

# Omnyra

## Initial Problem Statement

Easy access to DNA synthesis and weak buyer checks let bad actors slip through and make dangerous biological agents.

## Final Problem Statement

Existing safeguards miss AI-generated threats and the government lacks visibility into today's bioengineering capabilities.

## 130 Interviews



Kari Montoya, FBI  
Problem Sponsor



Nelson Layfield, FBI  
Government Mentor



Sal Badillo-Rios, DIU  
Government Mentor



Laura Clapper, MD  
Business Sponsor



Mark Clapper, MD  
Business Sponsor

# Our Team: A Mix of Computer Science & Biology



**Emilin Mathew**

BS in Computer  
Science & Biology



**Taralyn Nguyen**

BS in Computer  
Science & Management



**Stefan Thottunkal**

MD/MS in Community  
Health and Prevention  
Research

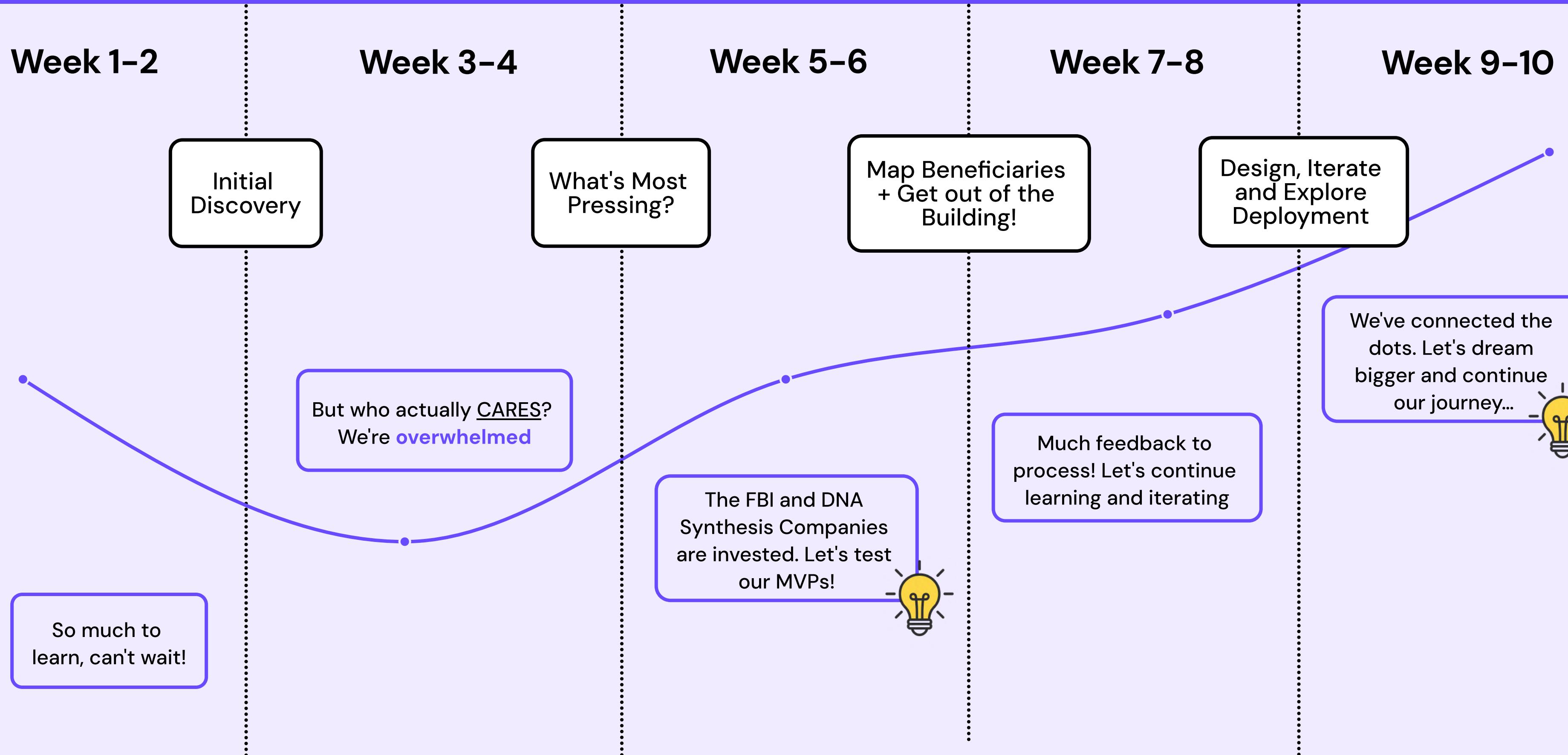


**Varsha Saravanan**

BS & MS in Computer  
Science



# Highs, Lows, and Lightbulbs...



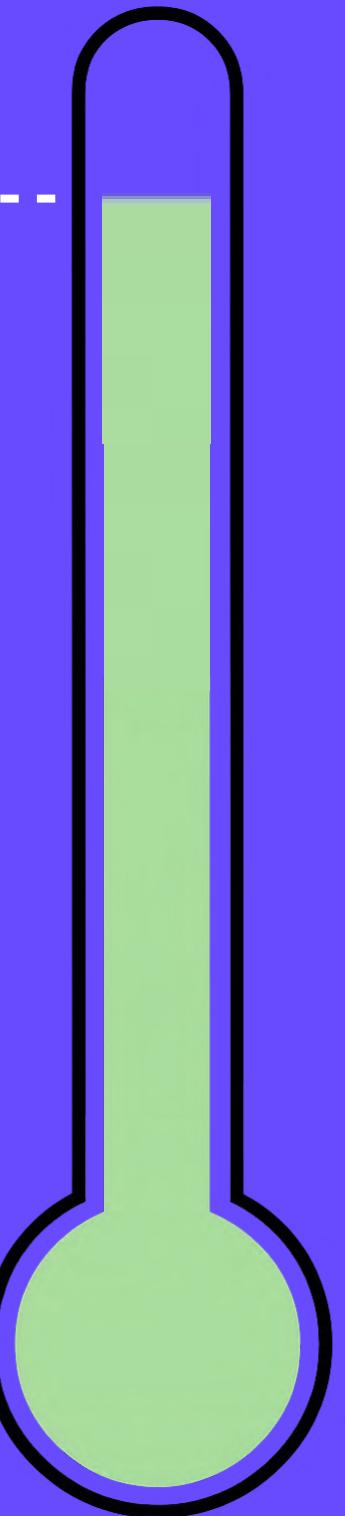
# Week 1-2

21 Interviews in...

## Understanding Problem Space

Emotion Meter

Excited -----



## Suspicious Order



Biosynthetic Company



Bioweapon Built



Catastrophic Outbreak



**Some companies assume  
every customer is safe.  
That assumption could be  
deadly.**

*"It's not our job to verify  
customers' orders."*

— U.S. DNA Synthesis Company

# We Interviewed Every Major U.S. Competitor in Biosecurity Screening

1 Customer Screening Tool



5 Sequence Screening Tools



IBBIS



SecureDNA

BATTELLE

The screenshot shows the 'Enter Query Sequence' section with a text input field for sequence entry, a 'Clear' button, and a 'Query subrange' section with 'From' and 'To' fields. Below this is an 'Or, upload file' section with a 'Choose File' button showing 'No file chosen'. A 'Job Title' input field and a descriptive title input field follow. A checkbox for aligning two or more sequences is present. The 'Choose Search Set' section includes a 'Database' dropdown set to 'Standard databases (nr etc.)', a 'Core nucleotide database (core\_nt)' dropdown, and an 'Organism' section with an optional dropdown and an 'Add Organism' button. It also includes 'Exclude' and 'Limit to' sections with checkboxes for 'Models (XM/XP)', 'Uncultured/environmental sample sequences', and 'Sequences from type material'. An 'Entrez Query' section at the bottom contains a text input field and a 'Create custom database' link.

We mapped the field.  
Every tool follows the  
same outdated playbook.

