Guanine

Deep-Tech Diagnostics for the AI-Driven Era

Sepsis Diagnostics at the Speed of Clinical Decision

A Deep-Tech White Paper on Software-Defined Electrochemical Sensing

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INTRODUCTION

Critically ill patients presenting in the emergency department with suspected sepsis require rapid, informed intervention. Standard blood culture-based diagnostics typically take days, which may delay appropriate treatment incraeet mortality, and lead to inefficient use of costly antibiotics.

- Sepsis is a leading cause of death and prolonged hospitialzations wordwide.

- Conventional diagnostic approaches walk a tightrope between missing pathogens that require immediate treatment and waiting too long to confirm)

This white paper explores how Guanine uses software-defined electrochemical sensing to deliver a three-tier rapid diagnostic pipeline, each layer designed to meet critical clinical needs within the short sepsis intervention window.

→ Rule in or rule out a sepsis diagnosis in 20 minutes.

→ Identify the pathogen and AMR status in 60 minutes.

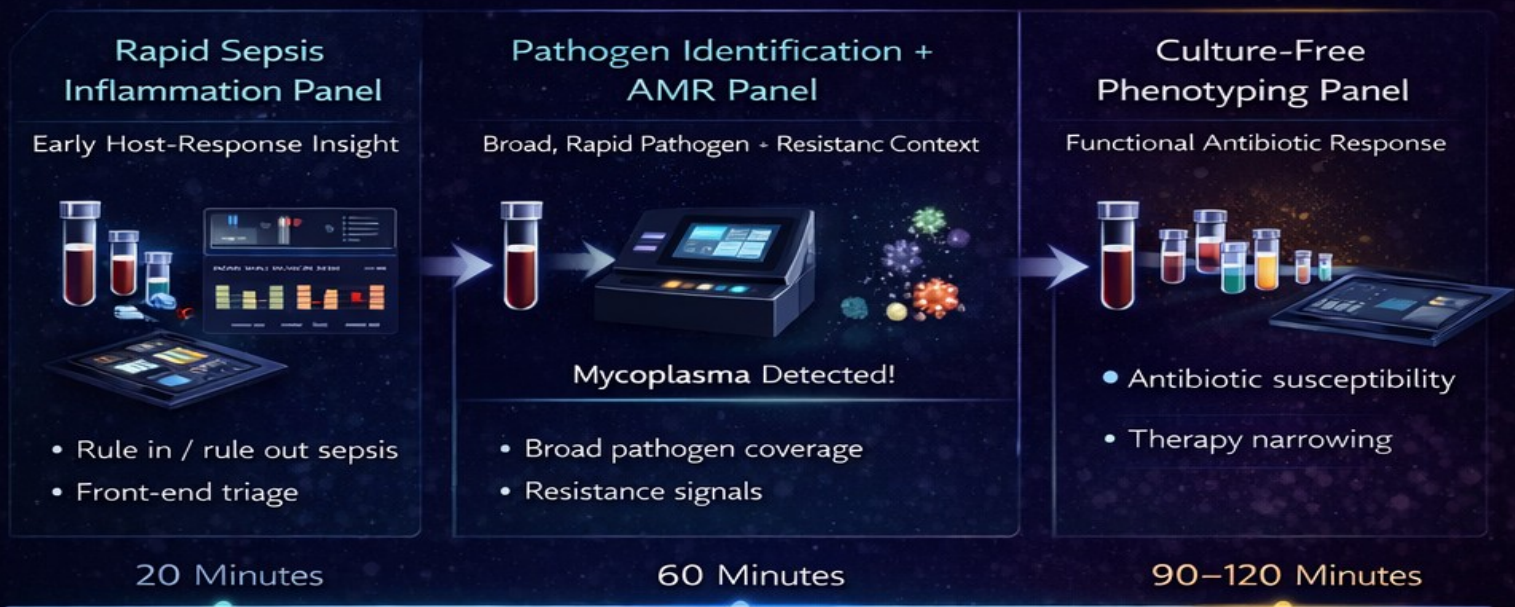→ Precisely phenotype the patient for optimal antibiotic therapy in 90–120 minutes.

