

Academic, Commercial Collaboration for Testing

➤ **COVID-19 assay developed by SUNY Upstate now used at 64 campuses statewide to keep them open**

➤➤ **CEO SUMMARY:** *In several important ways, this collaboration involving an academic clinical laboratory and a commercial company has paid big dividends, not just for the two partners, but also the parent university that oversaw the project. The two partners developed a SARS-CoV-2 test, then manufactured it in large quantities. The molecular COVID-19 test, named Clarifi, uses a saliva specimen and has the lowest limit of detection of any saliva test on the market. It is used at 64 SUNY campuses in New York State.*

ONE LESSON THAT ACADEMIC MEDICAL CENTER LABORATORIES are learning during the COVID-19 pandemic is that collaborating with the right commercial diagnostics company can result in development of an effective molecular SARS-CoV-2 test that is then manufactured in large quantities and even used by universities to test their own students, faculty, and employees.

That's exactly the story at **SUNY Upstate Medical University** in Syracuse, N.Y., which partnered with **Quadrant Biosciences**, a molecular diagnostics company embedded at **SUNY Upstate Medical**, to co-develop the **Clarifi** COVID-19 saliva test. The test received emergency use authorization (EUA) from the FDA on September 22, 2020, and **New York State Department of Health** approval in late August.

How a professor within SUNY Syracuse made this all happen provides a road map that will be useful to other pathologists and molecular PhDs as they continue to respond to the pandemic and provide SARS-CoV-2 tests to the communities served by their clinical laboratories.

Moreover, because of the test's performance characteristics, it became the

COVID-19 test of choice—not only for the student COVID-19 testing program at the SUNY campus in Syracuse—but for all 64 SUNY campuses throughout the state of New York. The numbers confirm the success of this effort. By the end of January, over 600,000 Clarifi SARS-CoV-2 tests had been performed on students, faculty, and employees at all SUNY campuses statewide.

Quadrant Bioscience manufactures the test kits and SUNY Upstate performs the Clarifi tests at its clinical laboratory in Syracuse. Along with the high volumes of testing it enables for the SUNY system, Quadrant also sells the Clarifi tests to other clients and customers.

➤ **SARS-CoV-2 Assay**

This success story begins when Frank Middleton, PhD, Director of the **State University of New York Molecular Analysis Core** (SUNYMAC) facility at SUNY Upstate in Syracuse, knew he had to act quickly to develop an assay that could be used to identify the SARS-CoV-2 virus, which causes COVID-19. Middleton is also Associate Professor in the Department of Neuroscience and

Physiology, Department of Psychiatry and Behavioral Sciences and the Department of Biochemistry and Molecular Biology at SUNY Upstate Medical University.

Middleton was uniquely prepared to take up this challenge. He has worked in saliva-based microbial and RNA biomarker development for the past decade. He had the full support of the university administration and an on-campus partner, Quadrant Biosciences, as well as the assistance of several researchers.

“We were challenged with developing a lab test that could help meet the needs for increased testing capacity, remote self-collection, and use in asymptomatic individuals, while also avoiding as many reagent shortages as possible that so many other labs faced,” explained Middleton.

The work on the individual test was initiated in March 2020 with two working prototypes for a saliva-based multiplexed assay by the first week of April, and final data for submission to the federal **Food and Drug Administration** (FDA) by the end of April.

However, changes made by the FDA to its requirements for validation samples forced the team to start over. The team submitted its data to the FDA for approval in early June, received feedback in early July, and resubmitted the request in early August. SUNY’s Clarifi COVID-19 test received emergency use authorization from the FDA on September 22, 2020. New York State approved use of the test in late August.

► **Lowest Limit of Detection**

The Clarifi COVID-19 test kit has the lowest limit of detection of any saliva test on the market, at just 600 NDU/mL. In addition, it is engineered to limit false-negative results by integrating an RNA stabilizing solution into the saliva collection kit.

“The Clarifi test is more sensitive than other saliva tests, which likely reflects

the fact that the sample collection device stabilizes the RNA in the saliva—including the host and the viral RNA—using a proprietary combination of buffers and enzymes that also completely inactivate the virus and make the samples extremely safe for handling,” Middleton noted.

“We worked with the swab collection device manufacturer—**DNA Genotek**—to substantiate all this and even tested the viral and microbial inactivation properties ourselves. This property has the added benefit of allowing the test to be collected remotely—in some cases hundreds of miles away from a lab—and used for both pooled and individual tests after storage or transport at room temperature for several days.

“Of course, we want the results much sooner than that, but there is no substitute for maintaining the quality of the starting material,” he added.

► **Developed with Quadrant**

Quadrant Biosciences (Syracuse, N.Y.), a startup that was established on the SUNY Upstate campus about six years ago, began working with Middleton on development of the test early on.

“At the beginning of the pandemic last February and March, Quadrant had a total of about 25 people working on our campus, ranging from programmers, engineers, and data analysts to clinical research associates and bench scientists,” Middleton said. “One of those bench scientists was a former PhD student of mine. When our campus went on shutdown mode, I was given the green light by my university to continue working on the saliva test, and Quadrant offered their support in the form of personnel and purchasing power. After a week on my own, I asked my former graduate student to work with me, and we actually co-developed the saliva test. I later added the pooled test component.”

SUNY Upstate worked hand-in-hand with Quadrant to get the test through the

SUNY's Clarifi Molecular COVID-19 Assay Uses Saliva Specimen, Supports Pooled Testing

SUNY'S COVID-19 POOLED TESTING PROTOCOL allows for collection of saliva that can be tested as part of a pool and also individually if needed. Each pool can test between 10 and 25 people at a time using one assay, although campuses are currently advised to use a maximum of 12 in a pool.

