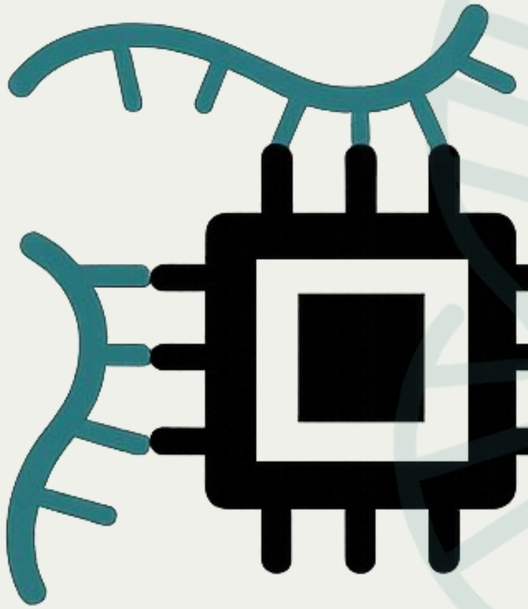
TEL AVIV UNIVERSITY אוניברסיטת תל אביב

iGEM

iGEM TAU 2026 Presents:



CERNAL

COMPILER-LIKE ENGINE FOR RNA LOGIC

THE UNMET NEED

Strain engineering tunes how much a cell makes, not whether or when it makes it.

SYNTHETIC BIOLOGY IS MISSING A TOOL

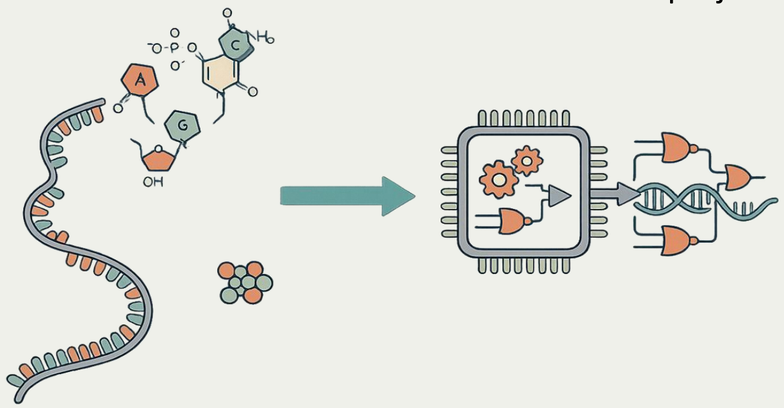
Today, there is no generic platform that makes gene expression conditional on a defined cellular state using programmable logic.

Limited transferability

A circuit tuned for one host or strain does not transfer cleanly to another

Manual RNA design

RNA-level conditional regulation is promising, but still expert-driven and rebuilt for each project



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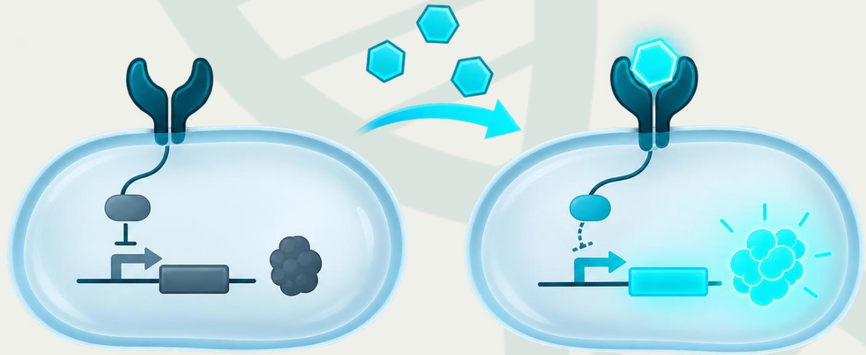
THE CHALLANGE

SPECIFICITY

COMPATIBILITY



Programming cells remains a slow, highly customized process that relies heavily on manual design and trial and error.

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One Language. Every Cell.

RNA carries, interprets, and regulates the information that cells use to function.



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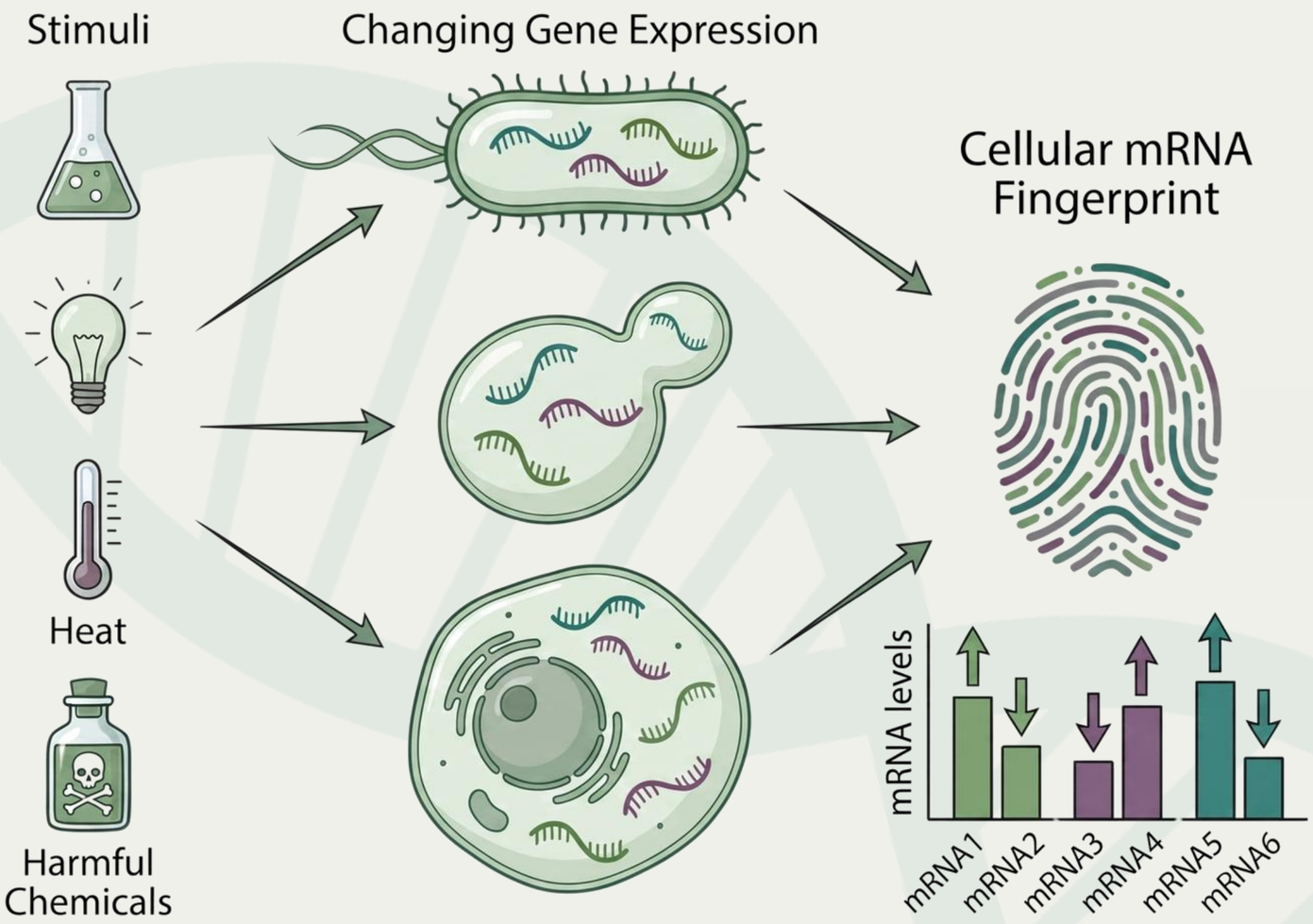
What we know