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Time-Aligned Sepsis Diagnostic Timeline

Rapid diagnostic insights within the critical first hours help guide sepsis intervention and improve outcomes.

Figure 1. Software-Defined Electrochemical Sensing for Rapid Sepsis Diagnostics (0–120 Minutes)

Rapid Sepsis Inflammation Panel

Early Host-Response Insight

- Rule in / rule out sepsis
- Front-end triage

20 Minutes

Pathogen Identification + AMR Panel

Broad, Rapid Pathogen + Resistanc Context

Mycoplasma Detected!

- Broad pathogen coverage
- Resistance signals

60 Minutes

Culture-Free Phenotyping Panel

Functional Antibiotic Response

- Antibiotic susceptibility
- Therapy narrowing

90–120 Minutes

The Guanine platform delivers actionable diagnostic insight in three tiers within the critical early window (0–120 minutes):

→ In **20 minutes:** rapid multi-omic analysis of systemic inflammatory markers rules in or rules out sepsis at the bedside.

→ In **60 minutes:** rapid pathogen identification covering bacteria, fungi, viruses, and protozoa in clinically relevant timeframes.

→ In **90–120 minutes:** culture-free phenotyping rapidly determines antibiotic susceptibility and resistance, optimally guiding therapy within the critical early decision window.

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Multi-Omic Host Response in 20 Minutes

On presentation, rule-in / rule-out decisions are critical in sepsis management and can speed triage beyond subjective evaluation.

→ Existing pathogen-specific tests may be negative during early stages of a sepsis response.

→ Guanine delivers actionable information regardless of pathogen status.

→ Multi-omic classification measures the host's immune response to sepsis.
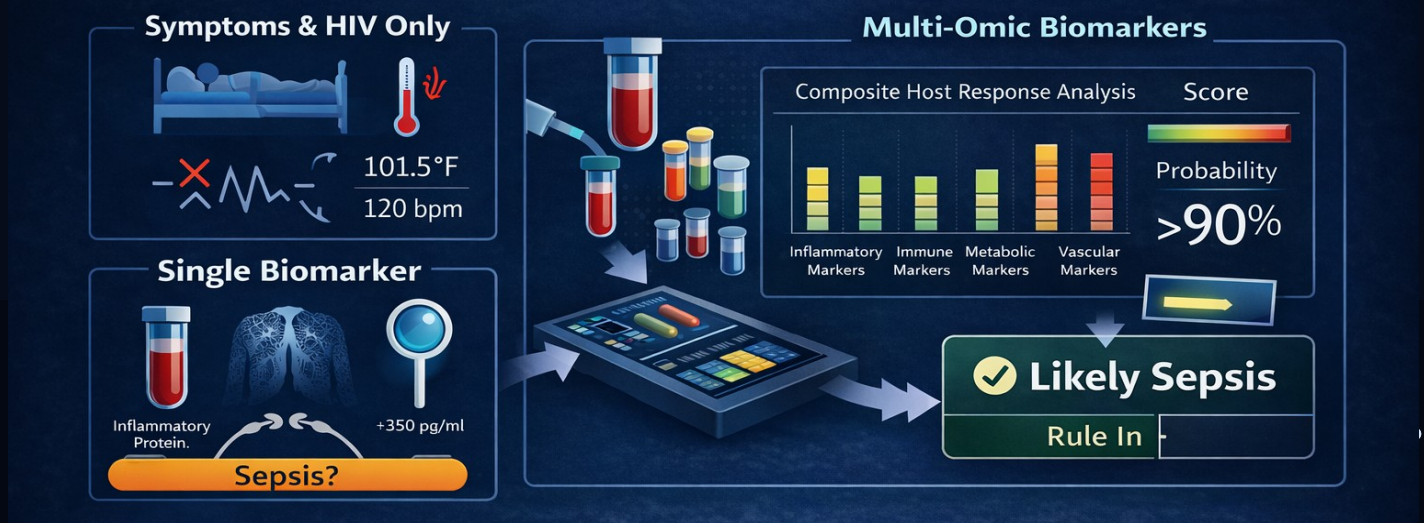

Figure 2. Rapid multi-omic host response profiling enables rule-in or rule-out of sepsis within the first clinical decision window (~20 minutes).

