Biotechnology Research at SEAFDEC/AQD

The Nutrition Building where the biotech labs are located on the second floor

Aquaculture research will soon benefit from biotechnology facilities to be established at the SEAFDEC Aquaculture Department's main station at Tigbauan, Iloilo, Philippines. The laboratory complex will be located at the second floor of the Department's Nutrition Building. Worth more than US$6 million, it will be largely a result of a grant from the Government of Japan, which supplemented existing laboratory facilities at AQD with additional and advanced equipment and machinery. The host government, the Philippines, will provide counterpart funds of US$0.6 million for the improvement of the laboratories and acquisition of experimental tank systems. Proponent and recipient of the Biotech Lab is the country's Department of Agriculture (DA) while AQD and the DA-Bureau of Fisheries and Aquatic Resources will operate it.

THE LABORATORIES

Four laboratories are to be housed in the complex. These are for (1) molecular endocrinology and genetics, (2) microbiology, (3) feed technology, and (4) algal production technology.

Molecular Endocrinology and Genetics Laboratory. The laboratory's mandate is to develop strategies to enhance the reproductive and developmental potentials of cultured species. Some research problem areas AQD researchers are interested in include:

- Control of the fishes' reproductive cycles to achieve off-season maturation and spawning
- Sex inversion
- Growth enhancement
- Optimizing conditions for the use of hormones and other substances to promote larval settlement and metamorphosis
- Development of molecular markers for parental/pedigree analysis and marker-assisted selection
- Determination of the genetic variability of wild and cultured populations of marine and freshwater fishes

What has been done so far by SEAFDEC/AQD researchers is cloning the cDNA for rabbitfish *Siganus guttatus* and milkfish *Chanos chanos* growth hormone (GH). Exploiting recombinant DNA technology to produce large amounts of GH is necessary for large-scale growth enhancement applications for the species. In the future, efficient methods of incorporating the recombinant GH into larval, nursery and grow-out diets will be developed, and ways to prolong the bioavailability of the hormone will be explored. Studies on genetic variability, and molecular genetic analysis of freshwater fishes such as catfish and bighead carp are also being undertaken. The researchers aim to clone gonadotropins and gonadotropin-releasing hormones, develop protocols for off-season maturation and spawning in cultured fishes, and clone P_{450} aromatase, the enzyme responsible for conversion of testosterone to estrogen, a key step in the process of sex inversion.

Molecular Microbiology Laboratory. The objectives of the facility are to:

- Establish and maintain fish cell lines for use in the diagnosis of viral diseases
- Develop rapid and sensitive techniques for the detection and identification of fish, crustacean and shellfish pathogens
- Develop vaccines and immunostimulants against potential fish, crustacean and shellfish pathogens

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Facilities in the Biotech Lab include thermal cyclers to amplify DNA by polymerase chain reaction (PCR), refrigerators and ultra low freezers

- Develop alternatives to antibiotics
- Develop beneficial microorganisms for aquaculture wastewater treatment.

Currently available fish cell lines include the following: bluegill fry (BF-2), catfish spleen (CFS), grouper fin (GF), sea bass kidney (SBK-2), snakehead spleen (SHS), white sturgeon skin (WSSK), fathead minnow (FHM), Epithelioma papulosum cyprini (EPC), snakehead fin (SSN-1) and white sturgeon spleen clone 1 (WSS2C1). Aside from maintaining fish cell lines, the laboratory currently conducts diagnosis using one-step and nested polymerase chain reaction (PCR) techniques of white spot syndrome virus (WSSV) and viral nervous necrosis (VNN), shrimp and fish viral pathogens, respectively. Cell culture is also being used in the diagnosis of fish viral pathogens like VNN.

The laboratory is expected to:

- Establish and maintain more cell lines
- Develop monoclonal antibody-based techniques for disease diagnosis (eg. monodon baculovirus and hepatopancreatic parvo-like virus)
- Develop PCR-based techniques for other fish and shrimp diseases
- Apply recombinant DNA technology to improve fish resistance to diseases
- Establish an effective disease control program
- Identify schemes and products to replace antibiotics as disease control agents
- Isolate microbes and develop techniques for their mass production for bioaugmentation and bioremediation.

Feed Technology Laboratory. The facility has five projects.

- Development of cheap alternative protein sources to reduce feed cost. Since imported feed ingredients are costly, the project aims to develop nutritionally effective diets with reduced costs and identify cheap alternative protein sources.
- Improve feed efficiency and growth performance of cultured species. The project's objectives are the improvement of feed ingredient quality and bioavailability through fermentation and enzyme technology and evaluation of nutrient absorption rates in cultured species.
- Reduction of losses due to diseases in aquaculture production systems. Since the use of chemotherapeutants may cause the development of drug-resistant pathogenic bacterial strains, AQD feed technology researchers are interested in finding out feed additives and nutrients that will stimulate the fish's immune system and enhance disease resistance.
- Reduction of adverse environmental impact due to inefficient feeds. The project aims to develop low polluting or "environment-friendly" feeds.
- Improved feeds for genetically superior breeds. There is yet no available feed for genetically improved strains. Since higher levels of both macro and micronutrients may be required for feed formulation, optimal levels of these nutrients must be determined.

Algal Production Technology Laboratory. The laboratory aims to

- address the problem of deterioration of seedstocks of cultured seaweeds
- maximize the utilization of algal resources for industrial and medical applications
- develop pollution control and wastewater management measures using algae.

The laboratory will conduct studies on algal physiology, genetics and chemistry. It will undertake further studies to improve algal strains by tissue culture and protoplast technology; characterize algal strains, species and populations at the DNA level; isolate, identify and characterize algal natural products of great industrial or medical use, and develop appropriate culture techniques; and explore the potential or efficiency of algae as biological filters, and in the process, study the uptake and fate of hazardous elements and compounds. ###