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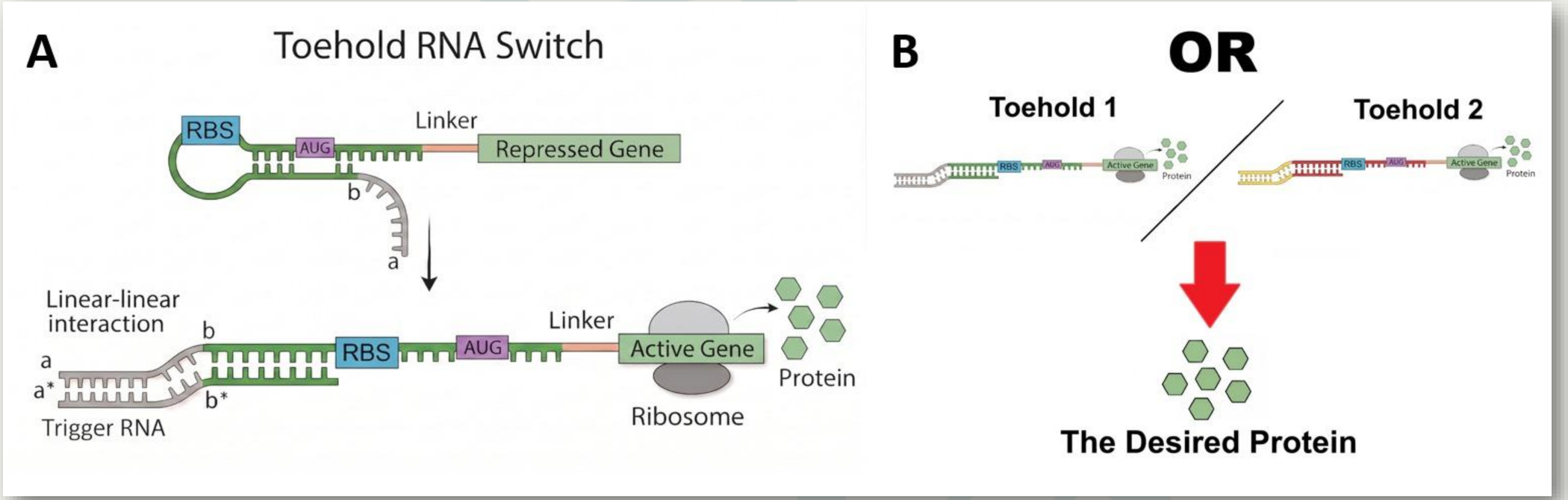
Example for Our logic gates