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Broad pathogen detection and actionable resistance insight within the clinical decision window

After initial rule-in, clinicians must rapidly identify the infectious threat and determine whether resistance is likely. Conventional culture-based workflows delay this step by days, forcing empiric broad-spectrum therapy and increasing downstream risk.

→ Detects common, atypical, and slow-growing pathogens directly from blood

→ Delivers actionable antimicrobial resistance (AMR) markers within 60 minutes

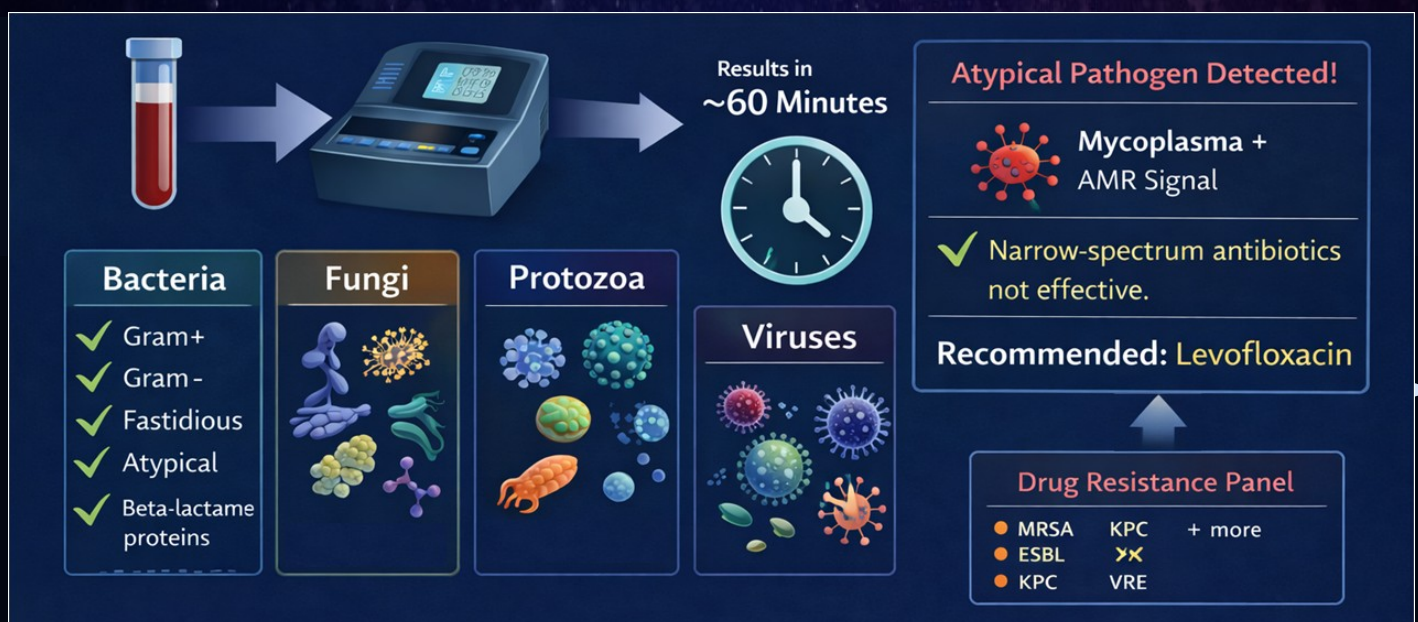→ Reduces reliance on empiric therapy while culture results are pending

Figure 3. Broad pathogen identification with integrated resistance profiling enables earlier, targeted antimicrobial decisions within the first hour of care.

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90-MINUTE CULTURE-FREE PHENOTYPING

Direct measurement of functional antibiotic response within the clinical decision window

After pathogen identification, clinicians must determine which therapy will actually work. Traditional antimicrobial susceptibility testing (AST) requires culture and delays definitive treatment by days. Guanine replaces this delay with rapid, culture-free phenotyping that directly measures antibiotic response.

