August 2014
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NEWSLETTER

POWERFUL TRIO:

- PLUS RESIN MEDIA
- FLUORESCENT TECHNOLOGY
- SOPHISTICATED ALGORITHMS

Sepsis has a significantly high mortality rate exceeding that of acute myocardial infarction and common cancers; this phenomenon is similar worldwide and delaying diagnosis by as little as one hour devastatingly impacts patients' survival. And so, rapid detection of bacteremia using blood cultures remains the most important function of clinical microbiology laboratories, to aid in initiating prompt and appropriate therapy, ultimately increasing the odds of survival for septic patients.

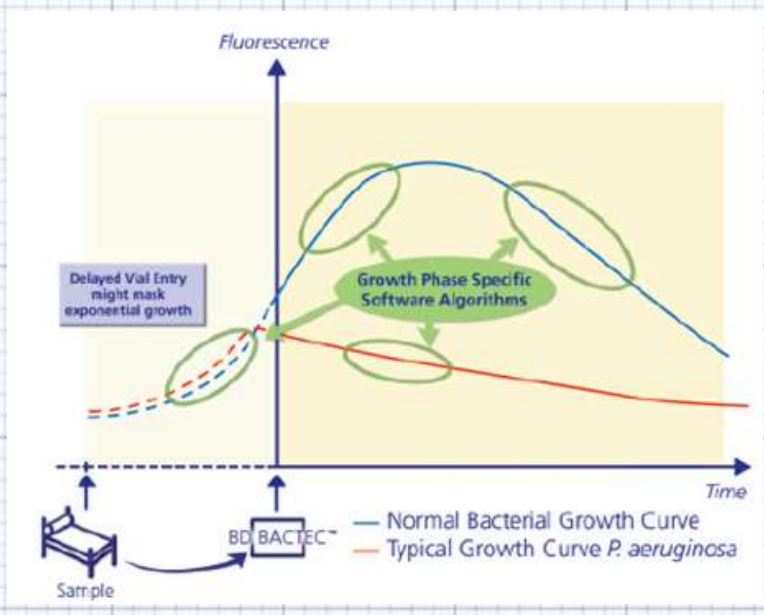
In our previous monthly newsletters[1], the performance and benefits of the BACTEC™ PLUS media with resins and the BACTEC™ Automated Blood Culture System with fluorescent technology have been well elucidated in depth. These advances have been developed largely on well-designed controlled clinical evaluations of the instrumentation and media.

To bring the performance of blood culture further, the BACTEC™ systems provide up to 37 proprietary algorithms depending on specific factors as media type, extended delay vial capability, fastidious bacteria etc. to improve recovery. These sophisticated algorithms, in combination with fluorescent technology and resin media, form a powerful trio, which ensures a high degree of accuracy in recovery and significantly faster time-to-detection.

Built on the proven history of previous BACTEC™ 9000 instrumentations; the latest BACTEC FX goes even further with advanced ergonomics and exceptionally exciting innovations such as vial-activated workflow, remote alarms and blood culture observation, as well as the integration of customer-focused data management system by the EpiCenter software.

Media-Specific & Growth-Specific Algorithms

In the BD BACTEC™ systems, the proprietary algorithms applied can be generally divided into media-specific algorithms depending on different media types and kinetic/growth-specific algorithms, which are based on a database of over 500,000 growth curves. The combination of both algorithms enhances the overall sensitivity and time-to-detection for positivity, even in cases of delayed vial entry, which is discussed in the next section.



Fluorescent Technology and Sophisticated Algorithms: a Powerful Combination

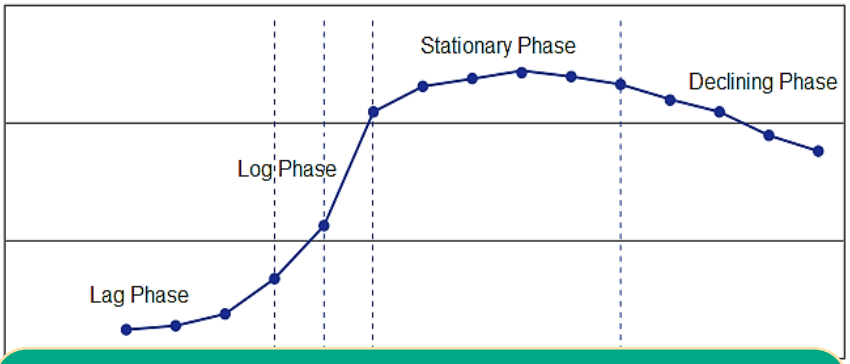
Delayed Vial Entry Considerations

According to Cumitech 1B², blood culture vials should be delivered to the laboratory and loaded into the continuous-monitoring blood culture system as soon as possible to prevent delays in detection. Ideally so but in a more realistic context, immediate loading of the vials are not always feasible attributed to transport from outlying hospitals, limited instrument capacity or collection of blood cultures during the night.