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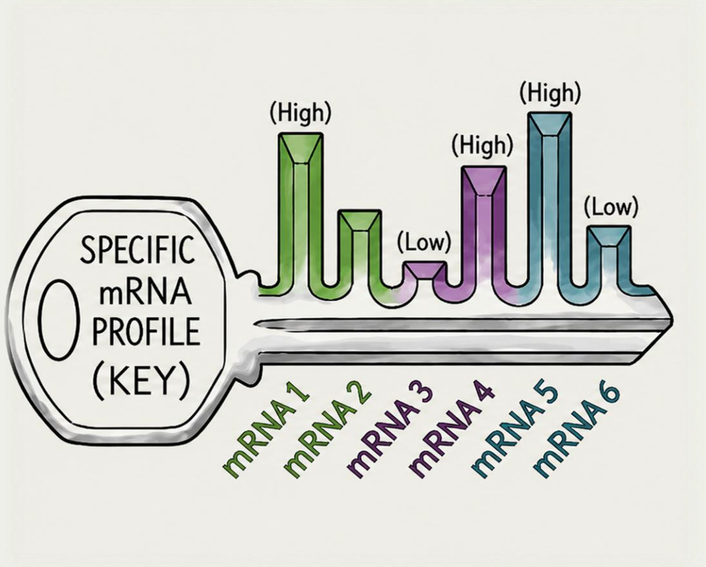
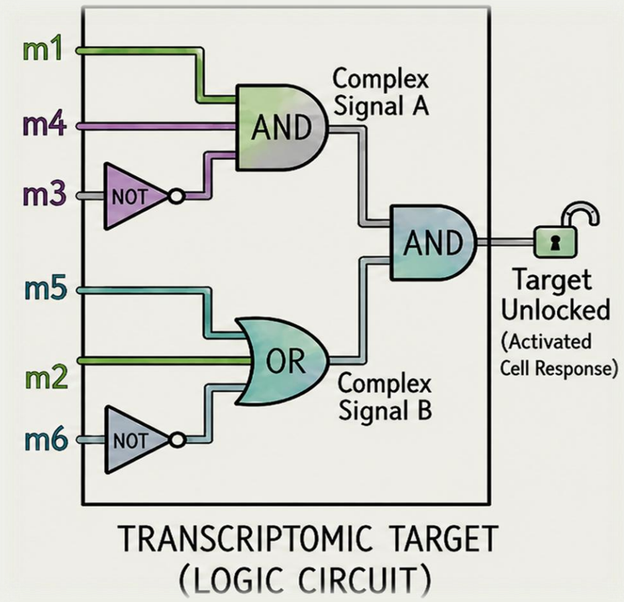
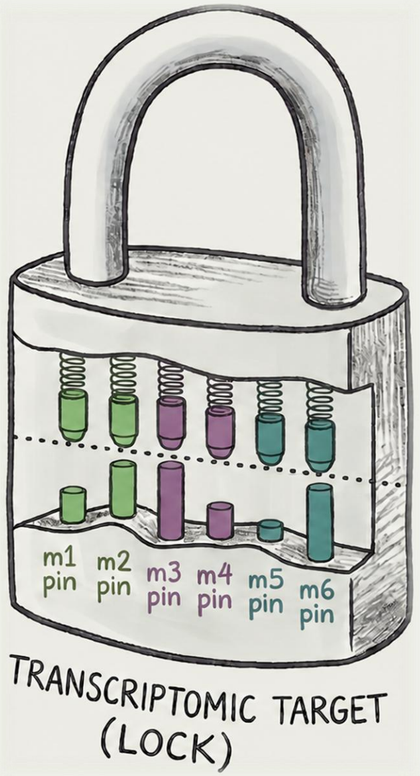
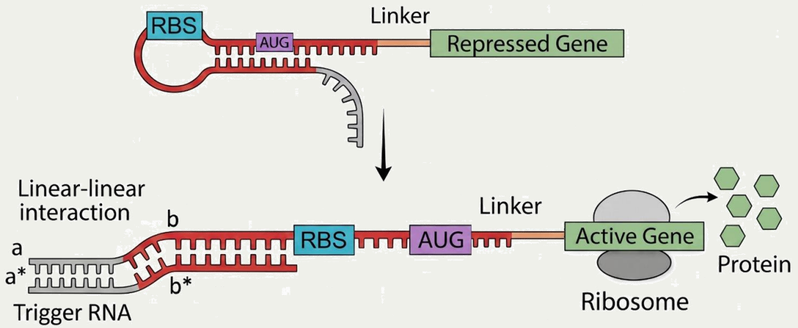
OUR APROACH: THE LOCK & THE KEY







Toehold RNA Switch



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Only the exact match unlocks the output. At a specific time and cell.

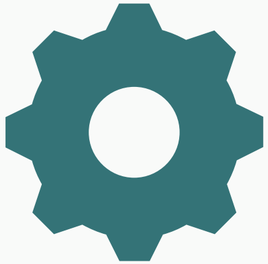
CERNAL is a biological compiler

1. HIGH-LEVEL SPECIFICATION

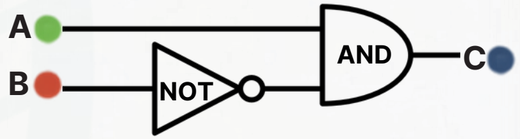


IF A AND NOT B THEN ACTIVATE C

2. CERNAL's Algorithm



3. LOW-LEVEL OUTPUT



4. IMPLEMENTATION





Compilers enable faster, more reliable design of biological systems by **bridging the gap between intent and implementation.**

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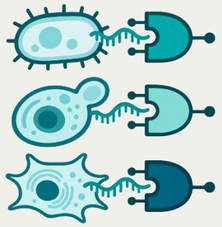
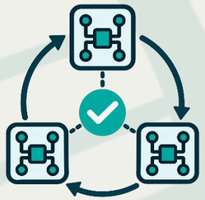
CERNAL UNIQUE VALUE



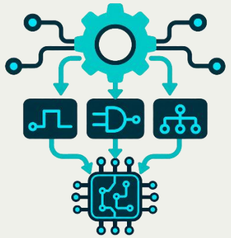
Gates fitted to each host

Trigger-responsive segments adapt gates to each use case and host.



Reproducible design

Computational design reduces individual bias and supports the DBTL cycles a foundry already runs.



Automated circuit design

The platform handles trigger selection, gate design and topology.

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Our POC

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1

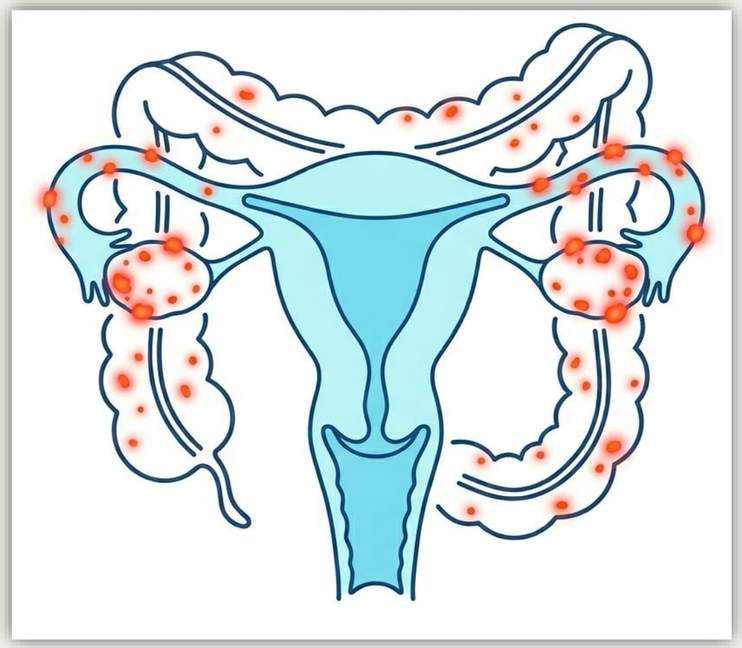
Endometriosis

Cells in the Wrong Place

Tissue similar to the uterine lining **grows outside the uterus** and bleeds internally, causing severe inflammation and chronic pain that can lead to organ damage and infertility.

