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Diagnostic Innovation to Contain Resistance

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Mass Spectrometry: Faster Identification of Microorganisms Points to More Effective Therapies and Good Stewardship of Antibiotics

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The rapid identification of microorganisms has been shown to help guide patient treatment and improve clinical outcome. Waiting several days for a definitive identification of the pathogen provides an obstacle to the clinician seeking to target therapy with the most effective treatment.

If clinicians don't feel confident in the lab's ability to deliver quick, accurate results, they are more likely to take a "better safe than sorry" approach, which usually means prescribing a broad spectrum of antibiotics at a dosage high enough to overcome any resistance to a single antibiotic until the susceptibility results are available. In this way, speed of diagnostic laboratory results has a critical impact on curbing the growth of antimicrobial resistance.

Now, a new method has emerged that can reduce identification to a few minutes. This speed of results can better guide antimicrobial treatment, helping clinicians to prescribe the right antimicrobial at the right dosage.

Mass Spectrometry (MS) technology has been evolving over the past 50 years. Multiple techniques have emerged utilizing MS that enable rapid and detailed analysis of chemicals, proteins, lipids and DNA. Matrix Assisted Laser Desorption Ionization - Time of Flight (MALDI-TOF) is the technique used for profiling a sample for present proteins.

MALDI-TOF has made significant advances in multiple areas especially for cancer and infectious disease biomarkers. In the past decade, MALDI-TOF has been developed for microbial identification using the species specific proteins - or signature proteins - that allow the microbes to be identified at the species level. These molecular "signatures" can be used for rapid bacterial and fungal identification (ID) from isolated colonies.

The introduction of MALDI-TOF for microbial identification transforms the microbiology lab by providing a number of benefits, including organism identification within minutes, higher accuracy than conventional methods, consolidation of testing (bacteria, yeast, fungi, etc.), and significant reduction in the cost per test.

The biggest payoff for clinicians is the huge reduction in time that it takes to identify organisms. Specifically, MALDI-TOF enables laboratories to rapidly identify organisms from colonies grown overnight and directly from select patient samples. A process that used to take days can now be limited to hours or even minutes.

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Once the organism identification is generated, the lab and the clinician have an understanding of the organism type – information that allows for a more targeted therapy. Integrating the susceptibility testing also provides an opportunity to prescribe only the most effective antibiotics. Equipped with better information, clinicians can avoid empirical prescription, a critical key in reducing the growth of antimicrobial resistance.

How MALDI-TOF Works

The primary MS testing platform is the Shimadzu MALDI-TOF MS. In it, a sample is mixed with another compound, called the matrix. This mixture is applied to a metal plate and irradiated with a laser. The mixture absorbs the laser light and vaporizes, along with the sample. In this process, the sample is ionized. An electric field is applied to lift these ions into the time-of-flight

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APUA 30th Anniversary Celebrations at 51st ICAAC: Sunday, September 18, 2011

Join APUA staff, colleagues, and friends at the symposium "Novel Approaches to the Containment of Antibiotic Resistance in Industrial and Developing Countries: Celebrating 30 Years of APUA" from 11:15 AM to 12:45 PM on September 18, and the subsequent Annual International Member Reception from 7 PM to 9 PM at the Hyatt Regency McCormick Place in Chicago. At the reception APUA will present the 2011 Leadership Award to ESCMID and Dr. Giuseppe Cornaglia, and the 2011 Chapter Leadership Award to APUA-Nepal and Dr. K.K. Kafle.

RSVP to Jennie (jennie.choe@tufts.edu or 617-636-0966).

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mass spectrometer, which separates them according to their mass and displays the results as a series of lines, or spectrum.

As the proteins reach the detector a profile is generated (named the spectra), that represents all the proteins analyzed on the MALDI-TOF. By analyzing the pattern of fragments, it is possible to deduce the structure of the molecule.

bioMérieux partnered with Shimadzu to integrate the company's knowledge base of MALDI-TOF and acquired AnagnosTec to integrate the extensive knowledge it has built for microbial identification algorithms and databases over the past 12 years.

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bioMérieux is developing the VITEK MS™ (Research Use Only), a new platform for the clinical microbiology lab that will integrate with the VITEK® 2 system and provide rapid identification and susceptibility testing.

The goal is to apply mass spectrometry for bacterial identification, creating the market's fastest antibiotic susceptibility test on the bioMérieux VITEK platform. This will serve to get more labs using the MALDI-TOF platform to identify microorganisms. The more labs that are able to provide results to clinicians with the speed and accuracy made possible through MS technology, the fewer the cases of antimicrobial misuse.

Conclusion

MS technology has the potential to provide a dramatically improved alternative to traditional laboratory identification methods for microorganisms in the process of medical diagnosis. The speed, robustness and minimal costs of sample prep and measurement make this solution ideal for high through-put use. With the speed and accuracy made possible through MS technology, clinicians no longer need to overprescribe antibiotics for patients with infections.

By utilizing MS technology, they can quickly discern the type of infection or infections present, allowing them to more specifically target their therapies with the right antimicrobial at the right dosage. Targeted antimicrobial therapy, informed by test results made possible by MS technology and integrated with accurate susceptibility testing, plays an important role in slowing the growth of resistant bacteria.

bioMérieux Inc. is a worldwide leader in in vitro *diagnostics for medical and industrial applications. They develop instruments, software, and reagents that are used for healthcare and product safety.*

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