How the PhenoMATRIX™ expert software suite revolutionizes the microbiology laboratory

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bioMérieux has installed the world's first PhenoMATRIX™ expert software suite at the LABOSUD clinical laboratory in Montpellier (South of France). Jérémy BAYETTE and Guillaume TEISSIER, medical microbiologists and Co-Managers, discuss how the expert software, in combination with the WASPLab® solution, has positively impacted their laboratory's organization.

Guillaume TEISSIER, biologiste médical co-responsable de LABOSUD

Jérémy BAYETTE, biologiste médical co-responsable de LABOSUD

Presentation of the LABOSUD laboratory

LABOSUD was founded in 2009 to merge resources regionally, on the principles of liberal values and financial independence. LABOSUD comprises more than 70 neighbourhood sites connected through specialized technical platforms. The structure continues to evolve by introducing innovative technologies and adapting to new scientific advances. LABOSUD is also part of the INOVIE group, which brings together more than 330 clinical laboratories. Today, INOVIE has 4,200 employees including 460 medical microbiologists. The group handles more than 43,000 patient samples every day. The LABOSUD technical platform in Montpellier was equipped with two WASPLab® lines (4 incubators) in 2017. At that time, 800 samples were being processed each day. We currently handle 1,400 samples per day, and we are expecting to further increase that figure to 1,750 before the end of the year – without additional staffing. Our high-volume cases, such as urine cultures and detection of multi-resistant bacteria, are our priorities for automation. Our automated specimen processing line has been in routine use since December. In April 2018, we added the PhenoMATRIX™ module for colony growth reading and interpretation algorithms.

The WASPLab® system

WASPLab® is a microbiology specimen processing solution. It addresses all aspects of automated specimen processing: planting and streaking, Gram slide preparation, enrichment broth inoculation. It automates incubation with one or more Smart Incubators, while plate reading is done with a high-quality image acquisition system and intuitive, easy-to-use WASPLab® web interface. Embedded algorithms for differential image analysis enable sorting of plate images so that numerous results can be reported simultaneously, rapidly and reliably. Once validated by a technician, negative plates are automatically discharged from the WASPLab® system – thus avoiding unnecessary plate handling. Relevant information is then automatically sent to the laboratory information system (LIS).

PhenoMATRIX™ expert system

The introduction of PhenoMATRIX™ in 2018 ushered in the next level of innovation. PhenoMATRIX™ (COPAN) is an expert software system that consolidates the algorithm results with demographic patient data from the LIS, based on the lab's specified rules, which are entirely customizable. Plates are automatically discharged and sorted according to user-defined rules. No plate is physically manipulated. PhenoMATRIX™ also enables specific pathogen detection in chromogenic media such as CHROMID® CPS® Elite (CPSE), as well as automatic enumeration. At LABOSUD, PhenoMATRIX™ is used for urine samples (the majority of our cases). The laboratory uses it to separate positive urines from negatives. Among the negative urine samples, PhenoMATRIX® gives a "Day 1 negative" result after 16 hours of incubation for samples with less than 50,000 white blood cells. It flags the rest for longer incubation. Regarding the positive urines, these are sorted into three distinct classifications:

- *E. coli*, which is visible by its specific color on CPSE
- Non-*E. coli*
- Polymorphic (3 or more morphotypes)

Bacterial colony counts are given for all three categories.

La solution WASPLab® au laboratoire LABOSUD

The impact of PhenoMATRIX™ and WASPLab®

Using the PhenoMATRIX™ expert system with the WASPLab® solution had an immediate, positive impact on our organization across the board. First off, we gained time by significantly lowering the time spent reading plates, automatically sorting negative and positive results through PhenoMATRIX™, and reporting a high number of results simultaneously. Out of a total of 1,000 urine samples daily, more than 800 positive and negative results are reported in less than one hour.