1 IN 10

WOMEN



The Invisible Enemy

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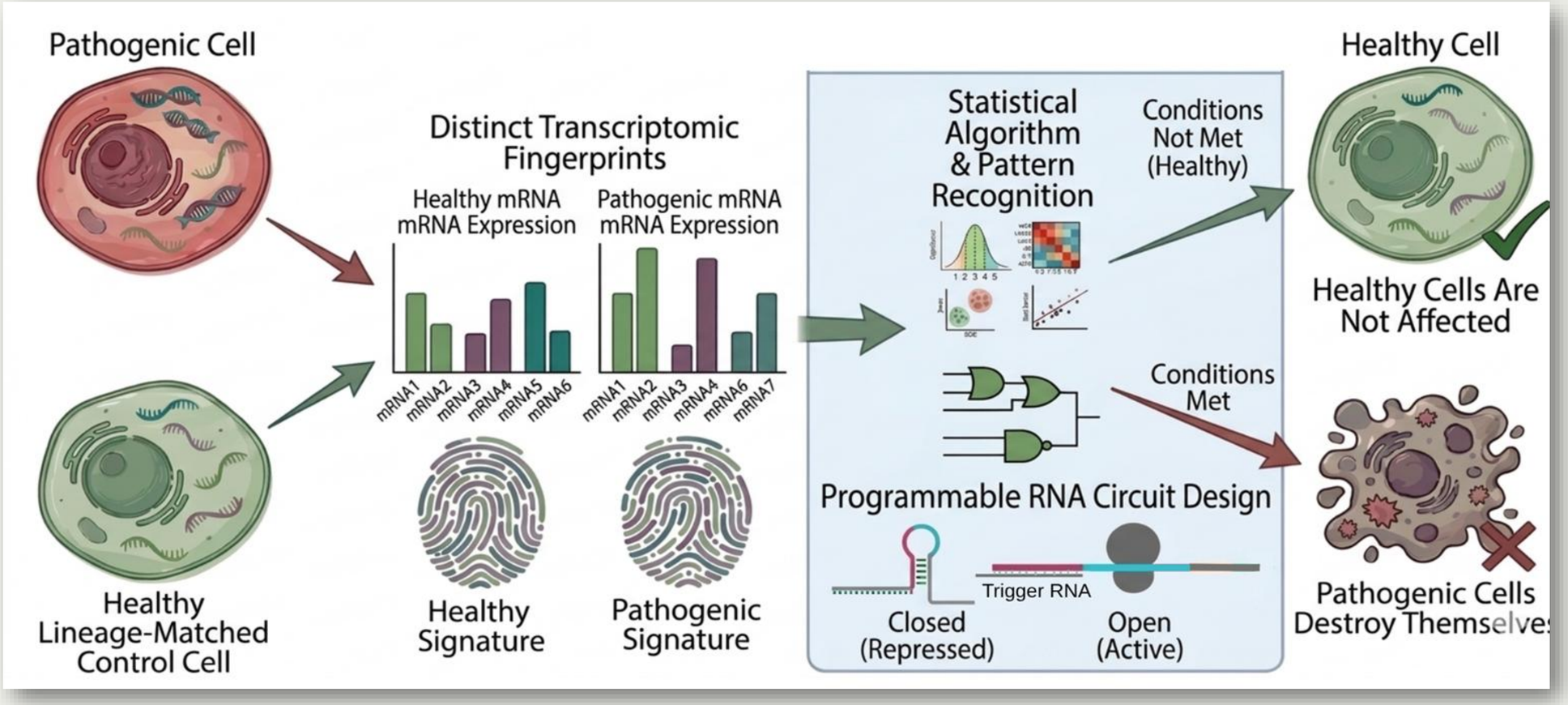
1

Endometriosis



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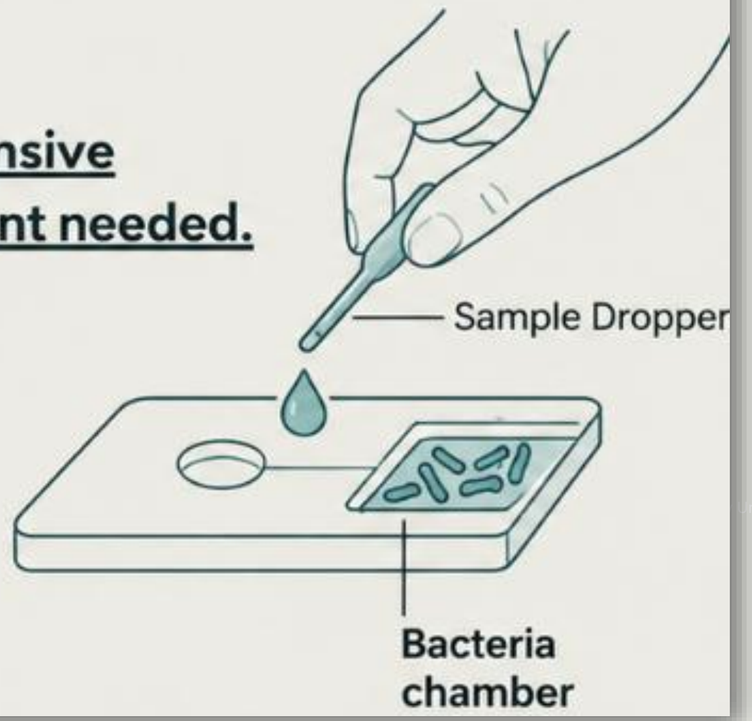
2

PFAS Detection

Releasing GFP only when A cell is exposed to PFAS.

No expensive equipment needed.



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PFAS Chemicals

Sunday, August 9, 2026
Today's Paper | Food Festival

The Philadelphia Inquirer

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Federal court approves settlements that will pay New Jersey $2.5 billion for PFAS contamination

DuPont and related companies will pay $2 billion for environmental damage for "forever chemicals" at three industrial sites, including two in South Jersey. 3M agreed to pay up to $450 million.

