



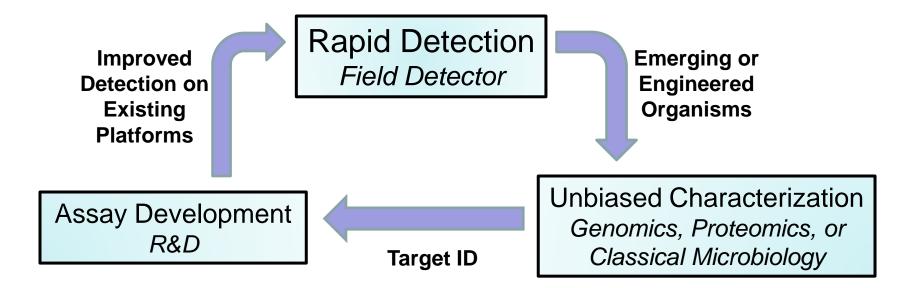
TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

NDIA Biosurveillance Conference

Dr. C. Nicole Rosenzweig US Army, Edgewood Chemical Biological Center 27 August 2012

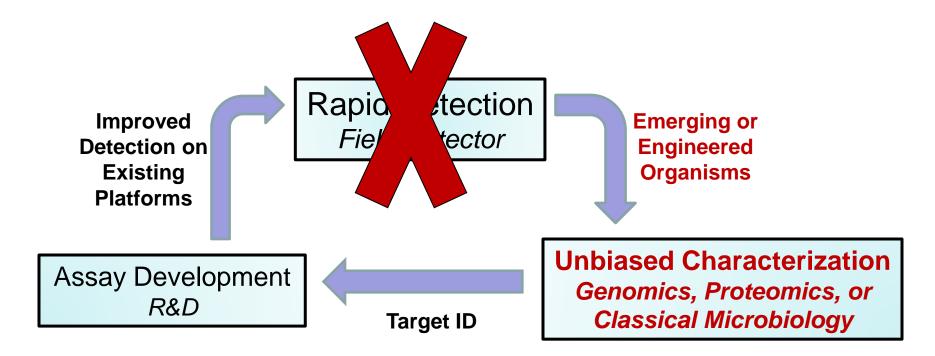
UNCLASSIFIED//APPROVED FOR PUBLIC RELEASE