Pooled testing uses the Clarifi COVID-19 test, co-developed by professor Frank Middleton, PhD, his team at SUNY Upstate Medical University, and Quadrant Biosciences. According to SUNY's testing protocols, a local collection team at a school should be able to receive up to 6,000 saliva samples and create 500 pools in a single day.

Each campus typically has a testing area manned by student volunteers along with healthcare professionals. Students or staff swab the inside of their mouths for about 15 seconds and swabs are placed in a collection tube with a stabilizing solution. At the pooling station, a healthcare profes-

sional decants the liquid from the tube into a separate common pool tube. The swab remains in the original collection tube so that it can be tested individually if needed.

The samples are sent to the laboratory at SUNY Upstate for testing. A negative test for the pool means that all those in the pool are presumed to be COVID-free. A positive test for the pool requires that each of the individual swabs will then be tested using the Clarifi PCR test.

"The real difference between our pooled methodology and others is that—with a single swab—we can do the pooling and the reflex testing," Middleton noted.

"We average turnaround of under 24 hours from time of receipt for pooled tubes. If we have to test individual samples, that takes a little longer, but no more than one additional day. Each campus gets a report that shows a list of all the students in a pool along with a notification of students who have tested positive for COVID," he added.

FDA authorization process successfully, and they continue to work together on the distribution of the test to the 64 SUNY campuses. Quadrant also helps recruit and hire essential lab workers to staff the laboratory at SUNY Upstate.

"It is an understatement to say that without Quadrant's input, this SARS-CoV-2 test would be just another good idea left on the shelf of an academic scientist, without the ability to reach approximately 150,000 people per week at present and double that number by the end of February," Middleton said.

➤ **Test at 64 SUNY Campuses**

SUNY is using the Clarifi COVID-19 test to screen students and faculty at the 64 SUNY campuses throughout the state of New York. The system is using pooled

surveillance, which allows multiple samples to be run in a single test, along with reflex testing as needed.

As of mid-January 2021, more than 600,000 Clarifi tests had been performed on SUNY's campuses, with 200,000 of them done in the two weeks leading up to the winter break, which began just before Thanksgiving.

"The Clarifi test has served as one of the cornerstones for reopening SUNY campuses, with others being social distancing, preventive hygiene, and personal protective equipment (PPE)," noted Middleton. "During initial development of the test, we thought it was an assay that might be used on our campus [SUNY Upstate] and did not expect that it would eventually be deployed across more than 60 SUNY institutions.

“Since the SUNY-wide surveillance efforts have begun, the test has been used to screen more than half a million samples in pooled fashion, with approximately 2% to 3% of samples being subjected to reflex testing. The cost savings alone from not having to pay for individual testing of those students more than offsets all of the investment made in developing the test,” he noted.

► Test Performed at Cost

SUNY Upstate, which developed and performs the testing, provides access to the Clarifi test for other SUNY campuses at cost, which is \$15.

For other schools outside the SUNY system, the cost is \$30 per test. Each campus sets its own testing schedule, but Middleton notes that—as would be expected—campuses that achieve the best overall low positivity rate are those that do the most testing.

“We have some campuses that test all students every week and they have positivity rates of about 0.2%,” he said.

Noting this, the SUNY Chancellor in January 2021 directed all SUNY campuses to test 100% of their students each week during the spring 2021 semester.

As of January 29, 2021, a total of 4,261 people tested positive for SARS-CoV-2 out of 778,667 tests administered on SUNY’s campuses, according to the SUNY COVID-19 tracker. Each campus sets its own trigger for transition to 100% remote learning.

The trigger at **Buffalo State**, for example, is 100 cases, while the trigger at the **Fashion Institute** in Manhattan is 45.

► Test Now Offered to Others

SUNY and Quadrant have begun expanding the Clarifi testing protocol beyond the SUNY system and other private colleges, offering testing for a few elementary and middle schools, including some in Pennsylvania.

“Bandwidth is the problem in terms of expansion,” Middleton explained. “We

SUNY COVID Test Used to Test Wastewater

SUNY AND OTHER SCHOOLS ARE USING A MODIFIED VERSION of the Clarifi PCR assay to monitor wastewater on campuses to identify community-level transmission.

The SARS-CoV-2 Early Wastewater Surveillance Platform started as a collaboration in mid-March between scientists from **Syracuse University**, SUNY College of Environmental Science and Forestry, and SUNY Upstate. SUNY Upstate provided the space and specialized equipment needed to develop the specifics of the assay.

Although the assay used for wastewater testing is similar to the one used for saliva testing, wastewater is tested in a different laboratory using a different reference gene assay.

have more people interested in using the services than we alone can accommodate. We expect there to be a continued need for college and pre-college testing for the next six to eight months.”

To help meet this demand, SUNY Upstate Medical University and Quadrant are opening a new laboratory at the University of Buffalo to increase testing capacity, Chancellor Jim Malatras announced on January 31.

The new lab, which is expected to be operational by March 1, will be able to process 150,000 tests per week, increasing total COVID-19 testing to 350,000 tests per week across SUNY, with results being returned to campuses within 24 hours.

SUNY is investing \$120,000 in the expansion by purchasing the equipment to process the Clarifi test at the new lab. Additional funding will be provided by Quadrant, and the laboratory will be staffed by Quadrant in partnership with SUNY faculty and student medical researcher teams.

TDR

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