BREAKING THE BREEDING BARRIER

SINO-CANADIAN RESEARCH ON

INDUCED FISH SPAWNING

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A new cooperative project between Canadian and Chinese scientists will soon bring a cheaper and more effective means of breeding Chinese carp to fish farmers.

Dr R.E. Peter of the University of Alberta was studying the effects of a hormone produced in the brain, called luteinizing hormone-releasing hormone (LHRH). It causes the pituitary gland to release a second hormone, gonadotropin, necessary for spawning in fish. But injections of this hormone and a synthetic derivative of it (LRH-A) were relatively ineffective in causing goldfish to ovulate.

Further studies in Peter's laboratory identified the problem. A second factor produced in the brain, dopamine, inhibits the release of gonadotropin from the pituitary. In 1982, Peter found that by injecting fish with both LRH-A and drugs that block the effects of dopamine he could induce ovulation in goldfish.

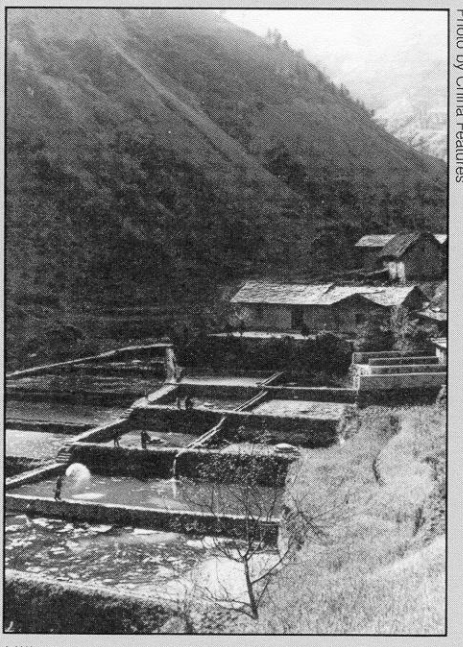

Photo by China Features

Villagers in central China breed fish in small ponds.

BETTER THAN TRADITIONAL METHOD

When Lin Haoren, chairman of the Biology Department of China's Zhongshan University in Canton, learned about Peter's discovery, he felt that it would provide a far better method of inducing spawning than the traditional method used by Chinese fish farmers. With support from IDRC, Dr Peter and Lin initiated a three-year cooperative project in 1984 to test the method on Chinese carp. So far, Lin said, "we have had positive results in laboratory experiments, and we'll soon begin tests at fish farms."

With a 3000-year history of fish culture, China uses over 10 million hectares of ponds, lakes, reservoirs, canals, rivers and their tributaries, as well as many paddy fields for fish cultivation.

In the temperate and subtropical regions of China, the growth period for cultured fish lasts seven to eight months. In the Yangtze and Pearl river basins fish can be bred continuously throughout the year. In 1984, China produced about 185 million tonnes of fish from freshwater fish culture, the biggest production of cultured freshwater fish in the world. But Chinese fish farmers were faced with the same problem as fish farmers elsewhere. Most of their fish do not breed naturally in captivity. So there had been the continual problem of supplying sufficient numbers of fry and fingerlings for stocking the ponds.

Since 1958 the Chinese have induced spawning in cultured fish by injecting mature fish with either the human chrorionic godadotropin (HCG) or extracts from the pituitary glands of carp. These techniques have been only partly successful. HCG is effective in only a few species and pituitary extract is very expensive. To induce spawning in a single fish it may be necessary to collect pituitary glands from 10 or more sexually mature carp. Even then many species cannot tolerate the injections and die after ovulation.

Chinese scientists recently introduced a new synthetic hormone, LRH-A, to induce ovulation. Although LRH-A provided a cheaper means of inducing spawning than the use of pituitary extract, it did not always work.

The Chinese had reached the same point in their research as Peter had in Canada. Then Peter found that dopamine, produced in the brain, inhibited the hormones needed for ovulation.

In the first phase of the Sino-Canadian project, Lin and his assistants at Zhongshan University test-injected cultured fish with synthetic LRH-A and pimozide, a dopamine antagonist.

HIGHER OVULATION RATE

"We have done tests on grass carp, common carp, mud carp, loach and bream. The results have shown that injections of LRH-A alone resulted in increased levels of gonadotropin in the blood, but were relatively ineffective for inducing ovulation. However, injections of LRH-A and pimozide at the same time resulted in a higher rate of occurrence of ovulation," said Lin, who reported his results to a symposium on carp culture in September of this year in France.

With the success of these initial studies, Lin said, the project is moving to search for more effective and cheaper forms of synthetic analogue and dopamine antagonist for use in fish culture.

In Canada, Dr Peter's lab has found a new analogue of salmon LHRH, which has proved to be more active than LRH-A in goldfish. This compound has now been brought to Lin's lab for testing on Chinese carp this year. After the tests, Lin said, "We may find that different kinds of synthetic analogues might be more effective in certain species of fish."

Since the dopamine antagonist (pimozide) now used in tests is not available in large amounts, both Dr. Peter's and Lin's labs are testing a series of alternatives to it. Last year Lin's lab found that reserpine, a drug that blocks the formation of dopamine, had a test record the same as or even better than that of pimozide. A Chinese drug manufacturing company has agreed to produce these chemicals for use on fish farms.

GROWTH HORMONES

Lin's lab also sent portions of the lower brain and the pituitary gland from carp to scientists in the United States and Japan in an attempt to isolate other hormones that may effect growth. "In the future, it may be possible to use hormones to influence the growth of fish much in the way we have been using hormones to influence ovulation," said Dr G. Van Der Kraak (from Dr Peter's lab), who came to China early this year to help Lin with the second stage of the experiments.

Lin said, "If we did not get the information and equipment from the Canadians, it would be very difficult for us to do the experiments."

"We also have obtained benefits from the experiments conducted in China," commented Dr Van Der Kraak. "The experimental results obtained from Professor Lin's laboratory have influenced the types of experiments we conduct in Canada, and may soon influence scientists studying fish reproduction throughout the world." □

Zhang Weimin writes for China Features.