# Existing Tools Have Little Defense Against Modern Threats

VSSQCVNLTRTQ

VS

VSSQCVNLTRTQ

**Direct Match**

**Detected**

VSSMMNLTRTQ

VS

VSSQCVNLTRTQ

**Minor Changes**

**Maybe Detected**

ATTQCVNTACT

VS

VSSQCVNLTRTQ

**Large Rewrite**

**Not Detected**

ATTCDWVNMWQ

VS

VSSQCVNLTRTQ

**Entirely New Threat**

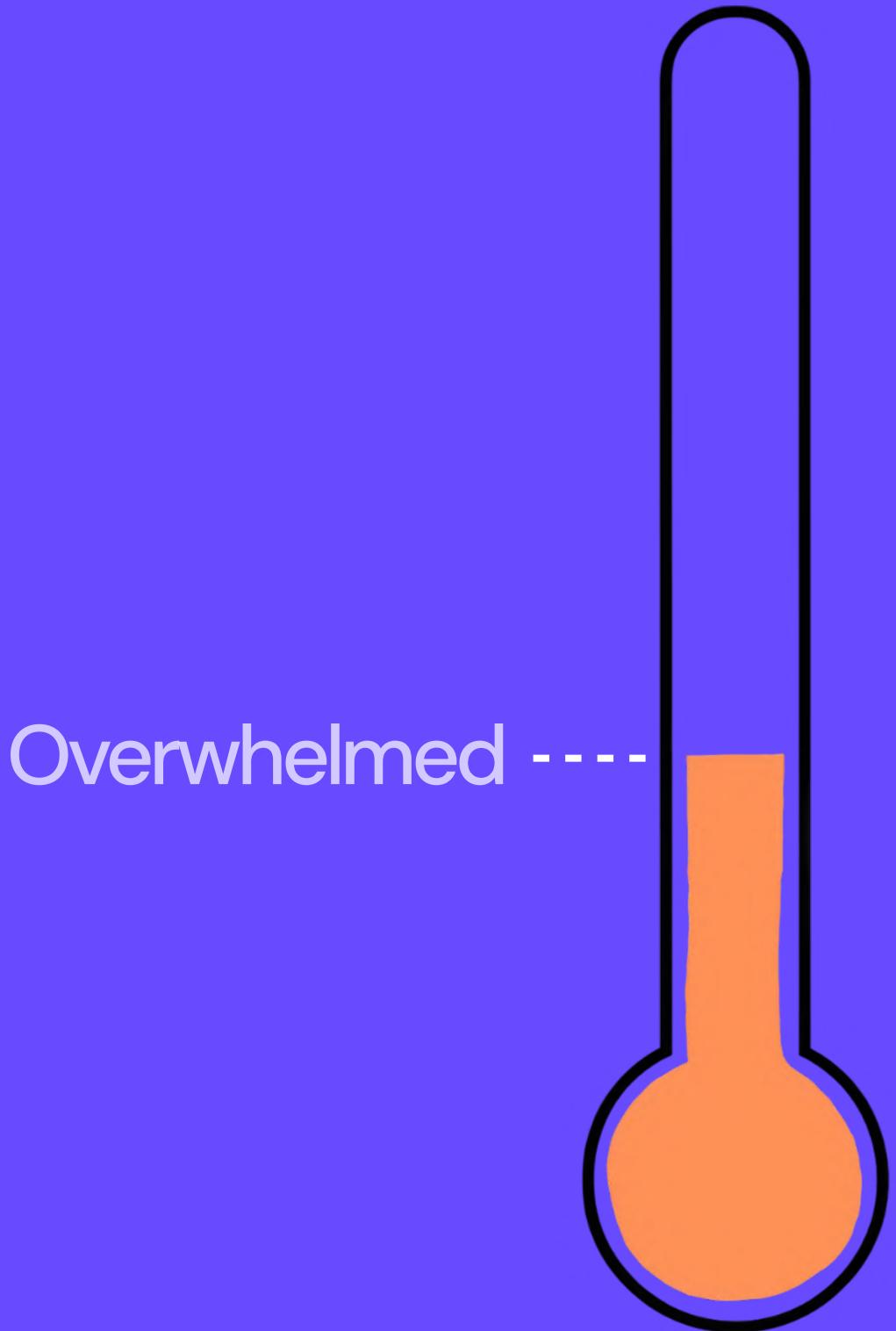
**Not Detected**

# Week 3-4

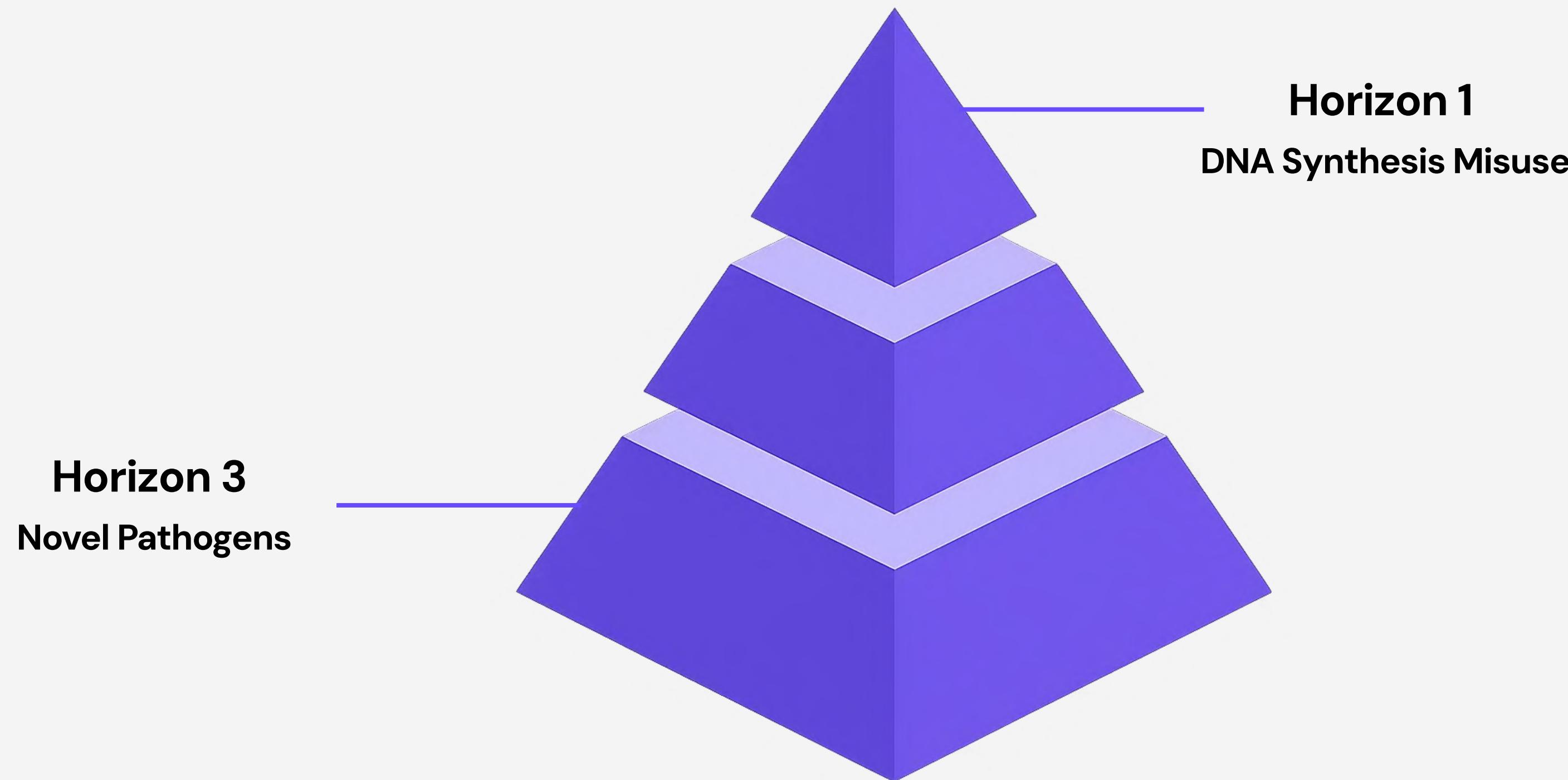
50 Interviews in...

What's Most Pressing?

