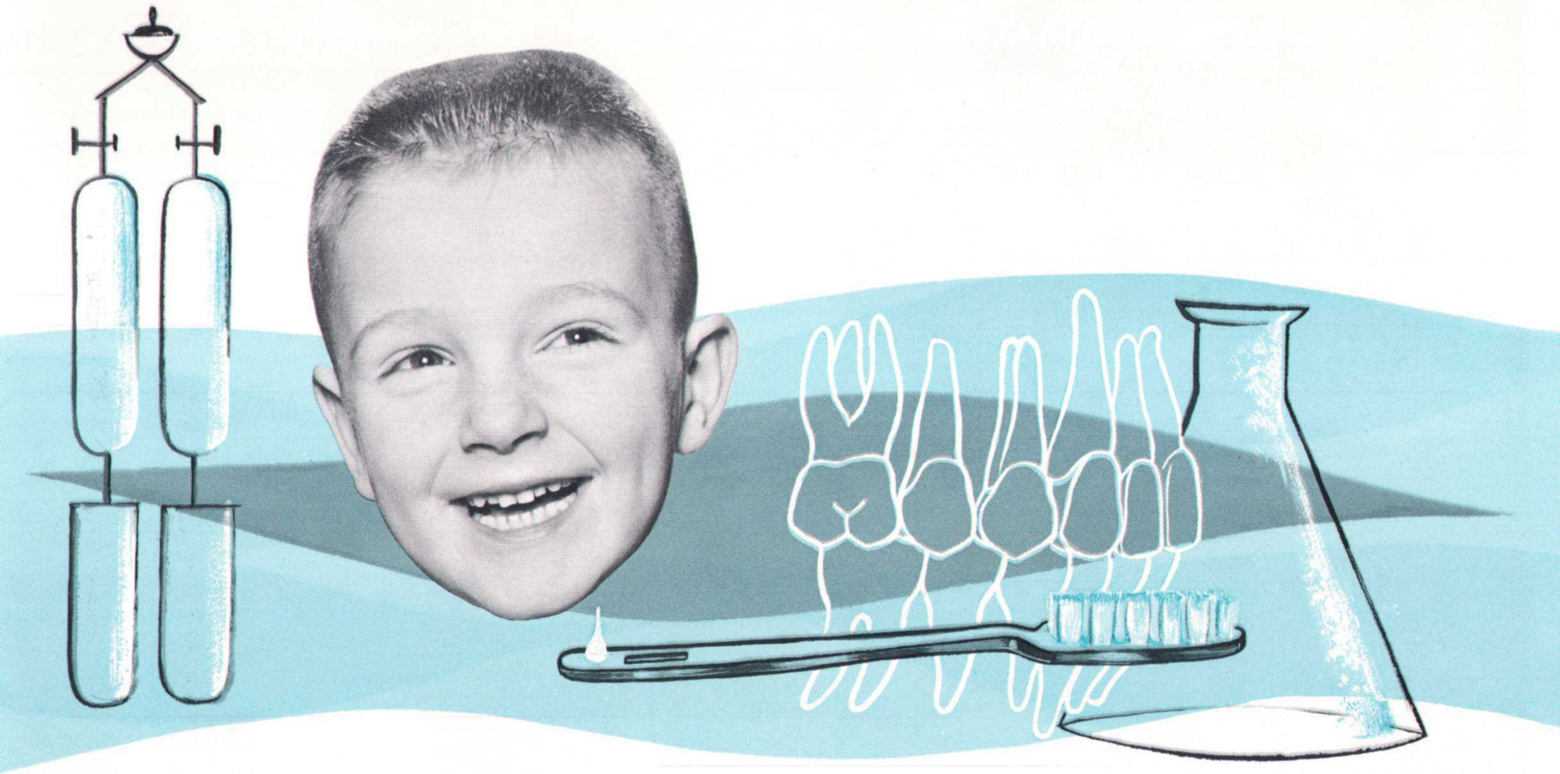
Plans are to house the Center in a $350,000 building of over 15,000 square feet, with room for the machine, several research laboratories, offices, a small special library, and a conference room.

