



## **Advanced Lab. Techniques Theoretical**

### **Lecture No.2**

# **Advanced Bacterial Diagnosis:**

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## **VITEK and BACT/ALERT Systems**

In the modern of medical microbiology, rapid and accurate bacterial diagnosis is crucial for effective patient care.

### *Automated Microbial Identification*

The VITEK system is a state-of-the-art tool used in clinical microbiology labs for rapid identification of bacteria and yeast species.

### *Antimicrobial Susceptibility Testing*

Beyond identification, VITEK performs AST to determine the effectiveness of various antibiotics against the isolated pathogens.

### *Advanced Technology*

Utilizing biochemical reactions and sophisticated optical systems, VITEK provides quick and reliable results for a wide range of microorganisms.

### *Clinical Impact*

The speed and accuracy of VITEK contribute significantly to timely patient treatment and help combat antimicrobial resistance.



Figure (1) shows Vitek device

## VITEK System: Principle and Process

### Sample Preparation

A suspension of the bacterial sample is prepared from a pure culture, ensuring a standardized concentration for accurate results.

### Check up for turbidity

Gram Positive Bacteria (GP) = ( 0.50 – 0.63 )

Gram Negative Bacteria (GN) = ( 0.50 – 0.63 )

Yeast = ( 1.80 – 2.20 )



Figure (2) shows densichek attached with vitek device

### Card Inoculation

The suspension is inoculated into a VITEK card containing multiple wells with different biochemical substrates.

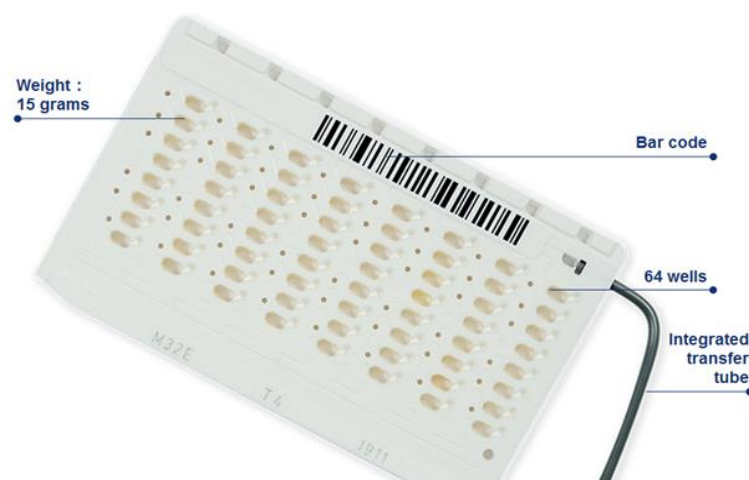


Figure (3) shows card of vitek (GN or GP)

### *Incubation and Monitoring*

The card is incubated in the VITEK instrument, which continuously monitors the metabolic reactions occurring in each well.

### *Data Analysis*

The system's optical sensors detect color changes or turbidity in the wells, creating a unique biochemical profile for the organism.

### *Identification and AST*

The biochemical profile is compared against the VITEK database for species identification, while growth patterns in antibiotic-containing wells determine susceptibility.

## **Advantages of the VITEK System**

### *Speed*

VITEK provides fast results, often within hours. This helps doctors make decisions and start treatment quickly.

### *Automation*

VITEK is automated, which means less work for lab staff and fewer mistakes. This makes the lab more efficient.

### *Comprehensive Database*

VITEK's database covers many different types of bacteria and fungi, including rare ones. This helps ensure accurate identification.

## **Challenges of the VITEK System**

### *Cost Considerations*

The VITEK system can be expensive to buy and maintain, which may be a problem for some labs.

### *Database Limitations*

The VITEK database doesn't include every microbe, so some rare ones might not be identified correctly.

### *Interpretation Complexities*

VITEK results sometimes need extra checks, especially when there are multiple microbes or unusual strains.

## **The BACT/ALERT System: Introduction**

### *Automated Blood Culture System*

BACT/ALERT is designed primarily for detecting bacterial and fungal growth in blood cultures and other sterile body fluids.

### *Critical for Bloodstream Infections*

The system plays a vital role in diagnosing severe conditions like bacteremia and fungemia, where rapid detection is crucial for patient outcomes.

### *Continuous Monitoring*

BACT/ALERT provides real-time, continuous monitoring of culture bottles, allowing for early detection of microbial growth.

### *Versatility*

While primarily used for blood cultures, the system can also be applied to other sterile body fluids, expanding its diagnostic capabilities.

