

## Liquid Handling Automation System Streamlines Sample Preparation for Nutritional Analysis

The Andrew Alliance Andrew+ pipetting robot enables Eurofins Scientific to remove manual processes that require time-consuming and potentially error-prone steps, gaining 30-60 minutes per day in analyst work time

**Products: Andrew Alliance™ Andrew+ pipetting robot, OneLab Software, Amino Acids ACCQ-Tag™ Kit, Waters LC columns, Empower™ Enterprise Chromatography Data System, Alliance HPLC System, Arc HPLC System, ACQUITY UPLC H-Class, ACQUITY UPC<sup>2</sup>™ System, ACQUITY QDa Mass Detector, Xevo™ TQ-XS Triple Quadrupole Mass Spectrometer, MassLynx™ Mass Spectrometry Software**

### NUTRITIONAL ANALYSIS AT EUROFINS SCIENTIFIC

Eurofins Scientific has established itself as a global leader in food, environmental, pharmaceutical and cosmetics products testing, as well as agrosience CRO services. The Eurofins Group comprises an international network of more than 900 independent companies in over 50 countries generally specialized by end client markets with more than 800 operating laboratories.<sup>1</sup> The group employs more than 50,000 people, has a portfolio of over 200,000 analytical methods, and performs more than 400 million tests each year to evaluate the safety, identity, composition, authenticity, origin, traceability, and purity of a wide range of products, as well as providing innovative clinical diagnostic testing services.

Recognized as a Center of Excellence for Nutrition, the Eurofins Nutrition Analysis Center, in Des Moines, Iowa, specializes in analyzing feed, commodities, pet food, human food, and dietary supplements for nutritional content. This Eurofins center is an ISO 17025 accredited laboratory and one of only 11 Official Reference Laboratories for soybean meal, certified by the American Oil Chemists' Society (AOCS) and National Oilseed Processors Association (NOPA). It is also a U.S. Department of Agriculture inspected laboratory.

The Eurofins Nutrition Analysis Center's services includes the analysis of macronutrients, such as proteins, carbohydrates and lipids; micronutrients, such as vitamins, minerals, and amino acids; nutrition labeling, including nutrition testing as mandated by the U.S. FDA Nutrition Labeling and Education Act (NLEA); and shelf life and stability, such as storage capabilities, microbiology, rancidity, and sensory.



*Eurofins' laboratory in Des Moines includes more than 50 Waters LC instruments with optical detectors.*

### WORKING WITH WATERS

The Eurofins Nutrition Analysis Center's close working relationship with Waters™ has developed over two decades as the laboratory continually invested in instrumentation and software. Currently, the long list of Waters equipment in the Des Moines laboratory includes more than 50 Waters LC (HPLC and UPLC), optical detectors, single quadrupole MS (QDa), and LC-MS/MS systems, as well as related software and consumables.

Dr. Elaine (Wenjuan) Jobgen, Director of Operations at Eurofins Nutrition Analysis Center, describes this relationship between Eurofins and Waters: "Waters is a part of our company's family. We work closely with our Waters support technicians, and they understand our needs and our goals for the future. Waters shared the capabilities of Andrew+ pipetting robot with us after they acquired Andrew Alliance because they thought it would be a good fit for our long-term efficiency goals. The fact that this solution became a part of the Waters portfolio was a huge selling point for us."

**“Our laboratory specializes in nutritional analysis: vitamins, minerals, amino acids, sugars, etc. Whatever you see on the nutritional label of any foods, we do it here.”**

**DR. ELAINE (WENJUAN) JOBGEN**

*Director of Operations, Eurofins Nutrition Analysis Center*



*Eurofins Nutrition Analysis Center is ISO 17025 accredited, and one of only 11 Official Reference Laboratories for soybean meal.*

With a wide range of clients across multiple industries, the Eurofins Nutrition Analysis Center is constantly looking to generate laboratory efficiencies. One of the laboratory's goals was to automate sample preparation and liquid handling and, following a recommendation from Waters personnel, the Eurofins team decided to trial the Andrew+ pipetting robot. For Eurofins, like many laboratories, replacing some manual processes that are time-consuming and could potentially introduce human error, and freeing analyst time, are attractive options.

## LABORATORY AUTOMATION

As contract testing labs face increasing competition, modern laboratories have been quick to embrace automation as a critical component to streamlining analytical workflows. The automation of routine and complex sample preparation helps minimize variability, improve traceability, and simplify method transfer.

This capability generates productivity gains and improves efficiency in the lab, while also allowing scientists to spend more time on value-added tasks – such as method development and validation, data analysis, and data interpretation. By removing time-consuming manual tasks, scientists can use their time effectively to collect data, allowing them to make better and faster business decisions.

While the advantages of streamlining sample preparation are numerous, any automation system needs to be affordable and easy to learn, use, and maintain. Companies must also carefully evaluate the adoption of new technology to determine if the return on investment (ROI) will pay off. This ROI can take many forms, including improvements in the data quality; increased productivity or efficiency gains; and the ability for personnel to focus on more important tasks.