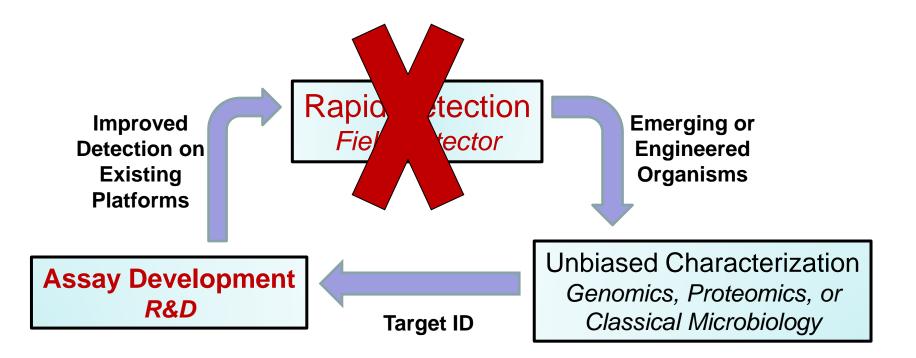
Analytical Gaps in Biological Detection

RDECOM



Analytical Gaps in Biological Detection

RDECON





ECBC Genomic Sciences





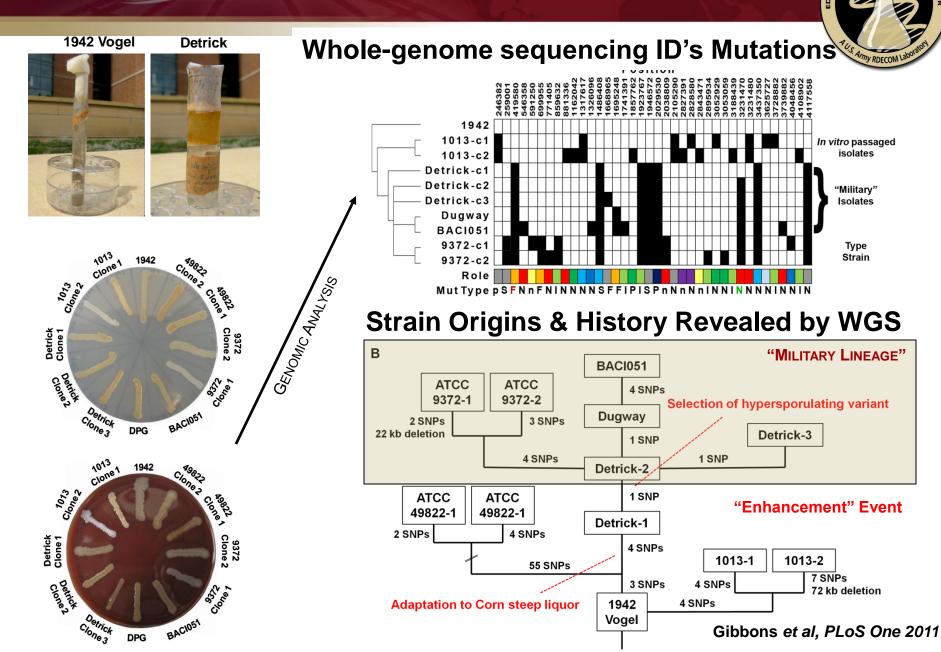




- Biosafety Level 3 laboratory for growing CDC category A and B select-agents
- Sequencing facility with the capacity to support of genomics and transcriptomics research
- BSL 2 and BSL 3 bio-aerosol research for challenging equipment and developing risk assessments
- Contemporary molecular biology, microbiology and biochemistry techniques
- Roche, Illumina, Opgen Argus platforms
- Sample processing experience with medical, environmental, and cultured material
 TECHNOLOGY DRIVEN, WARFIGHTER FOCUSED.

Research Example: Microbial Forensics of a Historical Biowarfare Simulant

RDECON



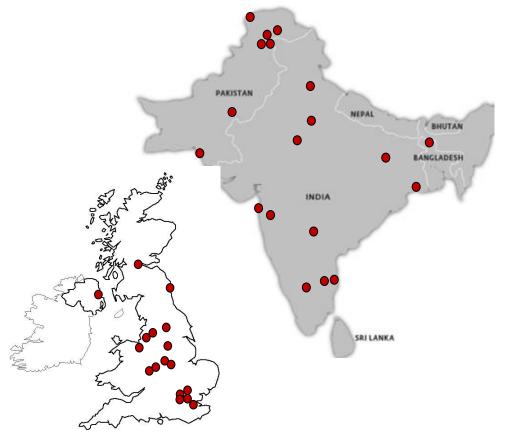
Research Example: MDR Surveillance: NDM-1 *Klebsiella* and *E. coli*



MBL's are β -lactamase enzymes that can destroy virtually all β -lactam based Antibiotics Penicillins, cephalosporins and carbapenems

| Antibiotic | MIC (mg/L) | | | % susceptible ^a |
|-----------------------------|-------------|-------------------|-------------------|-------------------------------|
| | Range | MIC ₅₀ | MIC ₉₀ | |
| Imipenem | 8 - >128 | 32 | 128 | 0% |
| Imipenem + EDTA | 0.125 - 8 | 0.25 | 1.2 | n/a |
| Meropenem | 2 - >32 | 32 | 32 | 3% |
| Ertapenem | 2 - >16 | 16 | 16 | 0% |
| Ampicillin | >64 | >64 | >64 | 0% |
| Piperacillin | >64 | >64 | >64 | 0% |
| Piperacillin- tazobactam | 32 - >64 | >64 | >64 | 0% |
| Cefotaxime | 128 ->256 | >256 | >256 | 0% |
| Ceftazidime | 64 - >256 | >256 | >256 | 0% |
| Cefpirome | >64 | >64 | >64 | 0% |
| Aztreonam | 0.125 - >64 | >64 | >64 | 11% |
| Ciprofloxacin | 0.125 - >8 | >8 | >8 | 8% |
| Gentamicin | 0.5 - >32 | >32 | >32 | 3% |
| Tobramycin | 8 - >32 | >32 | >32 | 0% |
| Amikacin | 16 - >64 | >64 | >64 | 0% |
| Minocycline | 2 - >32 | 16 | >32 | 0% |
| Tigecycline | 0.25 - 8 | 1 | 4 | 64% |
| Colistin | 0.5 - >32 | 0.5 | 8 | 89% ^b |