The Center will contribute to OSU and the state in a number of ways.

So far as research is concerned, the Center will make possible original work on computer logic and design; will stimulate an already established program at OSU in numerical analysis; will afford a promising approach to overall research on nervous systems, in collaboration with scientists at the University of Oregon Medical School. In bringing different specialists together on various projects it can produce cross-fertilization of ideas, stimulating research in totally unexpected directions.

As a tool, the machine will do faster and more complicated figuring than previously possible on campus. Large-scale economic studies can be made, and research assignments that cannot now be considered by OSU can be accepted. Federal funds for some of these are available.

In addition to stimulating and serving research, the Center activities also will provide excellent experience for mathematics and engineering faculty and students, and should attract others of high quality. It is quite possible that specific discoveries may lead to the local manufacturing of computers or computer parts.



Healthier Teeth . . . Decay Greatly Reduced in Corvallis

The United States has a 1 billion, 992 million-dollar dental problem. The problem would be less but costs would be higher if everyone who needed dental care went to a dentist. Actually, only about 40% of the population gets dental treatment.

In some places in the country the incidence of tooth decay is greater than in others. In Oregon, especially in the Willamette Valley, the rate of tooth decay is high.

The problem was of enough concern to conscientious parents in Corvallis to carry a vote to fluoridate the municipal water supply, hoping that tooth decay would be decreased among their children.

Fluoridation took place in January, 1953. However, before the new program was started Dr. Demetrios M. Hadjimarkos of the School of Home Economics, OSU, studied the teeth of 1,534 elementary school children ranging from 5 to 12 years of age.

Seven years later Dr. Gertrude Tank, also of the School of Home Economics, examined the teeth of 1,200 elementary school children of the same age group. All of them had been born and reared in Corvallis, having left the area only for short vacation periods.

Records of the group examined before and the group examined after fluoridation were compared, and it was found that:

- Children before fluoridation had three times as many decayed teeth as children seven years after fluoridation.
- Twice as many children were completely free of tooth decay after fluoridation as before fluoridation.
- Children who were born after fluoridation started had 44% less tooth decay than children of the same age before fluoridation.

Maximum effects on the teeth of the children studied cannot be expected before 12 years of exposure to fluoridated water, but the beneficial results apparent after only seven years of fluoridation are highly significant. It means a great saving in teeth, pain and discomfort, general health problems, and dental bills.

Dr. Tank is now working on a study in which the diet of children and its effect on the teeth also are being considered.

Muscle Disease Cured

May Aid Work on Human Dystrophy

In the early 1950's in central Oregon there was no hint of the livestock disaster soon to come to many ranches.

Sleek beef cows grazed on green alfalfa or ladino clover pastures, their calves beside them. Healthy appearing ewes produced a good lamb crop, and as soon as possible ewes and lambs were turned out of the lambing sheds onto green feed. Both cows and ewes had been fed high-quality legume hay when pastures were not available.

It was strange, but when the trouble hit it was worst in seemingly the best managed herds and flocks. One day a calf or lamb ran about, apparently in good health. The next day it fell over—dead. Or its legs became weakened and useless, death usually following.

Frantic ranchers called for help, many coming to their county agents. What had happened? Was the stock being poisoned in some mysterious way? Or was a contagious disease rapidly spreading? County agents called on Oregon State University for help.

In the heart and other muscles of dead animals OSU scientists found a whitish calcium deposit replacing part of the tissues. The trouble was the dreaded white muscle disease, WMD, in which calcium collects disastrously in the muscles of some animals much as it collects in muscles of humans who have a type of muscular dystrophy.

No one knew what caused WMD or what to do to prevent or cure it, although for 30 years Dr. O. H. Muth, veterinarian, OSU, had made observations on many cases of it in Oregon, and research was being done on the problem at OSU and universities in other states and countries.

