At the Noble research center the working capital of fish is kept in carefully controlled tanks.

A Noble Experiment

a major research fishery is being built on little money and lots of ingenuity

BY CONNIE RUGGLES

RESEARCH is not always white coats amid test tubes in sparkling, secluded laboratories. A researcher like Dr. Howard P. Clemens must often shed the white coat to become surveyor, plumber, electrician, welder and scavenger. By practicing all these trades and a great deal of ingenuity besides, Dr. Clemens has built a potentially costly fisheries research center at Noble with practically no financial backing.

The fisheries center is not easy to find. There are no signs pointing the way down the dirt road, past the farm houses and butane tanks; Dr. Clemens and his staff have been too busy to put them up. The research building is no ultra-modern structure of gleaming brick and glass. It is just a frame building with lots of windows and no air conditioning perched on a bluff above the bend of the South Canadian. But these do-it-yourself facilities are making O.U. a major contributor in the area of fisheries research.

Dr. Clemens's work with fish and his need for the specially equipped research center started with a $150,000 grant in 1959 from the National Institutes of Health, an agency of the federal Department of Health, Education and Welfare. The main project being carried on at Noble concerns the role played in reproduction by the pituitary glands in the brains of fish. Earlier work in this field has shown that injections of hormone extract can influence spawning habits of fish, but the process through which it takes place is not known. Dr. Clemens is now isolating the hormone components of fish pituitaries to determine their exact composition.

The work with pituitary hormones has resulted in a breakdown of the main project to include several smaller projects, all having a direct bearing on Dr. Clemens's work. Under the auspices of the Sports Fishing Institute two graduate students, Carrol S. McDermitt and Theophilus Insley, are studying the principles governing sex reversal in fish. By injecting a certain hormone into a female fish, it is possible to reverse its sex so that, although its chromosome structure is still female, it is a male in every other respect. This work is highly valuable in controlling the problem of over-stocked ponds.

With backing from the Hess and Clark Chemical Company, Jay Wiedeman, Leo Ray, Evertt Shackleford and Blake Grant are working on a project involving nitrofuran, a growth stimulant for domestic animals. They are checking its effect on fish where it has already proven valuable in controlling fungus occurring on fish eggs.

They are delving further into its use for control of other fish diseases with an eye toward the possibility of more advanced use in medicine.

In cooperation with the National Science Foundation Carl Reed and Danny Zellmer are conducting two undergraduate projects at the research center. Reed's work involves varying the length of time various fish are exposed to light and the effect this exposure has on ovarian development rate. It is known that the rate of egg development is stimulated according to the amount of light, but much depends on how the light is offered. Reed has constructed artificial days for a series of fish tank worlds. Some might have 48 hours of light followed by 48 hours of dark. Others might have alternating light and dark hours, and so on. Light control can be very important in commercial spawning of fish by making possible an accelerated spawning rate.

Zellmer is examining the effect of stress on the hydromineral cycle of fish. One way of detecting a hormone is by changing the salt and water balance in the fish's environment, then looking for alteration of the hormone level and the accompanying responses. Stress is induced by forcing the fish to swim in a sort of water treadmill where water is pushed through a cylinder at a rapid rate forcing the fish inside to swim. Merely handling the fish in water also produces stress. At present the treadmill is a simple cylinder supported by cement blocks and closed at each end by pieces of screening with hoses at one end forcing water through the cylinder. Dr. Clemens hopes eventually to get a tub that works centrifugally which will have closer control of water.

Under a National Defense Education Act grant, Waynon Johnson is working toward his master's degree by studying the specific differences in sex hormones of fish species including carp, goldfish, trout, channel cat, flat head cat, bull head cat, blue cat, buffalo fish, blue sucker, white bass, blue gill, white crappie and large mouth bass.

Most of these projects have some bearing on Dr. Clemens's large scale objective of tracing the role of fish pituitaries in reproduction. All require closely controlled experiments and a great deal of special equipment. This was the first and perhaps biggest problem Dr. Clemens and his staff had to get around before their research could even begin.