Emotion Meter



# We Started With Active and Strategic Threats



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# We Noticed Conflicting Perspectives

*"We do not see novel pathogenic orders often – it is not a pressing threat."*

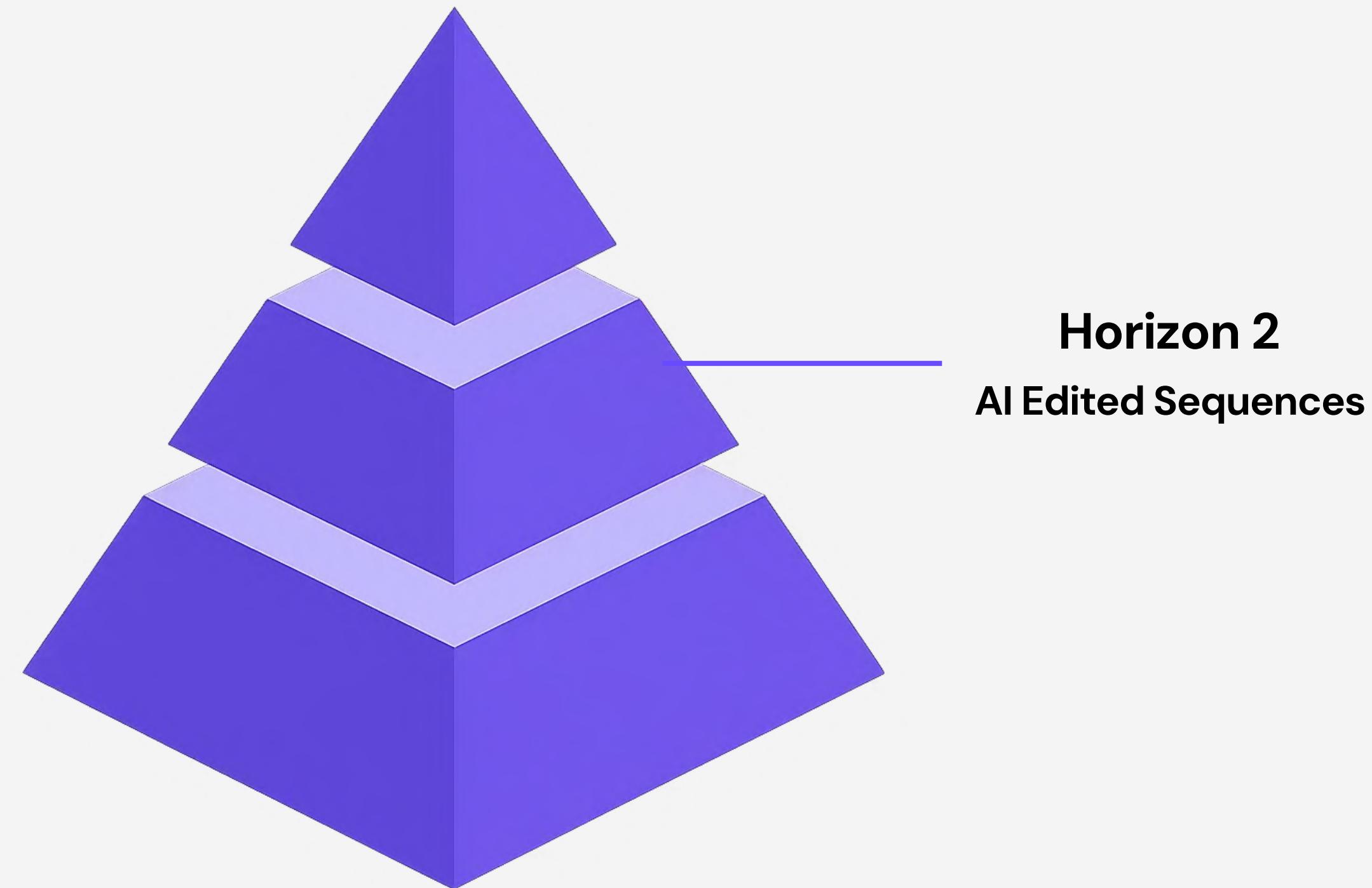
– Chief Security Officer of U.S. DNA Synthesis Company

*"95% of threats the HQ deals with are engineered in some capacity."*

– Intelligence Analyst at FBI Headquarters

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# But, We Were Still Missing Something Critical