Central Oregon ranchers tried desperately to save their stock. They treated lambs with vitamin E and obtained partial relief. Many tried giving wheat germ oil. Some, noticing that stock on sagebrush range seldom got WMD, gave their own stock access to sparse range. But nothing they tried gave consistent results.

By about 1955 in several areas nearly every cattleman and sheepman was out of business. Some lost all they owned.

At OSU Dr. Muth, in trying to solve the mystery, saw clues in the fact that the trouble was worst in intermountain, Pacific Northwest, irrigated regions, and that it was common when pregnant cows and ewes were fed high-quality hay from irrigated, fertilized fields.

Organized research on WMD had begun on campus in July, 1953, and now Dr. Muth, Dr. J. E. Oldfield, animal nutritionist; Dr. L. F. Remmert, agricultural chemist, and later Dr. J. R. Schubert, agricultural chemist, brought hay from the problem areas and fed it to a group of pregnant cows. When the calves were born most of them developed WMD.

After many tests were made the researchers found that for some reason a trace element—selenium—needed for good nutrition was not available to the animals as needed when this particular hay was fed.

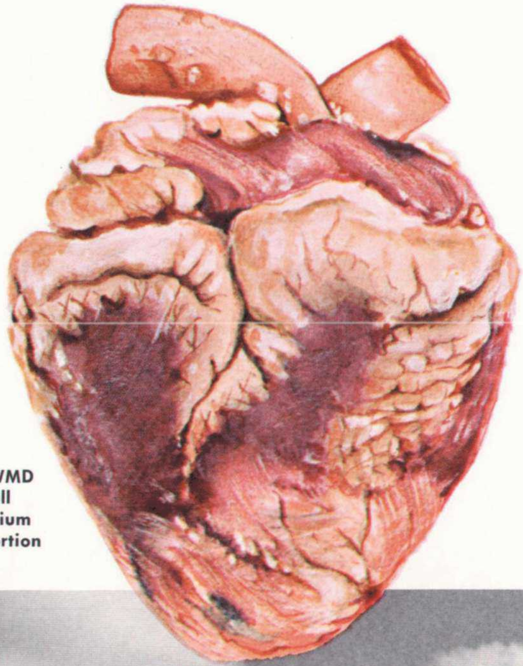
Next, a group of pregnant ewes was fed this hay, but the ewes or their lambs were treated with selenium—treated with great care, since only a trace of selenium was needed, too much being as harmful as not enough.

Results of the experiment were highly successful. The OSU scientists found that lambs of ewes fed the WMD-producing hay did *not* develop the disease when (1) an extremely small amount of selenium was added to the feed of pregnant ewes, or (2) when the lambs of untreated ewes were given carefully regulated hypodermic injections of selenium soon after birth.

Scientists in other areas have substantiated side effects noted in Corvallis—that lambs and calves from selenium-treated ewes and cows not only are free of WMD, but that they *gain faster* than normal animals. As much as 52% more than normal weight in calves within a 4-week period has been recorded.

Today, because of the successful outcome of WMD research at OSU no ranchers anywhere in the world need be forced out of business because of the disease, and no longer need valuable protein foods be lost to consumers due to this cause.

Scientists do not yet understand why some hay produces WMD. Some evidence indicates that heavy fertilization of the crop, especially the use of sulphur, has something to do with the interference of selenium used by animals. Research is continuing on that phase of the problem, as well as on safe and economical methods of administering selenium.



Lamb heart, with WMD evident by overall pale color and calcium deposits in lower portion

...The Whole State a Laboratory...

The research projects you have read about in the foregoing pages are only a sample of the hundreds that are in progress at Oregon State University. Some of our scientists will be disappointed because their work is not included, and some readers of this publication will miss seeing their particular interests described. To include everyone and every project would take a book many times this size. We have tried to pick significant, continuing projects of wide interest and diversity to show something of the breadth that investigations can have and to suggest the value of seeking new knowledge on a wide variety of questions.