- Directly measures functional antibiotic response, not inferred resistance
- Identifies effective therapy across susceptible, resistant, and atypical organisms
- Replaces 48–72 hour culture-based AST with actionable results in ~90 minutes
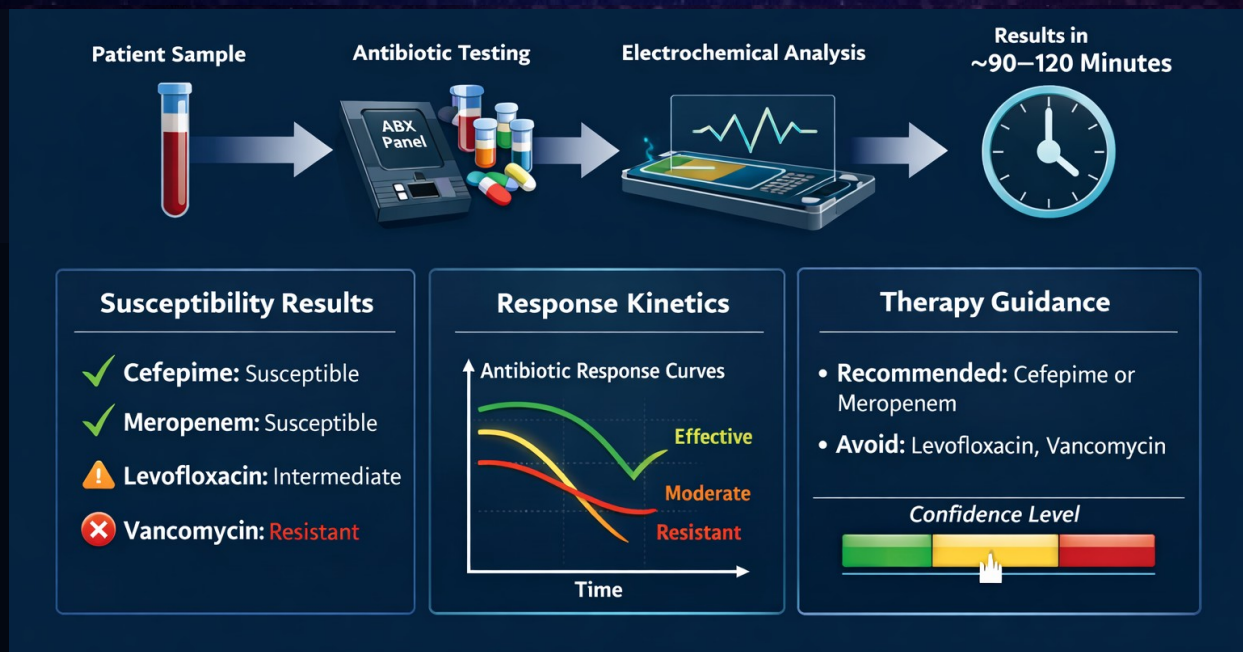
Figure 4. Culture-free phenotyping enables definitive antibiotic selection during the initial treatment window, eliminating reliance on delayed culture-based susceptibility testing.

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Why Pathogen ID Alone Cannot Guide Optimal Therapy

While rapid pathogen identification is essential, genotype alone does not predict clinical response. The presence of a resistance gene does not always translate into phenotypic resistance, and the absence of known markers does not guarantee susceptibility.

In sepsis, treatment decisions must account for the dynamic interaction between pathogen, host immune response, and antimicrobial exposure. Without phenotypic confirmation, clinicians are forced to rely on empiric therapy or delayed culture results.

→ Genotypic resistance markers may not reflect real-time drug susceptibility.

→ Host immune response influences treatment urgency and escalation decisions.

→ Phenotypic behavior integrates pathogen viability, resistance expression, and drug effect.

Gene presence

Binary (present / absent)

Inferred resistance

May overcall resistance

Functional Validation

Real-time growth / suppression

Continuous response curves

By integrating pathogen ID with culture-free phenotyping and host response profiling, Guanine delivers a clinically complete diagnostic framework.