Three years ago, the Eurofins Nutrition Analysis Center began to employ a “lean laboratory” management approach, which is driven by process optimization and derived from the principles of lean manufacturing. A lean laboratory focuses on delivering results in the most efficient way, including cost and/or speed, with the most efficient use of resources. The objective is to improve the economic efficiency of the organization by balancing quality, resources, and time.

**“We talk a lot about lean laboratory processes. A huge focus is on turnaround time. So, how can we do things more efficiently? Automation is, of course, at the top of the list. If a machine can handle certain tasks, like pipetting in sample preparation, then we can save time. Our analysts can walk away to do something else, and we can better utilize their time and skills. So, it's definitely a huge driver for us.”**

**DR. ELAINE (WENJUAN) JOBGEN**

*Director of Operations, Eurofins Nutrition Analysis Center*

Time savings is just one factor. In addition to analytical services, Eurofins also takes pride in continually developing new methods or improving old ones to better serve their clients. The different laboratories within the Eurofins network also work closely with each other on these processes.



“We frequently make changes that benefit our operational efficiency and help our clients achieve faster, better results. Our laboratory is responsible for new method development and validation – so, if there is anything new that we want to introduce to our clients, we want to make sure it’s thoroughly tested. We also maintain the performance of our existing methods. For example, perhaps a method developed in the 1970s used a less efficient HPLC column or an older detector. The principle remains the same, because the chemistry has not changed, but we can make improvements as technology evolves.”

DR. KAI LIU

*Senior Scientist, Eurofins Nutrition Analysis Center*

The Eurofins Des Moines team began looking at the benefits of automated liquid handling systems based on the experience of one of their sister laboratories.

Dr. Jobgen explains: “We began talking internally about automation for amino acids analysis. We wanted to automate the sample preparation process because it takes a lot of pipetting, which is time consuming and does have a risk of human error. So, we began reviewing our options.”

Originally, the Eurofins Nutrition Analysis Center was looking at a system from another vendor because it was already used in another Eurofins laboratory. That changed when the team learned about the Andrew Alliance Andrew+ automation system, which became part of the Waters family after its acquisition in 2020 – making it particularly appealing.

Dr. Jobgen describes how the company’s relationship with Waters influenced interest in the Andrew+ automation system: “We learned about the Andrew+ from our connections at Waters after the acquisition. It met our needs, plus it was less expensive than the other system we were considering. But a big reason was our relationship with Waters. We knew we’d get the support we needed.”

## ANDREW ALLIANCE ANDREW+ PIPETTING ROBOT AND ONELAB SOFTWARE

Andrew Alliance is known for its intuitive automation technology that includes robots and cloud native software for liquid handling. The Andrew Alliance portfolio includes the Pipette+, the Andrew+ liquid handling robot which is supported by additional connected devices and tools, and OneLab, an intuitive cloud-native software that enables fast, flexible and traceable sample preparation capability.

The flagship Andrew+ robot’s ability to reduce human error, while enabling time savings for better data analysis, was the primary benefit for Eurofins. Additionally, the Andrew+ robot and OneLab software offered liquid-handling automation without the need for extensive programming or engineering experience. OneLab cloud-native software ensures full traceability of protocols for consistent method transfer, as well as the ability to graphically design pipetting protocols in minutes and execute them straight away in any laboratory in the world – even allowing the remote monitoring of ongoing experiments.

In addition to pipetting liquids, the Andrew+ liquid handler can perform a wide range of complex experimental steps, such as column/tube and microplate transport using programmable gripper tools. The use of different laboratory tools by the Andrew+ robot is further supported by an ever-expanding range of Dominos – which is a modular solution that enables Andrew+ to use a broad range of consumables. Additionally, the Andrew+ offered improved traceability, with built-in intelligence that pinpoints the source of the error if a method fails.



*Some of the LC-MS/MS instruments in the Eurofins laboratory.*





## TESTING AND INSTALLATION

The Eurofins Nutrition Analysis Center evaluated the Andrew Alliance Andrew+ to ensure it would meet the laboratory's needs. This evaluation included specific tests to measure the robot's performance when compared to the manual processes currently carried out by laboratory personnel.

Dr. Liu describes this process: "The Andrew+ actually exceeded our expectations. We explored different solvents, analytes, and volumes from microliter (µL) to a 10 milliliter (mL) scale. We were looking at any methods with repetitive pipetting work where it could potentially help. Some tests included liquid transfer directly into a HPLC vial, so no further transfers were needed. When we compared the results of the manual process to the automated process, the robot was either equivalent or better. Its performance met our internal requirements regarding quality as well. While the robot is not necessarily faster than a human, it's worry free and error free. And our analysts can use that spare time to attend to more important tasks."

One trial involved a folic acid micro vitamin assay, comparing the robot vs. analyst on the same sample extract with same workflow, using water as the solvent. Steps involved using pipette volumes between 0.4–10 mL to carry out serial dilutions of various standard and solvent in 50 mL centrifuge tubes, with programed blow-outs, pauses, air cushions, and post dilution mixings, to prepare a calibration curve.