**AI-Edited Pathogens  
are more PRESSING  
than anticipated.**

**Current Safeguards are  
likely to FAIL yet very  
few are talking about it.**

# We Received Early Support!



**National Institute  
of Health**



**Aclid &  
SecureDNA**



**Twist Biosciences**



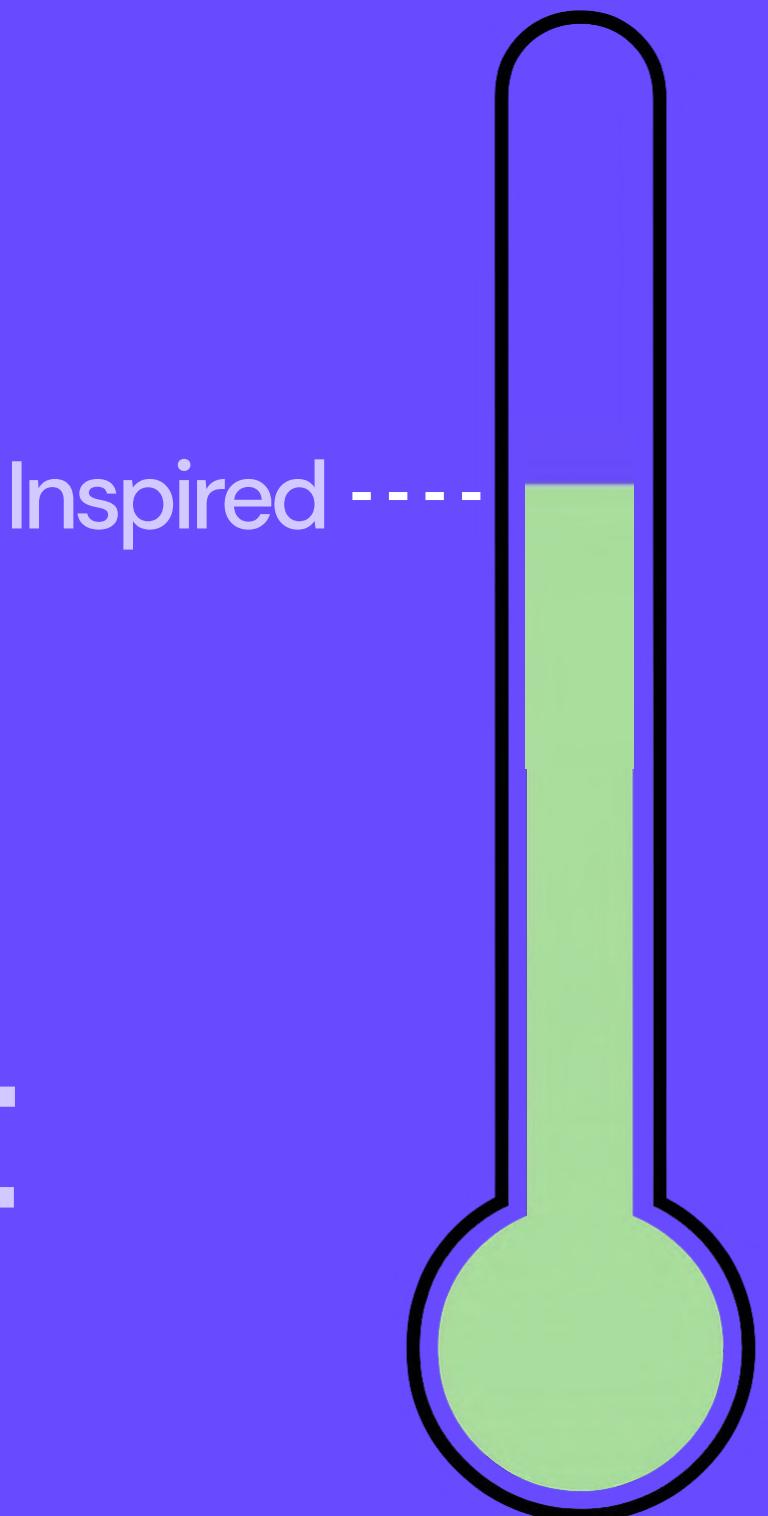
**National Security  
Commission for  
Emerging  
Biotechnology**

# Week 5-6

78 Interviews in...

Does anyone else care? + Get  
Outside the Building!