The text by Marion Teal and the illustrations by Virginia Taylor come "from life" and have been checked carefully for accuracy of content and exactness of color and form by the scientists concerned. The author and artist went into the field to gather impressions as well as facts, to picture the zest as well as the tedium of original investigations. They talked with scientists and made notes and sketches at many places in the state—at the Squaw Butte Branch Experiment Station in sagebrush country, aboard the oceanography laboratory on the Pacific Ocean, at the Warm Springs Indian Reservation, at an experimental stream in OSU's 11,000-acre forest laboratory, in laboratories and greenhouses beneath, in, and on the roofs of campus buildings. They have tried to show the human side as well as the mechanics of research.

As this book pretty well demonstrates, the whole state becomes a laboratory. Radar probes the weather factors from a mountain top, a "smell-o-meter" identifies air pollutants at a paper mill, crop dusters spray Harney County range country to test means of improving the forage. Scientists go out to odd corners of the region to set up experiments, collect information, and search for new angles that may throw light on various problems.

Most of the researchers also are teachers. Nearly all teach at least one class; some teach full time during the academic year and conduct their investigations during the summer. This close association between research and teaching is stimulating and gives the classroom subject matter a liveliness and interest that provides a good atmosphere for the training of young scientists. Also this research-teach-

The total amount spent for research annually at OSU and its branch stations amounts to nearly $5½ million. Of this, nearly $3 million comes from grants, gifts, and contracts of various kinds. Research is done under the direction of: General Research; Agricultural Experiment Station; Engineering Experiment Station; Science Research Institute; Transportation Research Institute; Water Resources Research Institute; Oregon Forest Research Center. The Agricultural Experiment Station directs more than 300 projects at the central station on campus and 13 branch stations throughout the state. More than 200 of these projects are completed each year. The other research organizations of OSU also direct projects on and off campus, with many private businesses, industries, municipalities, and individuals cooperating.

ing relationship serves in orienting many students, who do not intend to become scientists, to a world greatly affected by the march of scientific knowledge.

But campus teaching alone does not carry the findings of research to the ones who need it most. Land-grant institutions, such as OSU, long since found that just developing a body of knowledge about agriculture, forestry, and home economics was not enough. A means had to be found to get it out to producers, industries, markets, consumers, and homemakers. As a result, the Federal Cooperative Extension Service was established as one means of interpreting, adapting, and disseminating the results of research. Today we have extension agents in every county of the state. Through field demonstrations, short courses, circulars, newsletters, radio and television programs, newspapers, and personal consultation, the most up-to-date information on a wide range of subjects is carried to the people. In other fields such as engineering, pharmacy, business, investigators and consultants take an active part in similar methods for the wide distribution of information about the things with which they are concerned.

Scientists, of course, have more professional outlets for their findings: scientific meetings and conferences, journal articles and monographs. Just listing the publications of the OSU faculty, as done once during each biennium, requires 40 or 50 pages of small type. The Forest, Agricultural, and Engineering Experiment Stations, through the Oregon State University Press and the Office of Publications, turn out several series of scientific bulletins to disseminate the results of original investigations.

There was a time when the public was little interested in research. It was difficult to keep the torch lighted, and investigators in need of financial support met a widespread passive resistance. Now the situation is entirely changed. Producers of agricultural products are looking over the shoulders of experiment station workers to gain the earliest possible advantage of new information; so also in industry and other fields. Along with this development has come a surprising interest and understanding of the necessity of developing more fundamental knowledge. The well of applied research runs dry unless deeper borings are made to yield new basic information. Much support for this has come from federal agencies—the U. S. Department of Agriculture, the National Science Foundation, the National Institutes of Health, the Office of Naval Research, and the Atomic Energy Commission—but the state is supporting more fundamental investigations than ever before. Industry, likewise, not only in its own laboratories but also through grants to institutions has provided generous support of this kind through fellowships and outright contributions. Fundamental research is the key to the sound expansion of the economy as well as being the blood and sinew of a university.

A. L. Strand

A. L. STRAND

***President*, 1942-1961, Oregon State University**

About the cover—The outdoor-type young man on the front cover is a composite of many scientists and graduate students illustrator Virginia Taylor saw while visiting research projects described on these pages.

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