RDECON

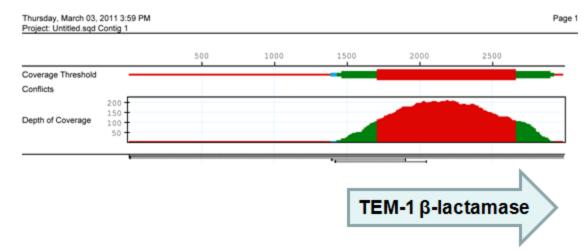


Mark Toleman, Cardiff University

Research Example: Detection of Genetically Modification – Yersinia pestis

- Yersinia pestis KIM
- Constructed in 1990's in U.S.A. to facilitate pCD1 virulence plasmid transfer between strains
- Contains ampicillin resistance marker

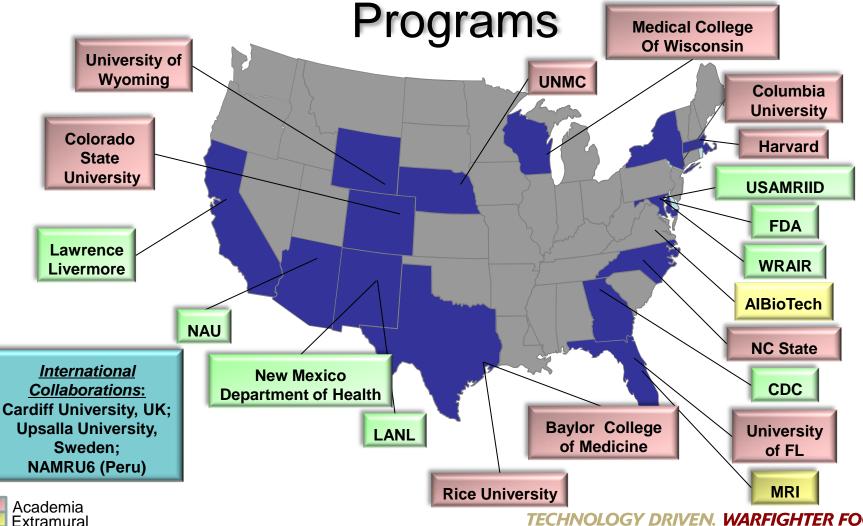
| Iteration | De novo contigs (Median Depth) | Total Assembled Bases | Identified Reference | RefSeq Accession | # Reads Mapped | % Ref coverage |
|-----------|---|-----------------------------|--|---------------------|-------------------|-------------------|
| 1 | 205 (44) | 4586247 | YP KIM Chromosome | NC_004088.1 | 555517 | 98.64 |
| 2 | 14 (76) | 169035 | YP KIM pCD1 | NC_004836.1 | 29312 | 95.92 |
| 3 | 6 (66) | 104051 | YP KIM pMT1 | NC_004838.1 | 16076 | 95.43 |
| 4 | 2 (23) | 8844 | E. coli A2363 plasmid pAPEC-02-R | NC_006671.1 | 368 | 1.0 |
| 5 | 1 (22) | 7616 | YP KIM pPCP1 | NC_004837.1 | 442 | 90.95 |