At the outset Dr. Clemens knew that he would need a research site where he could be assured of enough water to pump 300 gallons a minute through the various tanks. At 300 gallons a minute, enough water is used in two hours to furnish an average home for a year. Obviously the limited water facilities used by the city of Norman and by the University would be inadequate since they pump only about 120 to 200 gallons a minute. In time of drought, it would be impossible to get enough water. Still, Dr. Clemens was hopeful of finding a spot close to the University since he must divide his time between the research facilities and his classroom duties on the campus. Since the University could provide no suitable land, Dr. Clemens haunted the court house checking land sales and traveled thousands of miles to look at prospective sites. Then in November, 1959, Dr. Vera Buchheit, a retired physician who has residences in both Noble and Oklahoma City, took an interest in Dr. Clemens's plight. She donated 12½ acres just outside Noble with the hope that the research might lead to information useful in the field of medicine.

The site was ideal because of its proximity to the South Canadian River and its easy access to Noble and the University Main Campus. A frame building was moved from the old Navy hospital on South Campus to house the research facilities.

However, even with the land and building available, Dr. Clemens still could not begin work. He had nowhere to keep his fish, no equipment for conducting his experiments, no plumbing, no water, no lights, no heat, no tanks.

The professor and several of his students began scouring the area for material, any kind of usable material that cost little or nothing and could somehow be converted to cover their needs. Friends came to their assistance. One negotiated for the piping Dr. Clemens would need to run water to the large outdoor ponds and to the building. The Air Force agreed to sell them jet engine shipping tanks which could be renovated and converted to water storage tanks. The townspeople of Noble came out to help in any way they could. Government agencies provided information on ground water levels and layout schemes for the outdoor ponds. A well was dug, the one pump attached to bring water up the steep hill from the river.

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Every piece of work at the Noble fisheries is carefully examined and charted by researchers such as student Danny Zellmer who is working on his own undergraduate project at the center.

catching the fish is taken for granted, but extracting the pituitaries is another matter

Working steadily with makeshift materials, Dr. Clemens and his assistants, many of whom had never worked with pipes or wiring, installed the myriad valves and thousands of feet of pipes in the research building, constructed a roomful of fish storage tanks, devised a triple drainage system, wired the building for electricity, surveyed for the ponds and then stood back to see if everything worked.

"When we first turned on the water," Dr. Clemens says, "nothing happened. We checked every valve, every connection, hiked down to see if the pump was working, but still nothing happened. We finally found the water streaming out of one pipe. But we managed to fix it."

