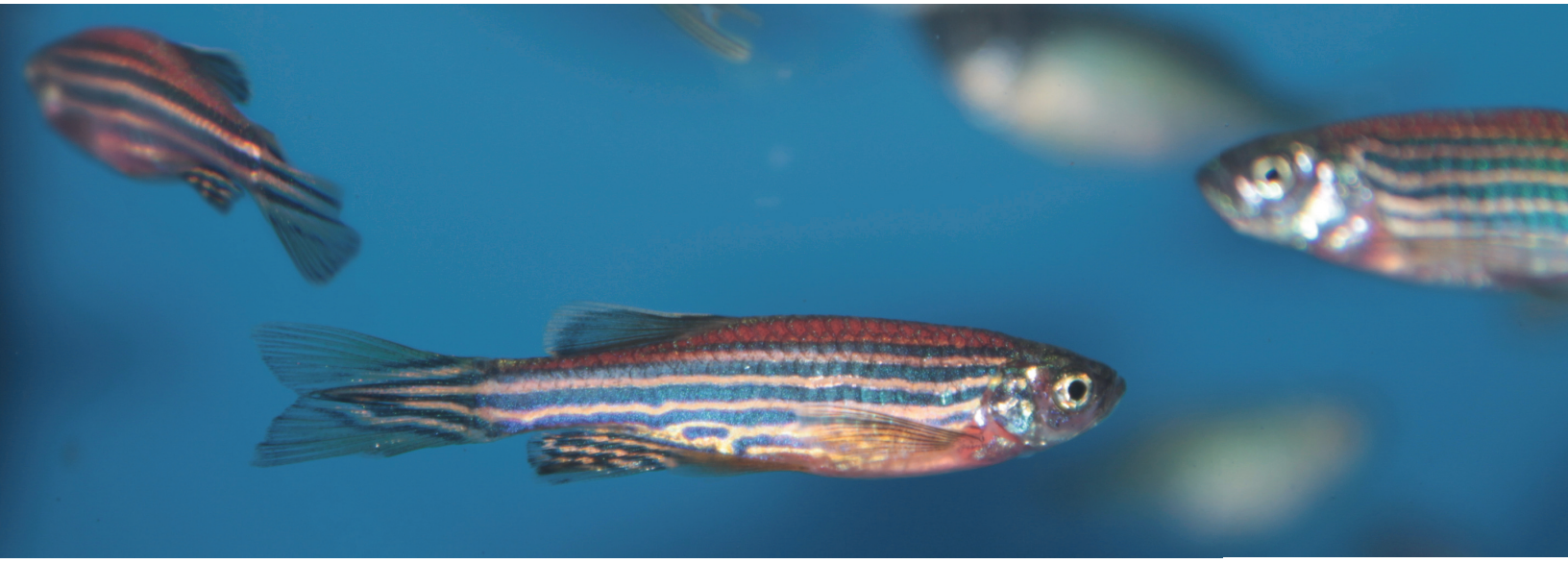
Zebrafish Research Made Faster, Easier and Safer by Innovative Water Testing System

Aquaculture Research | Application Note



Harvard Medical Researchers at Boston Children's Hospital Embrace Rapid Results

To better protect and improve human health, researchers around the world are studying how genetic mutations can lead to specific diseases. While this research has traditionally utilized lab mice as test subjects, there is a growing trend to focus on zebrafish instead. These small "tropical freshwater fish in the minnow family" are native to India, and they derive their name from the "horizontal blue stripes on each side of their bodies."[1]

Leading global researchers, including the National Institutes of Health (NIH), use zebrafish to study genetic causes and solutions for human diseases. At the Zon Laboratory[2] at Boston Children's Hospital, the primary pediatric program of Harvard Medical School, researchers are actively studying tens of thousands of zebrafish across thousands of tanks.

These teams are gaining key insights into human genetics and diseases including:

- Genes contributing to black melanoma formations
- Genes that, when deficient, allow melanomas to grow faster
- Causes of muscle fiber degeneration which leads to muscular dystrophy
- Various blood cells potentially leading to leukemias, lymphomas, and anemias

Benefits of Zebrafish in Medical Research

With such crucial areas of focus, it is essential that test subjects are as effective as possible. Accordingly, researchers are increasingly bypassing lab mice and instead testing zebrafish with gene mutations from patients with unknown diseases.[3] Benefits include:

- **Humans share 70% of their genes with zebrafish**, and these seemingly disparate species both have many **similar body structures and organs** including a vertebral column, two eyes, mouth and brain.[4]
- **Transparent bodies** enable faster observation of genetic mutations.
- **Fast reproduction** (hundreds of embryos every 7-10 days) and **high growth rates** (develop red blood cells in 24 hours) offer swift test results.[5]

Water Conditions for Effective Zebrafish Research

Maintaining stable and consistent water conditions across thousands of fish tanks is essential for research success, and there is a wide variety of complex test

factors that can each impact outcomes. For example, ammonia and nitrite levels are as important to fish health as the more common parameters of dissolved oxygen and pH.

To achieve this high standard of water conditions, researchers at Boston Children's Hospital use recirculating water systems that are tested routinely on the following parameters:

- **Continuous monitoring:** pH, conductivity, temperature
- **Weekly testing:** ammonia, nitrite, nitrate, pH
- **Monthly testing:** hardness, alkalinity, dissolved oxygen (DO), carbon dioxide (CO_2), phosphate, pH

While traditional probes can be used to monitor more basic parameters, the chemical tests for ammonia, nitrite, nitrate, hardness, alkalinity and phosphate are best measured with a photometric analyzer. Traditional probes, if they exist at all for more complex parameters, are often higher cost, more difficult to keep calibrated, and not always practical for high quantity use for maintaining thousands of testing tanks.