ECBC Genomic Sciences



ECBC Is Involved in Active Biosurveillance



Government

V RDECOM





Long term: use best of breed analytics to improve analysis

RDECON

Short term: identify capabilities that provide high-value analysis







Amazon Cloud

Web Services Communication Analysis Requests Data Exchange

DoD Firewall

ECBC HPC







Amazon Cloud

Web Services Communication Analysis Requests Data Exchange

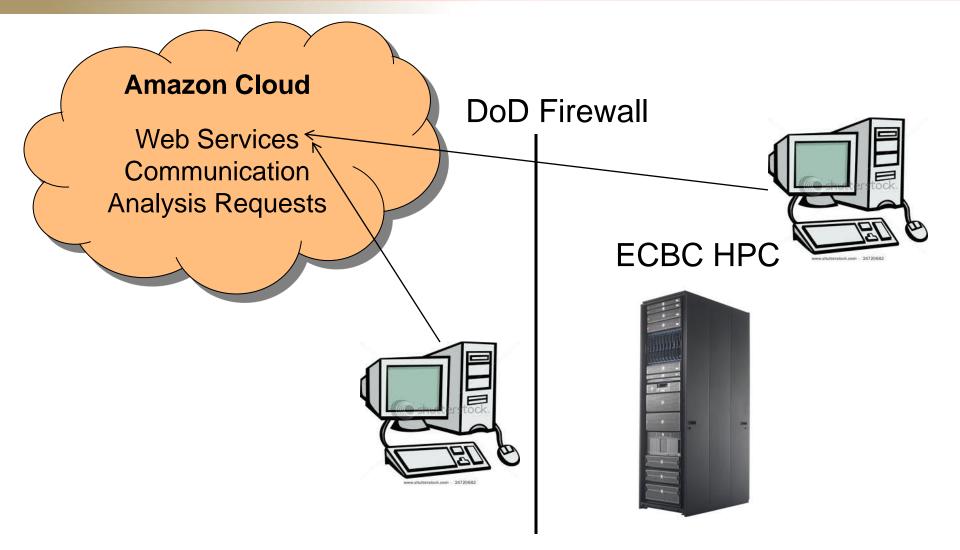
DoD Firewall

ECBC HPC



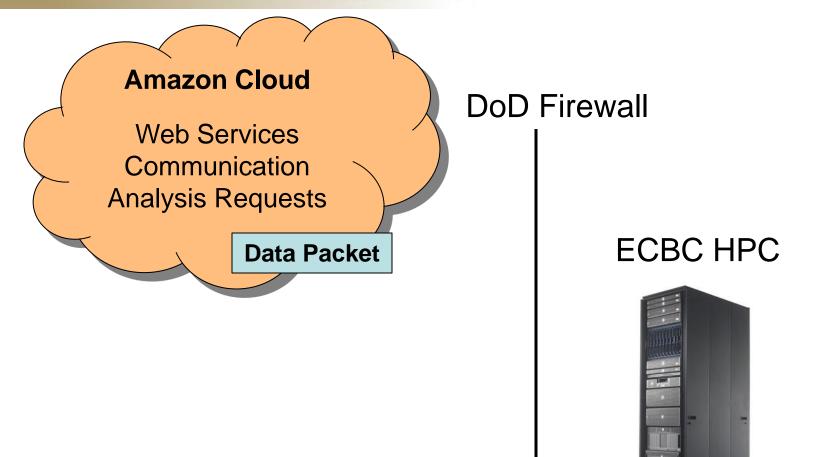






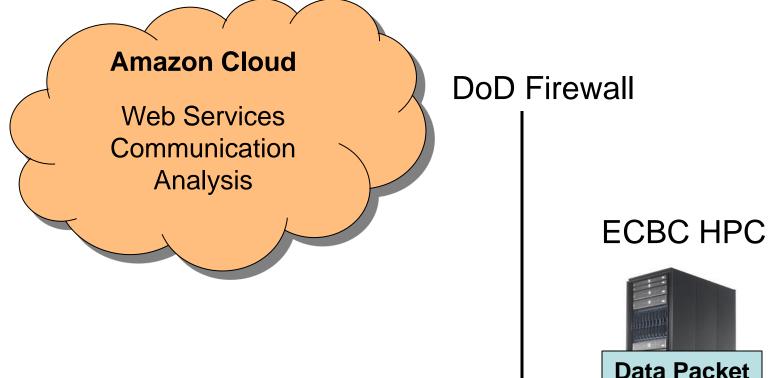














Pathosphere.org



| n - pathosphere.org Pathosph GLOBAL PATHWAY F | Dere.org | [| | | n ▼ Page ▼ Safety ▼ Tools icole Rosenzweig (Sign Out) Everything ▼ Q |
|---|--|---------------------|---------|-----------------|--|
| Welcome Guide Communities Analysis File Manager Pathogen Detection | TRI Message Board ⁽¹⁾ Message Boards Home ⁽¹⁾ Recent Posts ⁽¹⁾ My Posts ⁽¹⁾ My Subscriptions ⁽¹⁾ Statis ⁽¹⁾ Add Category ⁽¹⁾ Post New Thread ⁽¹⁾ Permissions ⁽¹⁾ | tics 🏦 Banned Use | | Opens New Wir | F - + × Search ndow) ^(A) Unsubscribe |
| Cross Sample ID Columbia-CII Forum | Categories Category <u>MiSeq Data Set 1 - Clinical Isolates</u> | Categories | Threads | Posts | 🔹 🖉 Actions |
| Luminex Contig Program | Subcategories: Combined Assembly Discussion, Roche Junior Data from 2011 MiSeg Data Set 2 Clinical Samples Subcategories: Sample Information | 1 | 3 | <u>18</u> | م محمد Actions |
| Forum Decision Support Team Forum | MiSeq Data Set 3_Assay Confounders_Isolates Showing 3 results. | <u>0</u> | 2 | <u>20</u> | sctions کی کھی |
| Documents | ▼ Threads | | | | |
| ECBC-GS Forum FOUO Database Documents Pathosphere Team Forum Wiki | There are no threads in this category. | | | | |
| Documents TRI Collaborations Forum | | | | | |
| | | | | tected Mode: Of | Settings Online Friends |





 Where do biodetection capabilities need improvement?

TERN

How can research efforts support reliable biodetection for biosurveillance?

 How can analytical and data security be maintained while creating a flexible informatics capability?





- Mechanism for DoD OCONUS facilities to share information between their personnel, regional hospitals, and US subject matter experts.
- Informatics resources should be developed in a way that provides a mechanism for analytical tool delivery in real time.