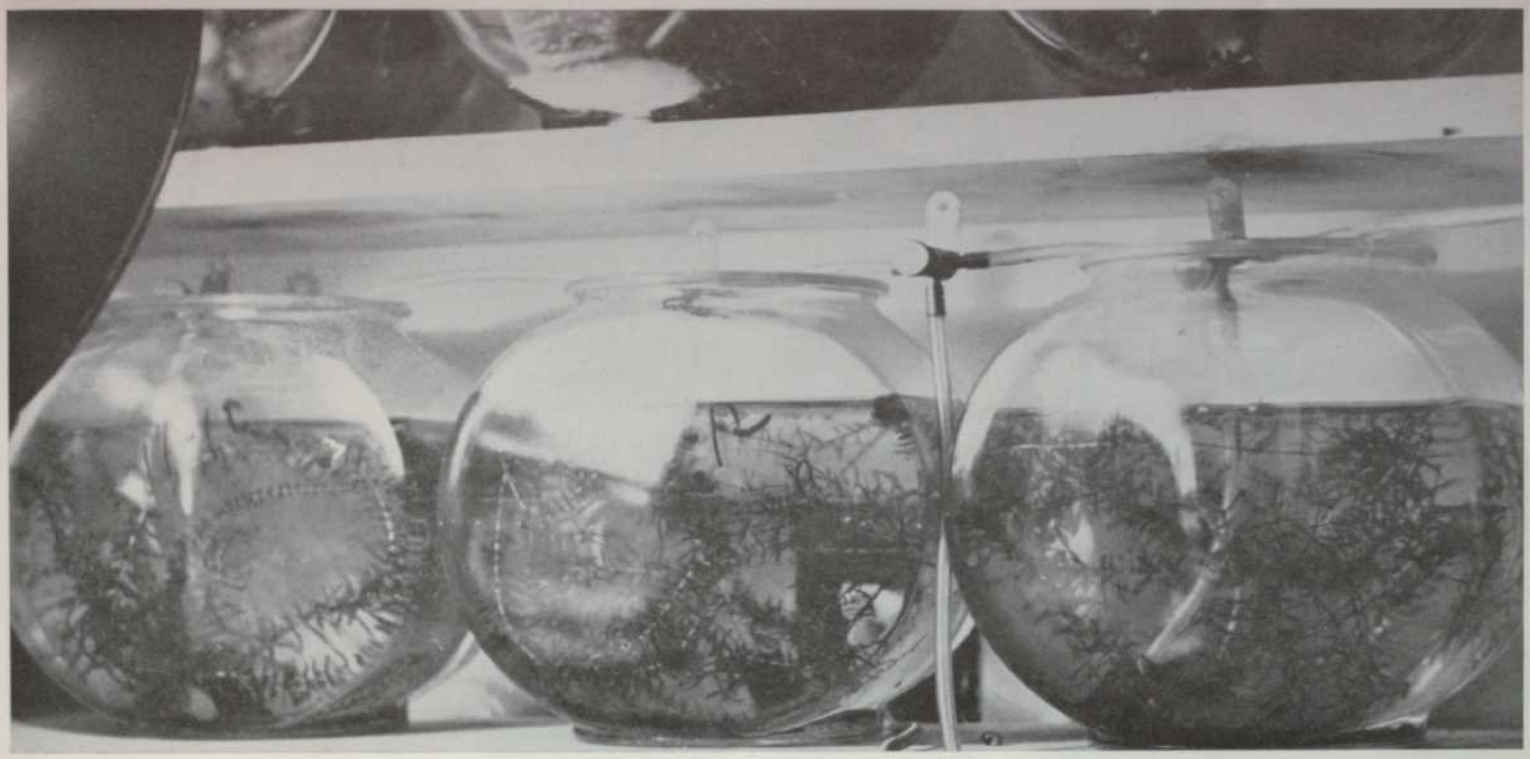
The fisheries have operated for over a year on just 50 gallons of water a minute from just one well. New wells are now finished and ready to pump the extra water, but at one time there was some doubt whether the single well was going to survive its burden. When the well was dug, it was placed on the east side of the river bed since the river itself was channeled to the opposite bank. Clemens and his men figured that the well—and their only pump—would be safe from possible flooding. During the winter, however, a gas line upstream exploded and caused the river to change course, bringing it to the eastern bank. With heavy rains and melting snow the river started rising. One afternoon Dr. Clemens received an emergency call from Noble asking him to bring another man to help save the pump.

Dr. Clemens could not find another man, so he and two co-workers tackled the four-man job of pulling the pump out of the water. By the time they reached the river the water was just a few inches from the base of the pump and appeared to be about ankle deep. In spite of the frigid weather and the swirling current, Dr. Clemens and his friends waded into the river. By the time they reached the pump they were chest deep in water, fighting to keep from being swept downstream. They retreated to the shore. They quickly built a raft, attached ropes and wires to themselves and the raft, anchored the loose ends to the shore and waded back out to the pump. The three of them managed to lift the pump off the well and onto the raft.

Those who work at the fisheries have managed to master the exacting technique of extracting fish pituitaries which vary in size from a pin head to a pea and are the basis of their work.

Dr. Clemens faced another perplexing problem when he made plans for laying out his ponds. Original plans called for 20 ponds on the land behind the research building. Each pond had to be built to rigid specifications—40 feet wide at bottom, 100 feet long and a 2-1 slope to the 8-inch drain to insure an adequate fresh water supply at all times. Dr. Clemens surveyed the land, marking off the ponds and carefully checking for underground line markers. When the crews came to dredge the ponds, they discovered that an unmarked sub-surface line restricted the available pond space to nine.