Secondly, traceability is strengthened through the bi-directional connection with the central LIS and archiving of images on the server. Reproducibility is improved through standardized streaking, which enables a good level of isolation for further testing needs. There is no variability linked to human interpretation. The imaging systems are qualified and reproducible from one system to another: lighting is defined for each culture media and the reading screens are calibrated. We also saw several positive impacts in terms of quality:
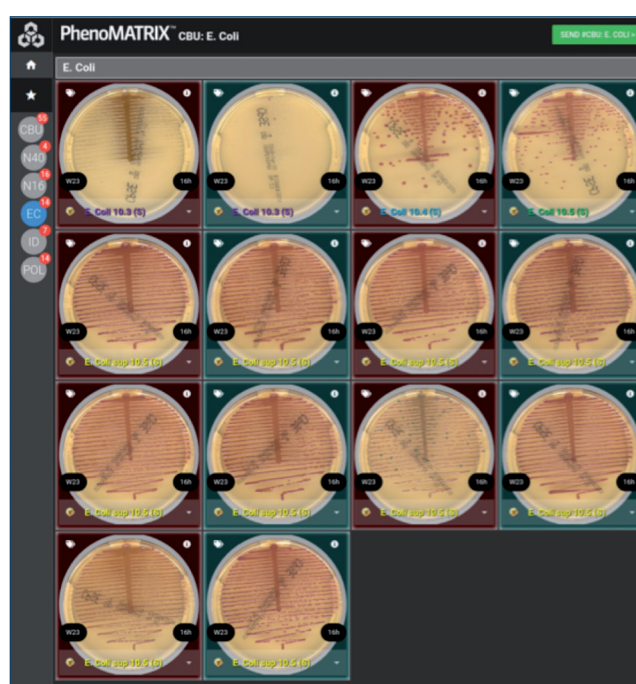
Ecran du système expert PhenoMATRIX™

La solution WASPLab® au laboratoire LABOSUD

• Given the sensitivity and specificity of the algorithms, we are able to focus on plates of clinical interest, for faster results for patients most at risk. We were able to reallocate staff to more value-added tasks.

• The sorting of positive samples into the various reading categories – E. Coli, non E. Coli, etc. – accounting for white blood cell count, patient history and clinical context

• Being able to set a specific, uninterrupted incubation time improves bacterial growth: Incubator doors are no longer opened, the time is aligned with accreditation requirements and the specifications in the CHROMID® CPS® package insert.

Safety is also improved through a significant reduction in plate handling, lowering risk to technicians. All negative plates are directly disposed of, and positives are automatically sorted and placed on specific racks designated for additional tasks (identification, AST, etc.), limiting the risk of human error. Finally, we also noticed an impact in terms of ergonomics in our work environment: More space on the workbenches; only two workstations now needed for specific tasks such as ID/AST; the WASPLab® and LIS systems synchronized; and using just one reading screen for all incubated and photographed plates in all the incubators.

A solution perfectly adapted to our needs

We work directly with patients, who come into our laboratory to have samples taken. We also work with care facilities – this can be retirement homes, rehabilitation and long-term care facilities, and Medicine-Surgery-Obstetrics clinics. We therefore receive a variety of sample types. As we increase our activity level, our challenge is to maintain the quality of analyses and results, and to provide the best possible medical service. To achieve that, we had to automate high-volume routine samples, in order to save time and ensure high-quality management of priority samples. Our main concerns were to find a reliable solution; to have the buy-in from the whole team; and to have a qualified

« Challenges rencontrés et bénéfices apportés par la solution WASPLab® »

Objectives	Solutions	Impacts
• Patient management: Infection diagnosis • Streamline the workflow to be able to handle a high volume of urine samples • Absorb an increasing volume of samples to treat with unchanged staff numbers	• Leverage the automated WASPLab® solution combined with bioMérieux's culture media range, particularly chromogenic media • Incorporate PhenoMATRIX™ artificial intelligence into the solution for automated delivery of	• Time savings/productivity • Traceability • Reproducibility • Quality • Safety • Ergonomics

partner to provide optimal support from preparing for deployment to starting production. This includes having application engineers for instrument set-up and validation, and to having training for the technicians and other users of the system.

A successful strategic partnership

Thanks to the collaborative efforts of the LABOSUD, bioMérieux and COPAN teams, we can now report over 80% of our routine urine test results with the click of a button. We are the first laboratory worldwide to have true artificial intelligence embedded in our microbiology processing solution – always in the interest of better serving our patients' health.

ABOUT BIOMERIEUX
Pioneering Diagnostics

A world leader in the field of in vitro diagnostics for over 50 years, bioMérieux is present in more than 150 countries through 43 subsidiaries and a large network of distributors. In 2017, revenues reached €2.3 billion with over 90% of sales international sales.

bioMérieux provides diagnostic solutions (reagents, instruments, software) which determine the source of disease and contamination to improve patient health and ensure consumer safety. Its products are used for diagnosing infectious diseases. They are also used for detecting microorganisms in agri-food, pharmaceutical and cosmetic products.

bioMérieux is listed on the NYSE Euronext Paris market
(Symbol: BIM – ISIN: FR0010096479).

LABOSUD

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BIOMÉRIEUX

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Les produits WASPLab et PhenoMATRIX sont fabriqués par COPAN et distribués par bioMérieux.

WASPLab, PhenoMATRIX sont des marques appartenant à Copan Italia S.p.a.

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PhenoMATRIX™

EMPOWERED BY BIOMÉRIEUX

Embedded interpretation intelligence for WASPLab®

PIONEERING DIAGNOSTICS

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