- Sequencing can be used for initial detection, but it is time consuming and expensive. Validation through traditional methods is required. Diagnosis completed by medical personnel.
- Decision makers make unambiguous decisions on ambiguous data. Scientific confidence must be communicated clearly.



Algorithm Prize



DTRA ALGORITHM PRIZE

The Challenge: Given raw sequence read data from a complex diagnostic sample, what algorithm can most rapidly and accurately process the data? DTRA is sponsoring an open competition with **\$1M** in awards available to the team(s) that can **best characterize an unknown sample**, with the least computational overhead. Prize details and sequencing datasets will be made available this Fall. Monitor **http://www.dtra.mil/Business.aspx** for updates.



Contributors



ECBC

Henry Gibbons Stacey Broomall Mohamed Aitichou Mark Karavis Joe Insalaco Alvin Liem Jessica Hill Michael Krepps **Pierce Roth** Eddie Salinas Ed Megan Greg Donarum Ed Fochler Patrick Carcel Josh Schulte

Columbia University Ian Lipkin David Hirschberg

TRI

Evan Skowronski David Klinzing Kent Kawashima

Funding provided by the Defense Threat Reduction Agency. Conclusions and opinions presented here are those of the authors and are not the official policy of the U.S. Army, ECBC or the U.S. Government.



ECBC Mission and Vision



| | RESEARCH & TECHNOLOGY | ENGINEERING | OPERATIONS & INTEGRATION | |
|------------------|--------------------------|-------------|-----------------------------|---------------------|
| WARFIGHTER NEEDS | | | W | ARFIGHTER SOLUTIONS |
| | | | | |

LIFECYCLE CHEMICAL AND BIOLOGICAL SOLUTIONS

MISSION: Integrate lifecycle science, engineering and operations solutions to counter CB threats to U.S. forces and the nation.

VISION: To be the premier resource for Chemical, Biological, radiological, nuclear and Explosive (CBRNE) solutions, uniting and informing the national defense community.

Basic research through technology development, engineering design, equipment evaluation, production support, sustainment, field operations and disposal.

Technology Driven Warfighter Focused

EDGEWOOD CHEMICAL BIOLOGICAL CENTER

For more information about the Edgewood Chemical Biological Center visit www.ecbc.army.mil

or email the Public Affairs Office

UNCLASSIFIED