The results were comparable between human and robot, with no bias observed.<sup>2</sup> The repeatability between the duplicate preparation of the lowest concentration (sample numbers D and E) was better on the robot.

Sample Number	Manual (mg/100 g)	Andrew+ (mg/100 g)
Sample A	0.37226	0.37895
Sample B	1.04335	1.06741
Sample C	0.03289	0.03163
Sample D	0.02505	0.02416
Sample E	0.02079	0.02198

After a series of similar positive results from these trials, the Eurofins Nutrition Analysis Center purchased the Andrew Alliance Andrew+ pipetting robot and began the process of introducing it into specific workflows. The Eurofins team was impressed by the intuitiveness of the system, which made training very easy after installation.

"Minimal training requirements allowed for a rapid implementation of this technology, which is essential for a busy laboratory. In terms of programming and training, our team needed maybe 20 minutes of explanation to show them how it works. After that, it's very intuitive. Showing someone simply how to operate it takes maybe five minutes. Then the sequence is the same, and all the prompts are simple enough to understand. You just log into the computer and click a few buttons."

DR. KAI LIU

Senior Scientist, Eurofins Nutrition Analysis Center

## RETURN ON INVESTMENT

Eurofins calculates ROI as part of the decision-making process when acquiring new technology. Dr. Jobgen went through a lengthy internal process to document how the purchase of the Andrew+ pipetting robot would meet the company's very specific requirements.

She describes this process: "I must submit justification for the purchase, which details the ROI. We look at efficiency, but also quality as well. Then we calculate the time period to get the money we invested back. If it's between 1–2 years, the decision is a no-brainer. If it takes longer, we might make a different decision."

Based on the trial data, Dr. Jobgen and Dr. Liu calculated that the Andrew+ pipetting robot could save between 30 and 60 minutes of an analyst's time per day. Time saving was just one of the factors, however.

Dr. Jobgen explains: "We use a lot of key performance indicators (KPIs) that we keep track of every day. We set goals accordingly. So, let's say you have 8 hours of one analyst's time, and they can run about 40 samples a day. But we want to improve our efficiency to 60 samples per day. How do we get there? Additionally, we must consider quality control measures – because quality is one of the most important factors for our clients. We must make sure any laboratory purchase can duplicate the level of quality we require."

## NEXT STEPS

With the Andrew+ liquid handling automation system fully operational in the Des Moines laboratory, the Eurofins Nutrition Analysis Center has begun the validation process of adding the robot to the company's LC, GC, and LC-MS workflows. The long-term goal is to enable Eurofins scientists to spend more time on value-added tasks such as data analysis and interpretation. The team recently completed the process to include the new Andrew+ automation system as an allowed standard operating procedure (SOP) where the final dilution is made directly into an HPLC vial. But that's just the first of many.

**"We have a lot of methods where we can use the Andrew+ solution. We see many benefits, including the improved consistency in liquid handling for sample preparation. For example, the robot is more uniform than a human pushing a button or aiming into the vessel, and so far, it has flawlessly located all the vessels."**

**DR. KAI LIU**

*Senior Scientist, Eurofins Nutrition Analysis Center*

The Eurofins team also plans to return to one of the original reasons for the purchase – automating the liquid handling process for amino acids analysis. Eurofins is a leader in amino acid analysis and offers a variety of methods that can quickly and accurately quantify the amino acids present in most food, feed, pet food, ingredients, and dietary supplements. The company has established methods for testing free amino acids, as well as the bound molecules in peptide form. Its technical expertise and market knowledge enable Eurofins' clients to verify compliance with the latest regulations in each country and market, both for raw materials and finished goods.

As a result, streamlining amino acids analysis workflows by automating sample preparation can offer many benefits for both the company and its clients.

# Waters

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*The Eurofins team trialed the Andrew+ pipetting robot to improve efficiencies in the lab.*

Dr. Liu describes the process of validating the Andrew Alliance Andrew+ pipetting robot for amino acid analysis: "We anticipate that adding the automated liquid handling will be seamless. Of course, it is an ISO-accredited method. So, we need to go through the process to prove to ISO and our clients that this change to the method will generate equivalent data to the old one. It will take approximately 6–12 months to complete that process, and then we will say it's ready to use in the method workflow."

Eurofins and Waters are continuing to work together to implement these plans in 2021 and beyond, making further improvements to efficiency in its Des Moines laboratory.

Dr. Liu concludes: "We love Waters! We're extremely comfortable working with them. The collaboration and communication from Waters, and their support, are totally in-sync with our goals and plans."

## References

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2. Liu K., Pointer B., Yang J., Skinner N., Toerber S., Karote D., "Automate Standard Preparations for Food Analyses – A Real World Evaluation", <https://www.waters.com/nextgen/us/en/library/application-notes/2021/automate-standard-preparations-for-food-analyses-a-real-world-evaluation.html>.

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