Emotion Meter



# At First, We Missed the Full Picture

**Bad Actor**



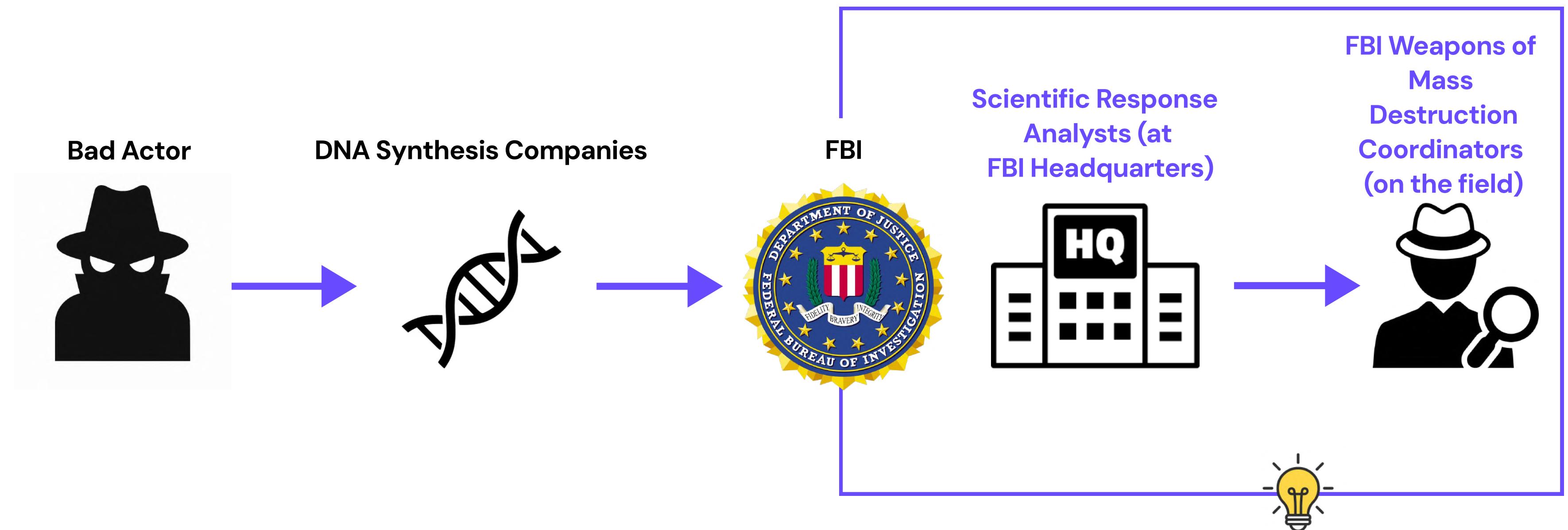
**DNA Synthesis Companies**



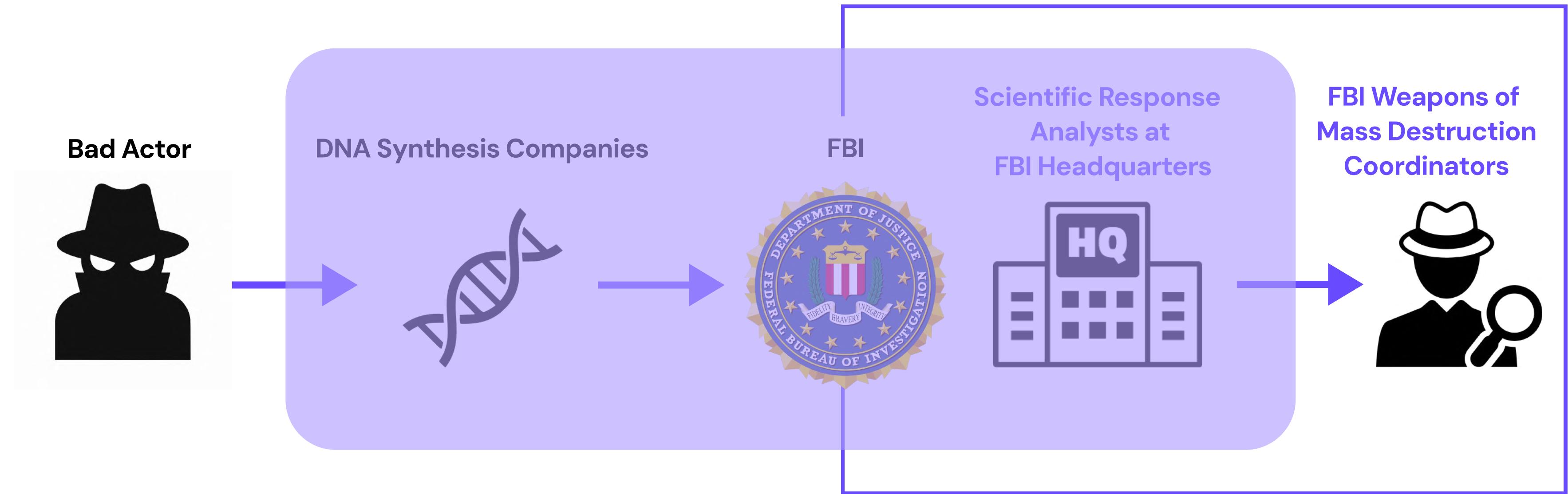
**FBI**



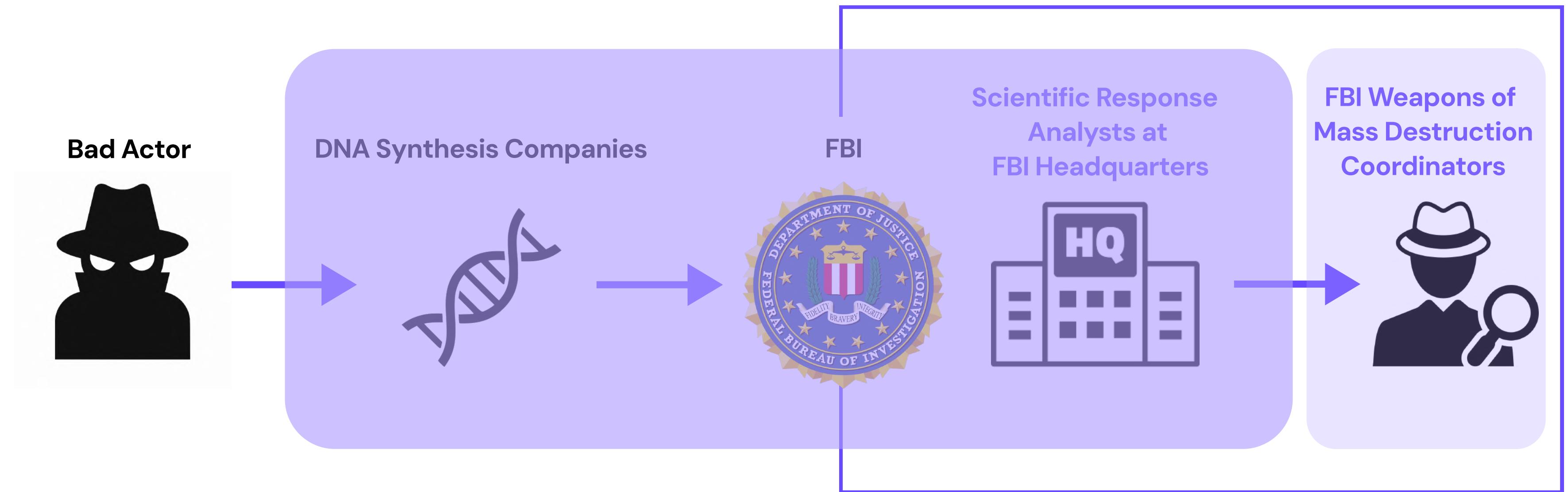
# Missing Piece: Clarifying the FBI Workflow



