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Minutes, not days: Partnership takes aim at rapid tests for shrimp diseases

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By Hank Hogan

Funding fast-tracks the commercialization of a gene-sequence technology that detects shrimp diseases in the field quickly and cost-effectively

With USDA funding, Sherlock Biosciences and the Gloucester Marine Genomics Institute will commercialize diagnostic tests for shrimp diseases. Photo by Darryl Jory.

Infectious diseases can crater aquaculture output, saddling producers with significant economic losses. White Spot Syndrome Virus (WSSV), for example, is so deadly to Pacific white shrimp that an outbreak can cause close to **100 percent mortality** (https://www.nature.com/articles/s41598-019-56170-y) in as little as a week. Over the last 30 years, losses due to the virus have topped an estimated $15 billion.

Given the speed with which the disease spreads and its lethality, shrimp farmers need tools to rapidly identify an outbreak so that measures can be taken to contain and treat the virus. Sherlock Biosciences is now partnering with the Gloucester Marine Genomics Institute (GMGI) to develop a diagnostic tool through a U.S. Department of Agriculture (USDA) Small Business Innovation Research (SBIR) Phase I award. The objective is to alert producers to a problem before it becomes a catastrophe.

“The ultimate goal is to sell directly to shrimp farmers, who currently have to send their samples to central laboratories, delaying the time for diagnosis and impacting the ability to quickly respond to outbreaks. With our platform, they can get the information they need within 30 minutes,” Mary Wilson, director of assay research at Sherlock Biosciences, told the *Advocate*.

This new tool builds upon research done by GMGI for years in developing a test for WSSV, according to Andrea Bodnar, science director. Those efforts succeeded, producing a sensitive test that could spot trace amounts of the virus. Bodnar noted that the researchers used tools originally developed to do gene editing, a technology called CRISPR.

“We’re using that same technology to detect specific genetic sequences,” she said.

These sequences uniquely identify WSSV, while CRISPR technology releases only those specific genetic sequences, leaving everything else alone. Amplification of those snippets multiplies them and turns minute amounts of tell-tale genetic sequences into enough material to be detected.

A technique developed and demonstrated by GMGI uses a fluorescent marker and a tag molecule attached to create a visible glow when a sample containing the virus is illuminated with the right light. GMGI photo.

The technique developed and demonstrated by GMGI used a fluorescent marker, a tag molecule attached to create a visible glow when a sample containing the virus was illuminated with the right light. This approach gave results comparable to the laboratory-based gold standard for detecting the virus, a quantitative polymerase chain reaction, or qPCR test. However, the GMGI test required further refinement to make it deployable in the field.

That’s where Sherlock Biosciences came in. The company’s initial focus has been on diagnosing human diseases, Wilson stated. In these efforts, Sherlock Biosciences has worked to simplify sample preparation so that its diagnostics can be used by untrained operators while maintaining sensitivity to react to small amounts of the pathogen. The other goal has been to have a test that is specific to a given disease, thereby minimizing the chance for a false reading.

Test characteristics such as speed, sensitivity, specificity and low cost are attractive in diagnosing human diseases. Those same attributes are also useful when spotting animal diseases.

“When it comes down to it, we believe nucleic acids are nucleic acids, no matter the source material,” Wilson said. “Our chemistries are very good at releasing and detecting nucleic acids in clinical samples.”

In an October statement, Sherlock Biosciences and GMGI reported **significant progress** (https://gmgi.org/news/press-release-gmgi-sherlock-biosciences-receive-funding-from-usda/) in converting the GMGI method to run on a Sherlock Biosciences platform.

After demonstrating that the diagnostic works, the next step will be akin to a beta test, with many different samples. The viral load in these samples will be evaluated by the new tool in a field deployment, with results compared to those from the qPCR method run in a lab. This beta test phase could take place next year, with the timing depending on funding and other factors. The length of the beta test, which will be paid for through an SBIR Phase II grant, has not yet been publicly announced. Product rollout could begin after the successful completion of the beta test.

The cost of the testing has not been set but estimates by Sherlock Biosciences are that diagnostics could be done for U.S. $5 to $20 each. That is significantly less than the cost to run qPCR. The new test results will also be available in minutes, not days.

While Sherlock Biosciences and its initial work with GMGI is focused on WSSV, Wilson noted that the company’s platform doesn’t care about the upstream organism whose genetic sequences are detected. Thus, many other diseases of interest could be tested.

“We believe the platform can be expanded to other diseases of interest to aquaculture,” Wilson said. “We imagine a future where, rather than sending samples out for testing, farmers are able to test their stocks for a panel of diseases on our platform.”

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