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Faster, More Confident Therapy Decisions

Delays and uncertainty in antibiotic selection drive excess mortality, toxicity, and antimicrobial resistance in sepsis. Traditional workflows force clinicians to initiate broad-spectrum therapy while waiting days for culture and susceptibility results.

By compressing the diagnostic timeline from days to hours, Guanine enables clinicians to transition from empiric treatment to targeted therapy during the initial resuscitation window. This shift improves outcomes while supporting antimicrobial stewardship without delaying care.

→ Earlier optimization of antibiotic therapy.

→ Faster narrowing of empiric broad-spectrum treatment.

→ Reduced exposure to ineffective or toxic drugs.

→ Increased confidence in escalation or de-escalation decisions.

→ Supports antimicrobial stewardship at scale.

Actionable diagnostic insight within the first hours of care changes the trajectory of sepsis management.

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A Unified Diagnostic Framework for Sepsis Care

Sepsis care demands coordination across emergency departments, intensive care units, and hospital laboratories. Fragmented diagnostic workflows introduce delays, variability, and handoff risk at each stage of care.

By delivering rule-in/rule-out assessment, pathogen identification, and phenotypic susceptibility from a single blood draw, Guanine simplifies sepsis diagnostics into a unified, time-aligned framework. This consistency improves clinical adoption while reducing operational complexity.

→ Standardized diagnostic decision points across care settings.

→ Reduced dependence on serial testing and reflex workflows.

→ Improved alignment between clinical teams and laboratory operations.

→ Faster time-to-action with fewer handoffs.

→ Scalable across institutions with varying laboratory capabilities.

A unified diagnostic framework transforms sepsis from a reactive process into a coordinated clinical pathway.

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Designed for Clinical Workflow Integration

For new diagnostics to impact sepsis outcomes, they must integrate seamlessly into existing clinical and laboratory workflows. Complex sample preparation, specialized staffing, or delayed turnaround times limit adoption at the point of care.

Guanine is designed as a modular, software-defined electrochemical platform that fits within current hospital operations. From emergency departments to centralized laboratories, the system supports rapid decision-making without disrupting established clinical pathways.

→ Single blood draw supporting multiple diagnostic decision points.

→ Minimal sample preparation compatible with routine workflows.

→ Flexible deployment across emergency, ICU, and laboratory settings.

→ Software-driven updates without hardware redesign.

→ Supports phased adoption without operational disruption.

By aligning diagnostic speed with clinical reality, Guanine enables adoption without compromise.

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Time-Aligned Insight to Transform Sepsis Diagnostics

Sepsis outcomes depend on timely, informed clinical decisions made under uncertainty. Existing diagnostic workflows fragment critical information across time, forcing clinicians to balance speed against completeness during the most consequential hours of care.

By unifying host response assessment, broad pathogen identification, and culture-free phenotyping on a single electrochemical platform, Guanine delivers clinically actionable insight aligned to real-world decision windows. This approach enables faster intervention, greater confidence in therapy selection, and improved stewardship without delaying care.

→ Rapid rule-in / rule-out assessment during initial presentation.

→ Broad pathogen ID and resistance profiling within actionable timeframes.

→ Phenotypic confirmation to guide targeted therapy decisions.

→ Integrated, scalable diagnostics supporting clinical adoption.

Time-aligned diagnostics redefine how sepsis is detected, treated, and managed across the continuum of care.

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Selected Clinical and Technical References

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A New Diagnostic Standard for Sepsis Care

Sepsis remains one of the most complex and time-critical challenges in modern medicine. Improving outcomes requires diagnostics that align with clinical decision-making, rather than forcing clinicians to wait for fragmented or delayed information.

Guanine introduces a time-aligned diagnostic framework that integrates host response assessment, broad pathogen identification, and culture-free phenotyping on a single electrochemical platform. By delivering actionable insight within the first hours of care, this approach has the potential to transform how sepsis is detected, treated, and managed.

As clinical validation and regulatory development progress, Guanine is advancing toward a future where faster, more confident therapy decisions improve outcomes while supporting antimicrobial stewardship at scale.

For partnership, collaboration, or additional information, please visit www.guanineinc.com.

The sepsis applications described in this paper represent products in development and are not yet commercially available.

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