# Pinpointing the Primary Beneficiaries



# Reframing WMD Coordinators as Secondary Beneficiaries



# We Got Out of the Building

→ in person connections



→ real world context



→ unexpected opportunities



**Dr. Drew Endy's  
Lab**

**Lawrence Berkeley  
National Laboratory**

**SynBioBeta  
Conference**

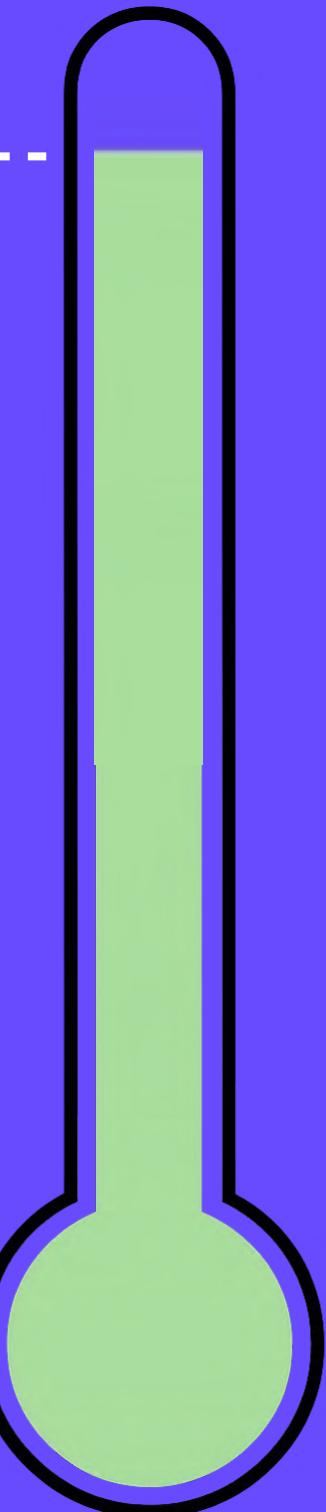
# Week 7-8

108 Interviews in...

Build, Validate, and Iterate

Emotion Meter

Growth Minded -----



# We're Building a Technical Moat: The First AI-Native Biosecurity Stack



## 1 – Synthetic Pathogen Database

Approach	Value Added
Function Preserving Framework	Simulates real-world evasion tactics to find what legacy tools fail to catch



## 2 – AI Classifier

Pipeline	Value Added
Analyst Ready Report	<ul style="list-style-type: none"><li>Confidence score</li><li>Predicted function or family</li></ul>
Classifier Layer	Predict functional risk (toxin vs non-toxin)
Pretrained Models	Use protein LMs to extract function from sequence.

# Testing Interface: AI-Native Pathogen Detection For Industry

The screenshot shows the Omnyra platform's user interface. At the top left is the Omnyra logo. Below it is a text box containing a paragraph about the platform's mission to detect synthetic biological sequences and its AI-driven detection methods. The main area features a 'FASTA input' section where a synthetic DNA sequence is pasted. A 'Submit' button is located below the sequence. To the right, there are two tabs: 'Natural Matches' and 'AI-Edited Variants'. Under 'Natural Matches', there is a 'Synthetic Functional Analog' section with three red bars representing different size ranges: 0-50 bp, 51-100 bp, and 101-150 bp. A warning message states: '⚠️ Pathogen Detected: Synthetic analog of Variola virus. Confidence level: High'. A blue 'View Threat Analysis Report' button is at the bottom. A purple arrow points from the 'View Threat Analysis Report' button to the threat analysis report on the right.

OMNYRA

Omnyra is an AI-driven platform designed to detect synthetic biological sequences that evade traditional homology-based screening tools. We offer streamlined FBI reporting options based on flagged risk levels. Our team is actively evaluating various sequence encoders, fine-tuning strategies, dataset curation pipelines, and embedding-based detection methods. Check out our demo to learn more about our vision!

**FASTA input**

```
>OMNYRA_SYNTHETIC_01 AI-edited analog of Variola virus strain India-1967 [Synthetic]
ATGGAGGATTATAAACATTCGGCACACAAAAGAAATAATGAAGATATACATA
AAGTTTGAGAATATTAA
ATCTAGAGATATCTATTATTACAGAAAATACAGGTAGGATAAGATACTTT
ATTCTTTAATTTTATT
ATTGAATATAATTGTTTATAAAGGTAAGTGTATGATGTTCTAAACGATGT
TTTCAAACTAGAGAGAA
TCTTCTATATTTATATTAACCTTGTCAGAAAAATAAGGATGGGATTATTTATAGA
```

**Submit**

**Natural Matches**    **AI-Edited Variants**

**Synthetic Functional Analog**

0-50 bp	51-100 bp	101-150 bp
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⚠️ Pathogen Detected: Synthetic analog of *Variola virus*. Confidence level: **High**

**View Threat Analysis Report**

**Threat Analysis Report**

**Threat Interval**  
0–150 bp

**Virulence Score**  
High

**Explore reporting options:**

**Flagged**     **Blocked**    **Report to FBI**

[View all flagged and blocked orders](#)

**Related variants in GenBank:**  
NC\_001611.1 AY243312.1 AY243313.1 AY243314.1 AY243315.1 AY243316.1

We're building something  
that doesn't currently exist  
but is needed.

# Our Screening Tool Received Positive Feedback And Interest

*Open to collaborating if Omnyra excel in speed, accuracy, and/or cost.*

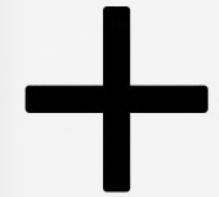
– Two Major Screening Tools in Market

*... Companies will appreciate the inbuilt ability to report to FBI when threats emerge.*

– Postdoc at Engineering Biology Research Consortium

# How Do These Insights Inform a FBI-Facing Tool

**Solve Bottleneck in  
Threat Reporting  
at FBI Headquarters**



**Seamlessly Integrate  
with Existing Pipeline**

# We Designed The First SynBio Threat Triage Tool For The FBI

### FASTA Input

```
>OMNYRA_SYNTHETIC_01 AI-edited analog of Variola virus  
strain India-1967 [Synthetic]  
ATGGAGGATTATAAACATATTGGCACACAAAGAAATAATGAAGATATACATA  
AAGTTTGAGAATATTAA  
ATCTAGAGATATCTATTATTACAGAAAATACAGGTAAGGATAAGATACTTT  
ATTTCTTAATTTATT  
ATTGAATATAATTGTTATAAAGGTAAGTGTATGATGTTCTAAACGATGT  
TTTCAAACTACAGACAA
```