בלעדי

כל הארץ PFAS: הבדיקות שחשפו זיהום מסוכן בקרקעות המיועדות לבנייה

בדיקות המשרד להגנת הסביבה חשפו עדויות לזיהום של כימיקלים בלמעלה מ־30 אתרים בארץ, בין היתר כאלה שמיועדים לבינוי למגורים. חוסר הפיקוח של המדינה על השימוש בקצפי כיבוי אש הוביל לחלחול החומרים המסרטנים לאדמה

שני אשכנזי 06:00, 08.07.26

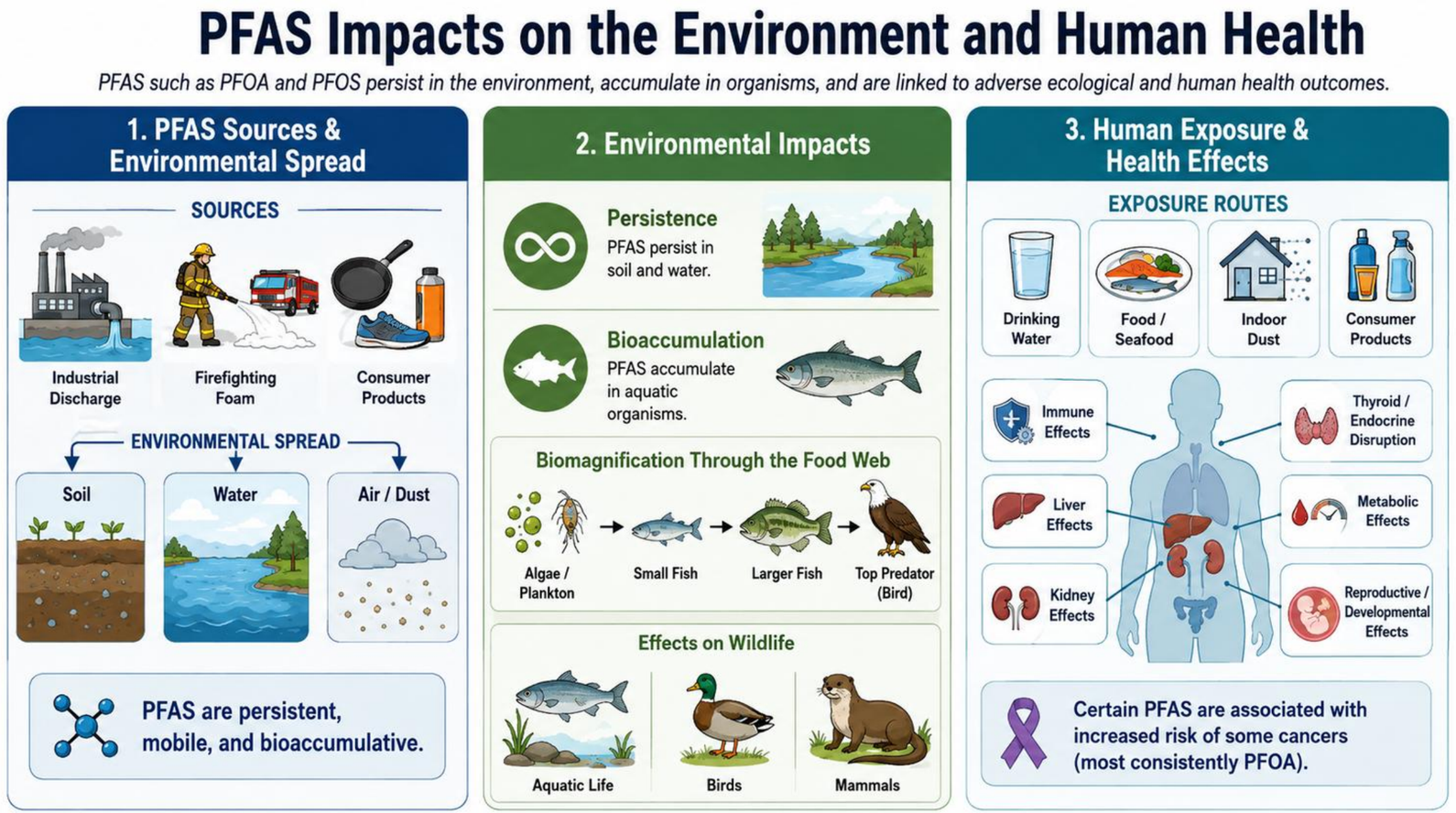
כלכליסט דיגיטל

info spot ‹ חדשות ‹ דוח אירופאי חדש על הסיכונים מפולימרים של מזהמי PFAS

דוח אירופאי חדש על הסיכונים מפולימרים של מזהמי PFAS

הפולימרים של PFAS מהווים עד 40% מכלל ה-PFAS באירופה, אך יש מעט מידע על השפעתם הבריאותית-סביבתית, משום שפולימרים נחשבים פחות מסוכנים. הדוח בוחן את הסיכונים לאורך מחזור החיים של הפולימרים, החל בשלב ייצור הפולימרים, דרך שלב השימוש וכלה בשלב הסילוק