Practical Challenges of Monitoring and Maintaining Research Tanks

Beyond these data requirements for accurately monitoring and maintaining water conditions, it is essential that all researchers perform key techniques and safety protocols for effective water analyses, data recording, and general fish safety. This regimen becomes increasingly challenging, though no less important, as the number of tanks increases into the hundreds and thousands.

The zebrafish facility at Boston Children's. Photo courtesy: K.C. Cohen

The challenge is clear – gather massive quantities of data in a timely manner while maintaining high research standards and do so with a team that potentially exhibits a wide range of experience and responsibilities, from an intern to a PhD researcher.

The Innovative WaterLink® Spin Touch® System Provides a Trusted Solution

To solve these complex challenges, researchers need accurate tools that are fast and reliable to simplify their data collection and maintain fish health.

Key benefits of the Spin Touch® include:

- Measuring up to eight key chemical parameters without having to mix or add reagents by hand
- Sufficiently automate processes to reduce user error and testing time while minimizing training
- Capturing results digitally in the device and seamlessly share results instantly
- Safely enables water testing without hazardous reagents

Measure Up to 8 Parameters Simultaneously

Without any experience or safety concerns, users can quickly use the Spin Touch® to measure up to eight aquatic measurements at one time. Researchers can specify testing based on freshwater or saltwater and gather data including:

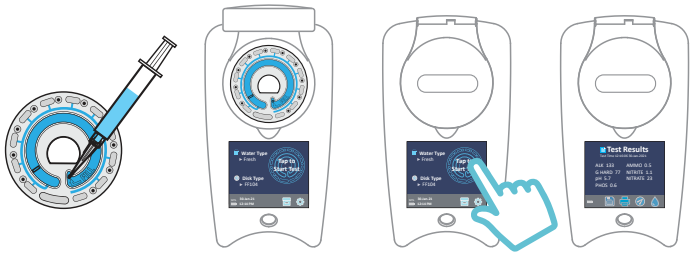
- Alkalinity
- Ammonia
- Calcium
- Hardness
- Magnesium
- Nitrate
- Nitrite
- pH
- Phosphate

"This device has saved us so many hours as far as doing manual water testing, taking samples, and getting read-outs."

–Kara Maloney, Aquatic Resources Program Manager of Boston Children's Hospital

Fast Data in Two Minutes

To use the Spin Touch®, researchers simply fill a two-inch SpinDisk® Reagent Cartridge with less than three milliliters of the sample water and place the disk in the instrument. After pressing start on the touchscreen, results will display in two minutes.



Share Digital Results via Bluetooth

Freshwater SpinDisk®

The on-screen test results can be instantly sent via Bluetooth to any connected device and are saved in the Spin Touch® library with a time/date stamp. Furthermore, a rechargeable battery means this portable instrument can quickly move throughout the lab to capture results.

Safe & Easy Results Without Clean-Up

This innovative photometer automatically completes all chemical mixing and analysis without the need for glassware or hazardous chemicals to clean up.

A Global Legacy of Water Analysis

For over 100 years, LaMotte has been an innovative leader in water quality analysis with world-class products focused on simplified methods for rapid analysis. The Spin Touch® continues this trend and has proved itself in diverse global industries for over 10 years.

Freshwater SpinDisk® Series: 4351-H (FF) and 4353-H (FX)

Test Parameter	Range	Accuracy	Method Detection Limit
Alkalinity	0-250 ppm	± 15%	15 ppm
Ammonia NH_3	0-3.0 ppm	< 2.0 ppm: ± 0.2 ppm; > 2.0 ppm: ± 0.4 ppm	0.2 ppm
Hardness	0-500 ppm	± 15%	20 ppm
Nitrate NO_3	0-300 ppm	± 30% up to 125 ppm	5 ppm
Nitrite NO_2	0-2.0 ppm	± 0.2 ppm	0.1 ppm
pH	4.5-10.0 pH	± 0.2	NA
Phosphate PO_4	0-2.0 ppm	± 0.2 ppm	0.2 ppm

Saltwater SpinDisk® Series: 4352-H (FF) and 4354-H (FX)

Test Parameter	Range	Accuracy	Method Detection Limit
Alkalinity	0-300 ppm	± 15%	15 ppm
Ammonia NH_3	0-3.0 ppm	< 1.0 ppm: ± 0.2 ppm; > 1.0 ppm: ± 0.4 ppm	0.2 ppm
Calcium	200-800 ppm	± 15%	NA
Magnesium	500-2200 ppm	± 15%	NA
Nitrate NO_3	0-60 ppm	± 25%	5 ppm
Nitrite NO_2	0-2.0 ppm	± 0.2 ppm	0.1 ppm
pH	6.5-10.0 pH	± 0.2	NA
Phosphate PO_4	0-2.0 ppm	± 0.2 ppm	0.2 ppm

Spin Touch® FF SpinDisks are available for sale in North America only. For Customers Outside North America WaterLink® Spin Touch® FX. Disks sold separately.

Disk Patent No. 8,734,734; FCl Patent No. 8,987,000; TCl Patent No. 8,993,337; FCl EU Patent No. EP2784503 A1

References

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2 Zon Laboratory Research, https://www.childrenshospital.org/research/labs/zon-laboratory-research

3 The zebrafish reference genome sequence and its relationship to the human genome. https://europepmc.org/article/PMC/3703927

4 Why Do Zebrafish Make Model Organisms in Scientific Research? https://news.cuanschutz.edu/dbmi/why-do-zebrafish-make-model-organisms-in-scientific-research

5 Zon Laboratory Research, https://www.childrenshospital.org/research/labs/zon-laboratory-research

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