**Submit**

**Natural Matches**    **AI-Edited Variants**

**Synthetic Functional Analog**  
0–50 bp    51–100 bp    101–200 bp

⚠ Pathogen Detected: Synthetic analog of *Variola virus*. Confidence level:  
**High**

**View Threat Analysis**

### Threat Analysis Report

**Threat Interval:** 0–150 bp  
**Virulence Score:** High  
**Explore reporting options:**

**Launch Investigation**    **View Full Report**

**Related variants in GenBank:**  
AY999001.1 AY999002.1 AY999003.1

**Launch Investigation**

**Method of Investigation:**  
e.g. Contact San Francisco WMD Coordinator (Kari Montoya)

**Threat Priority Level:**  
Select Priority

**Notes:**  
Add any relevant context or comments...

**Send Report**

**They Just Dropped The Mandate.  
We Already Built The Tool.**



[PRESIDENTIAL ACTIONS](#)

## IMPROVING THE SAFETY AND SECURITY OF BIOLOGICAL RESEARCH

Executive Orders

May 5, 2025

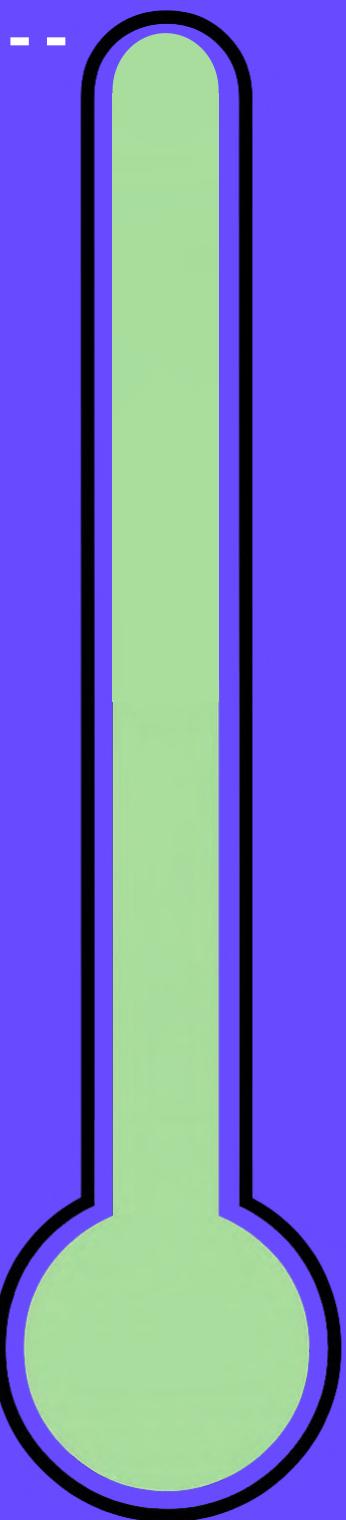
# Week 9-10

130 Interviews in total

Deployment + Post Class Journey...

Emotion Meter

Fired Up -----



# Positioning to Define the Dual-Use Future

## Where Our Existing Tech Goes Next

DIU Commercialization Summer  
Fellowship

FBI Pilot

Inform EO policy via OSTP  
conversations with our domain  
insights

Collaborate with screening  
providers

## Strategic Extensions

Gene function annotation

Deployable battlefield  
biosensors

Generative protein design  
platforms

Predictive drug discovery  
framework

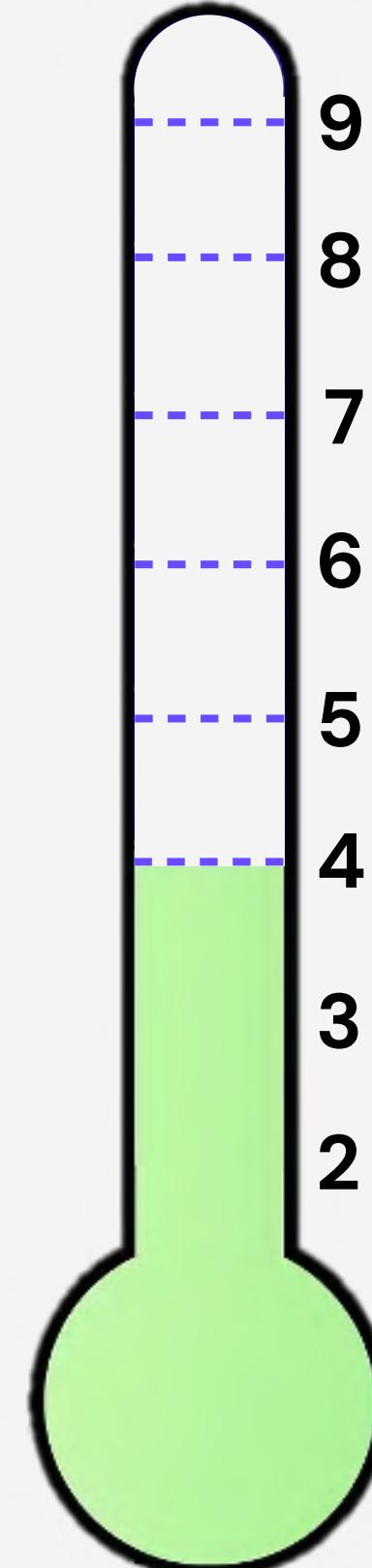
# Our Technology and Investability Readiness Levels = 4



**Completed scoping  
research to prove feasibility**



**Prototyped minimum fidelity  
MVP – proving it can detect  
sequences with high AI edits**



# AI Usage

We used AI to  
augment our work,  
to consult and assist  
– not replace