מאת: מערכת infospot | פורסם בתאריך: 16/6/2025



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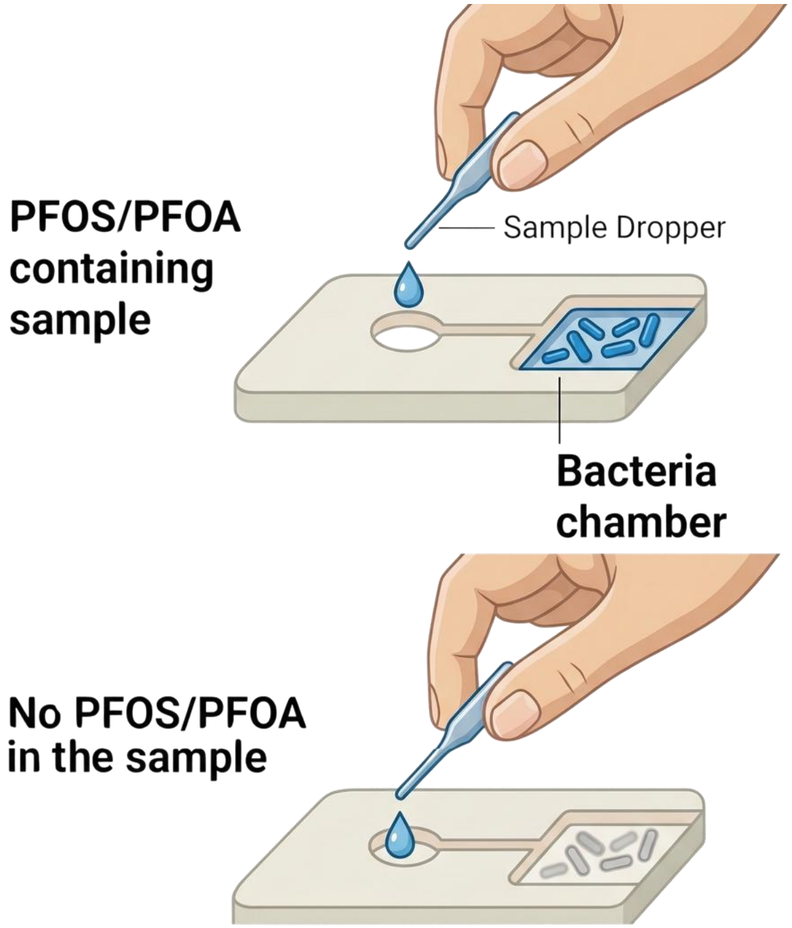
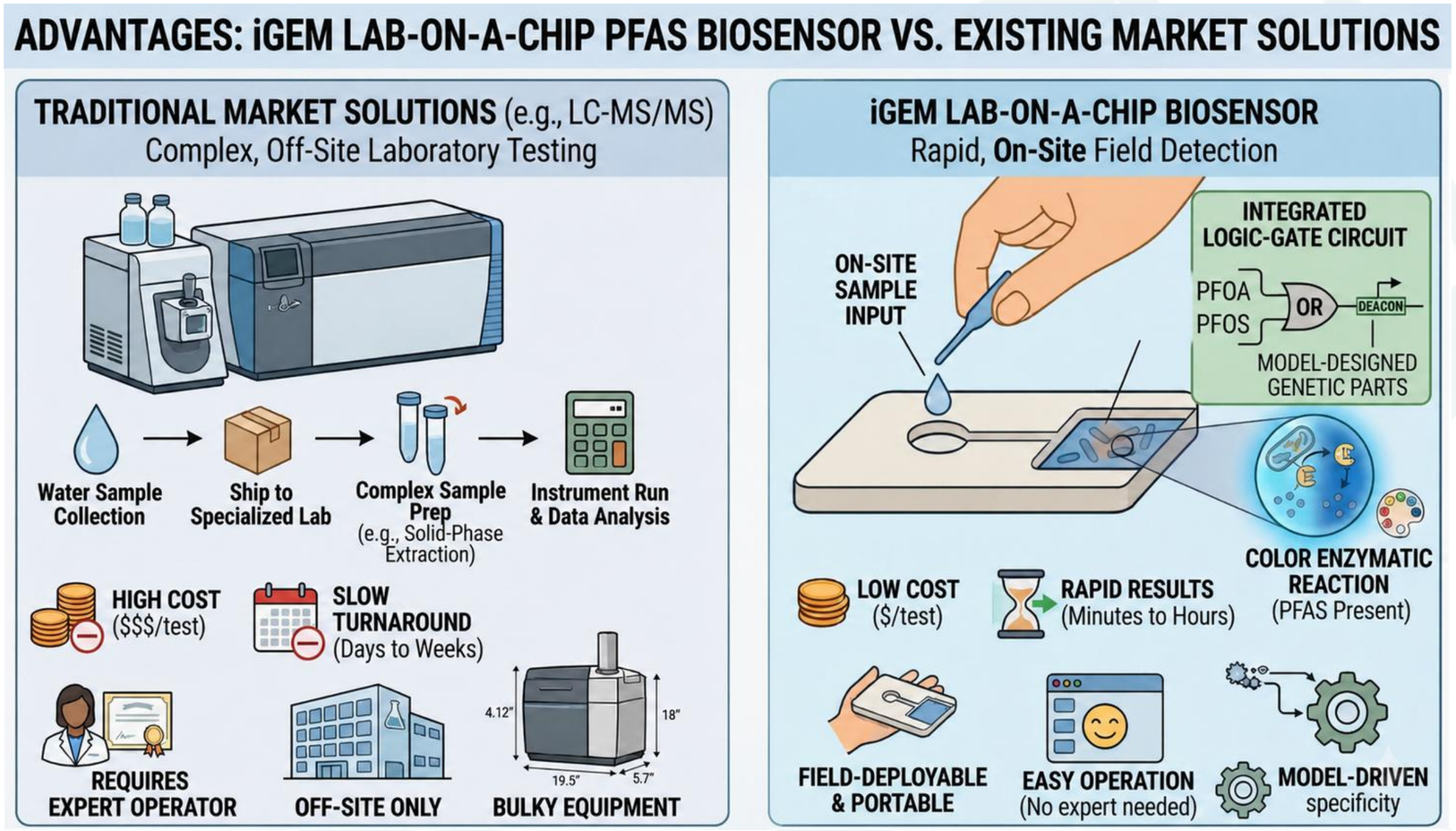
PFAS Detection Lab-on-a-Chip