Through all the mechanical setbacks Dr. Clemens was also busy trying to accumulate enough fish pituitaries to begin his study. He needed approximately a pound of the glands as an initial supply. But it takes an estimated one million fish to produce even a pound of these glands which range in size from smaller than a pin head to the size of a small pea. By the time they are put through the preservatives they have shrunk to an even smaller size and weight.



One entire room at the fisheries research center is filled with bowls of guppies. Each is carefully keyed for its part in the experimental proceedings.

"The first problem, of course," Dr. Clemens says, "is to catch the fish. But we sort of take that for granted."

Dr. Clemens figured he could rely on his long contact with other men in the fisheries business, both commercially and in research. He got his initial batch of fish from a commercial fishery in Iowa, but the real work involved extracting the pituitaries.

To get the work started, Dr. Clemens and his crew, bundled up in insulated underwear, heavy clothes, oil slickers and rubber gloves, spent a week picking pituitaries in freezing weather in the back of an Iowa ice house. The fish heads were brought to them in 55 gallon barrels. One man armed with a hatchet would cut off the top of the head. If he cut too far back, the pituitary was lost, too far forward and it was crushed. Dr. Clemens had tried various tools for this operation from a meat cleaver to a razor blade, but he found a hatchet to be the best method. As the heads came to him, Dr. Clemens lifted out the brain and removed the tiny gland. They worked steadily from 7 a.m. to 11 p.m. Finally, Dr. Clemens was able to train other men for the job, and he returned to Norman. His assistants at the research lab are now proficient at removing pituitaries from fish as well as at recording and weighing the tiny objects on a scale that is so sensitive that it can weigh an eyelash, a fingerprint or a breath of air.

With the initial batch of pituitaries, Dr. Clemens was at last ready to begin his study. The research building is now filled with tanks and bowls of fish in various stages of various sub-projects, but each has some bearing on detecting the pituitary hormones.

Dr. Clemens chose to work with fish for very economical reasons. There are over 30,000 species of fish compared with some 5,000 species of mammals, making the fish a practically unlimited resource. In addition there are far fewer problems in storing and breeding.

Extensive work has been conducted with guppies. One entire room at the research building is filled with shelves and tanks of guppies. Lining the walls are pairs of guppies in small bowls, each marked for its part in the project. During spawning the guppies produce 200 young a day which must be regularly removed from the tank to separate quarters since guppies are cannibalistic fish.

The do-it-yourself tanks in the large main room of the building have placed the Noble Fisheries among the top five or six in the country, Dr. Clemens says. Each has three drains so that any single tank can be filled with fresh water, pond water or recirculated water at any time, and each is easily accessible for repair or close work with the fish. The temperature is carefully controlled as well as the lighting and feeding.

Because of its standing in fisheries research, the Noble center receives inquiries on research and procedure from all over the world. A year ago a Japanese scientist, Kychiro Yamamoto, an instructor at Hokaido University, spent several months at O.U. studying Dr. Clemens's research. Dr. Clemens has received requests for aid from Illinois researchers interested in knowing more about a new freezing technique for preserving fish eggs and sperm; from a trout farm in Idaho needing information on techniques in spawning; from scientists in England seeking to know about spawning of the grass carp, a seemingly non-spawning fish which is excellent for controlling pond vegetation.

Because of his varied background in fisheries research, Dr. Clemens is usually able to be of assistance when requests come in. He holds a bachelor's degree in zoology from the University of Western Ontario, 1946; a master's degree in fisheries from Western Ontario, 1947, and a Ph.D. in limnology from Ohio State University, 1949. His work in fisheries research has been highly valuable not only in the research lab but in practical application for wild life officials and commercial firms as well as for vacation fishermen.

What does Dr. Clemens do on his own vacations? He visits other fisheries centers, studies their facilities, learns from their techniques. But there is one thing he never does: he never goes fishing.