Due to the prolonged delay, the kinetics of microorganisms in the vials may already have reached steady or stationary growth. To accommodate for the delay, these circumstances are well covered by the BACTEC™ PLUS vials' delayed vial entry capability and kinetic/growth-specific algorithms applied after loading into the BACTEC™ system.

The BACTEC™ PLUS vials currently have the longest delayed vial entry claim in the market for up to 48 hours at room temperature as compared to other commercially available media. Chapin and Lauderdale[3] reported no significant loss of recovery was observed from BACTEC™ PLUS vials maintained at room temperature for at least 48 hours.

The graph below shows an example of the number of growth-specific algorithms applied by the BACTEC™ system during different growth phases of the cultured strain as opposed to other systems available in the market. Evidently, the BACTEC™ system applies more algorithms from the initial phases to the stationary phase of growth, assuring more sensitive continuous-monitoring of vials especially those that have been entered in the system with delay. More often than not, the positives in delayed vials are often missed by systems applying solely a threshold algorithm.



PHASE	I	II	III	IV
BD BACTEC™:	7	2	1	3
Other Systems:	1	1	1	

Nico and Hilly[4] shared the unusual practice in their laboratory where they deliberately have to screen the color indicator at the bottom of BacT/ALERT vials prior to loading for 'suspected delayed bottles' with a transportation time longer than 4 hours. From their experience, the 'suspected delayed bottles' would most likely have a yellow color indication and that those bottles should be drawn for Gram staining and subculture. Such visual color inspection is very subjective and is completely unnecessary if the media and/or instrumentation are sensitive enough to detect the delayed entry of the vial.

In his study, Klaerner et al.[5] also pointed out that evaluation of the detection algorithm of the blood culture system is needed for continuous quality improvement and ensuring the optimal use of the system. He reported that the seeded BacT/ALERT FAN bottles held at 36°C for as few as 4 hours failed to detect *Pseudomonas aeruginosa* strains, as determined by terminal subcultures.

Secondary Detection Algorithms - Fastidious Organisms

In addition to the algorithms revealed earlier, BD BACTEC™'s secondary detection algorithms allow the detection of fastidious strains which produce hardly any CO_2, particularly *Pseudomonas spp* as well as slow growing organisms such as *Haemophilus* and *Neisseria.* The *Pseudomonas spp.* strains produce both CO_2 (early hours) and NH_4 (later on). As they react with each other, there will be no further increase in CO_2 to a positive result triggered by systems only using a treshhold algorithm. This leads to higher possibilities of false negative results. However, this slight decrease in signal during the incubation can be easily detected by the BACTEC™ secondary detection algorithms and subsequently flag the vial as positive.

IN SUMMARY, the combination of sensitive fluorescent technology, resin media and a multiplicity of detection algorithms all put together to achieve more specific and precise recoveries of bacterial growth for earlier and higher detection rate, thus facilitating more prompt and apt therapy to be prescribed. As mentioned earlier, other blood culture systems with more limited algorithms might not detect the presence of bacteria in specific circumstances, especially for delayed vial entry and fastidious organisms.

References:

[1]**Various authors**. BMSD Clinical Education Monthly Newsletters. Retrieved from: http://www.bmsd.com.my/page.php?pid=40&menu=sub

[2]**Dunne, W. M., F. S. Nolte, and M. L. Wilson.** 1997. Cumitech 1B-blood cultures III. American Society for Microbiology, Washington, D.C.

[3]**Chapin, K., and T.-L. Lauderdale.** 1996. Comparison of Bactec 9240 and Difco ESP blood culture systems for the detection of organisms from vials whose entry was delayed. J. Clin. Microbiol. 34:543-549.

[4]**Nico E. L. Meessen and Hilly G. de Vries-Hospers**. 2000. Failure of an Automated Blood Culture System To Detect Nonfermentative Gram-Negative Bacteria. J Clin Microbiol38(7): 2803–2804.

[5]**Klaerner, H.-G., U. Eschenbach, K. Kamereck, N. Lehn, H. Wagner, and T. Miethke.** 2000. Failure of an automated blood culture system to detect nonfermentative gram-negative bacteria. J. Clin. Microbiol. 38:1036-1041.

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