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Results

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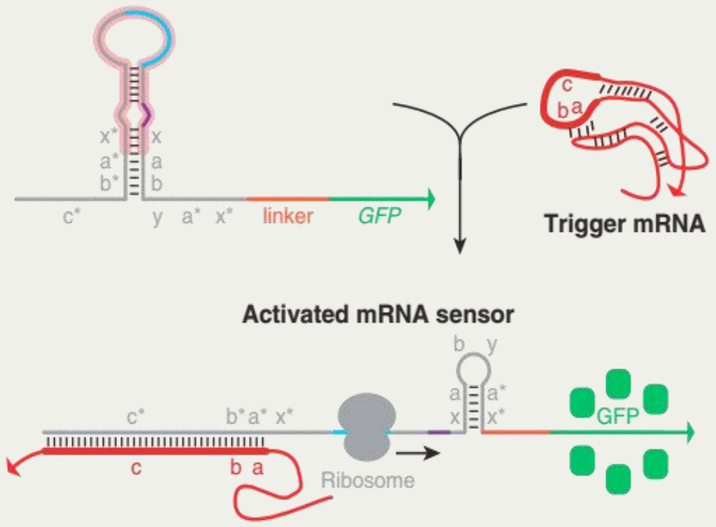
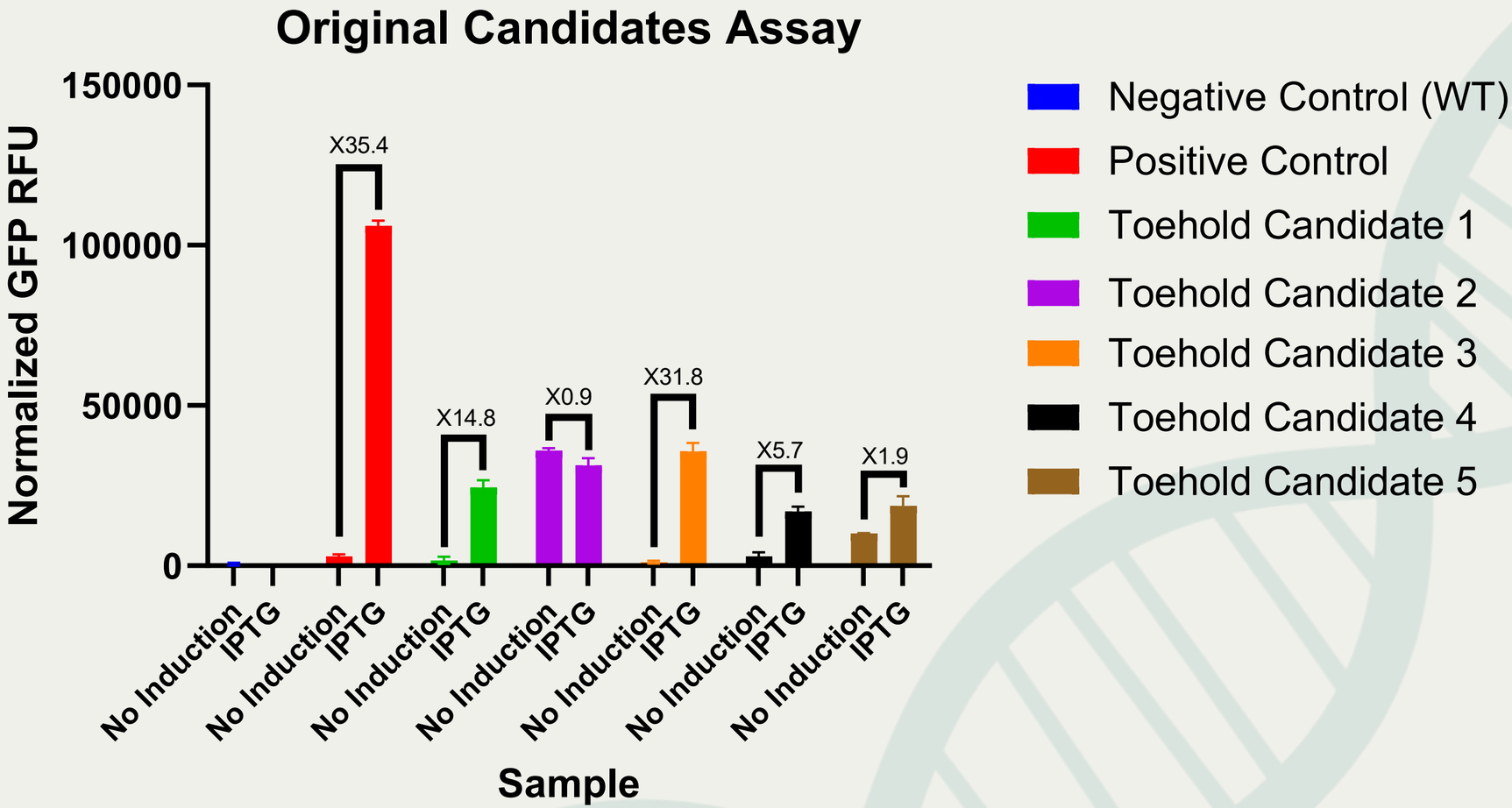
CERNAL Original Toeholds Development