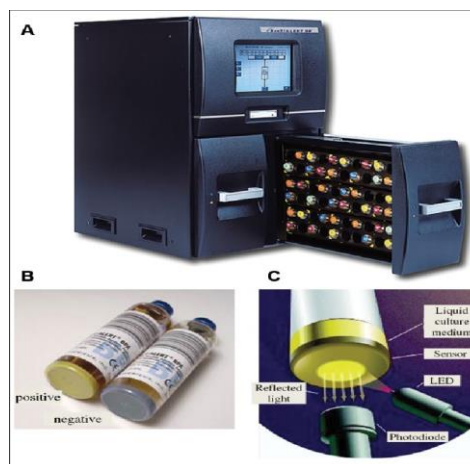


Figure (4) shows Bact/Alert device

## **BACT/ALERT: Principle and Process**

### *Sample Collection*

Blood or other sterile body fluid is collected and immediately inoculated into BACT/ALERT culture bottles under aseptic conditions.

### *Bottle Incubation*

The inoculated bottles are placed into the BACT/ALERT instrument, which maintains optimal growth conditions for potential pathogens.

### *CO<sub>2</sub> Detection*

As microorganisms grow, they produce CO<sub>2</sub>. A sensor at the bottom of each bottle changes color in response to increasing CO<sub>2</sub> levels.

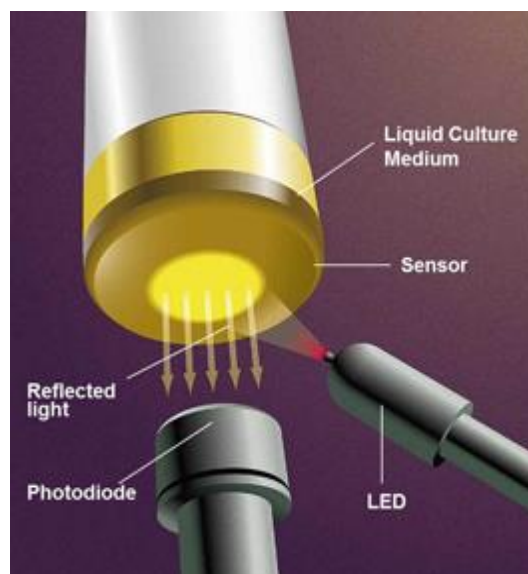


Figure (5) shows CO<sub>2</sub> detection in culture tube

### *Continuous Monitoring*

The system continuously checks the color of the sensor, detecting even slight changes that indicate microbial growth.

### *Alert and Follow-up*

When growth is detected, the system flags the culture as positive, prompting immediate follow-up testing for identification and susceptibility.

## **Types of BACT/ALERT Culture Bottles**

### *Aerobic Bottles*

Designed for the growth and detection of aerobic and facultative anaerobic microorganisms that require oxygen for optimal growth.

### *Anaerobic Bottles*

Specifically formulated to support the growth of strict anaerobic bacteria that cannot tolerate oxygen in their environment.

### *Pediatric Bottles*

Optimized for smaller blood volumes typically obtained from pediatric patients, ensuring sensitivity with limited sample size.

### *Fungal Bottles*

Specially designed media and extended incubation times to enhance the detection of slow-growing fungi and yeasts.



Figure (6) shows Bottles contain culture media

## Advantages of the BACT/ALERT System

### *Rapid Detection*

BACT/ALERT can detect microbial growth within hours, allowing for early initiation of appropriate treatment. This speed is crucial in managing severe infections like sepsis, where every hour counts.

### *Versatility*

While primarily used for blood cultures, BACT/ALERT can also be used for other sterile body fluids, making it a versatile tool in clinical microbiology. Its range of specialized bottles caters to different patient populations and suspected pathogens.

## Challenges of the BACT/ALERT System

### *False Positives*

Contamination during sample collection can lead to false-positive results, potentially resulting in unnecessary antibiotic treatment and extended hospital stays.

### *Cost Implications*

The initial investment for BACT/ALERT equipment and ongoing expenses for culture bottles can be substantial, potentially limiting its adoption in resource-constrained settings.

### *Negative Culture Limitations*

A negative result does not definitively rule out infection, especially for fastidious organisms or in cases of prior antibiotic administration, requiring clinical correlation.

### *Specimen Volume Sensitivity*

The system's performance can be affected by insufficient blood volume, particularly challenging in pediatric patients or those with difficult venous access.



## Comparison: VITEK vs BACT/ALERT

Feature	VITEK	BACT/ALERT
1- Primary Purpose	Identification and AST	Detection of growth
2- Main Application	Bacteria and yeast ID, AST	Blood cultures, sterile fluids
3- Time to Result	4-8 hours for AST	12-24 hours typically
4- Automation Level	Fully automated	Fully automated
5- Detection Method	Biochemical reactions	CO <sub>2</sub> production
6- Database Reliance	High (for identification)	Low (detects growth only)