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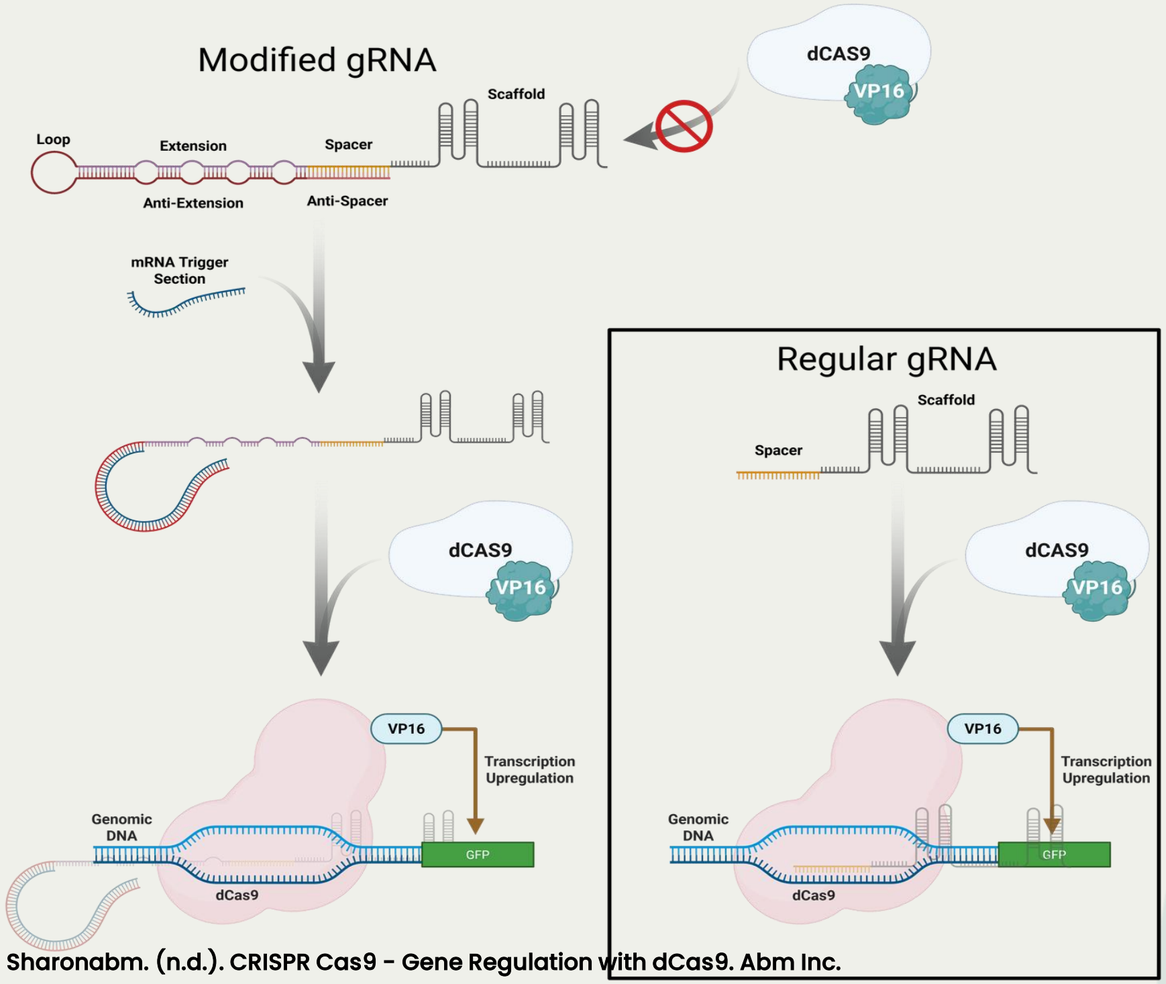
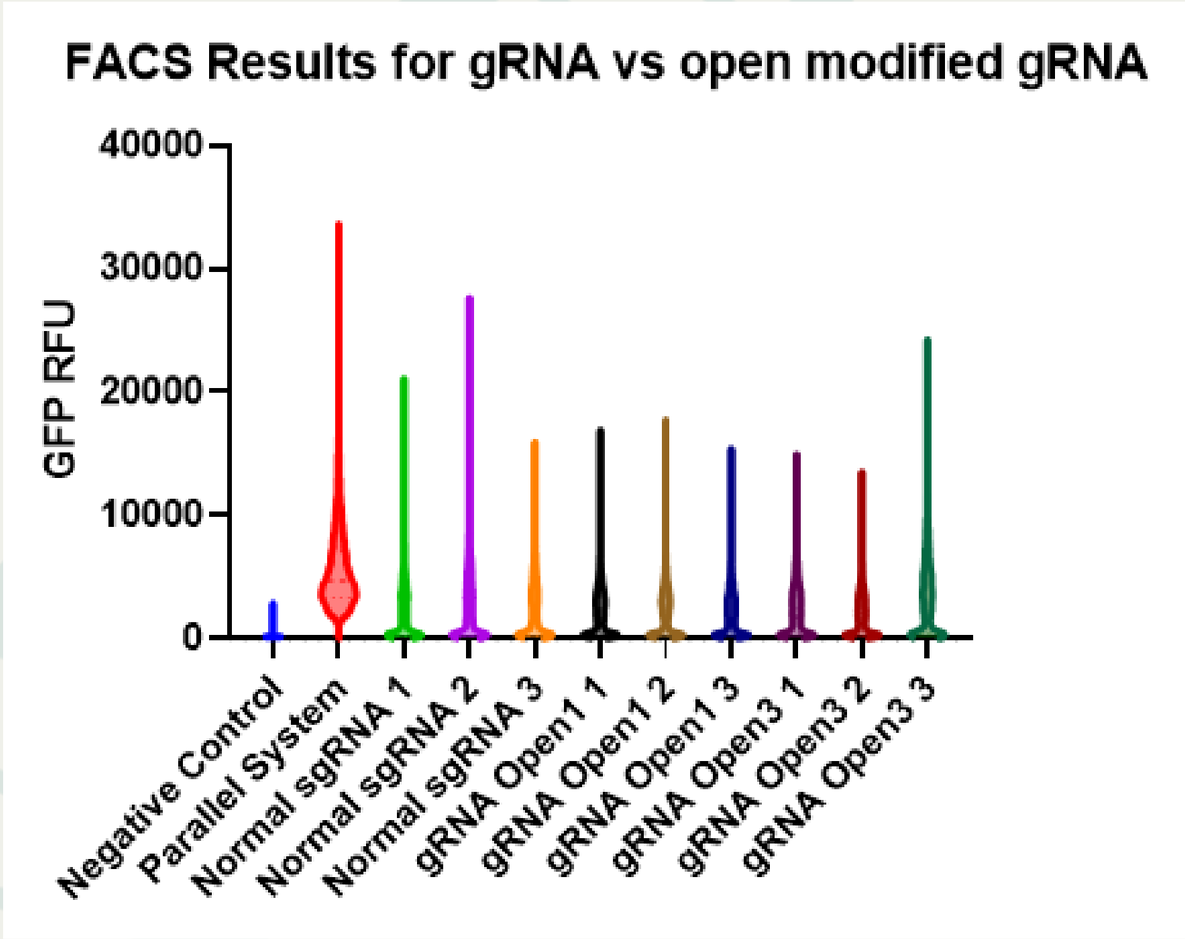
CERNAL Original Guild RNA Development



Sharonabm. (n.d.). CRISPR Cas9 - Gene Regulation with dCas9. Abm Inc.



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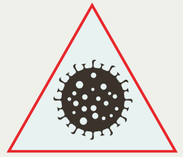
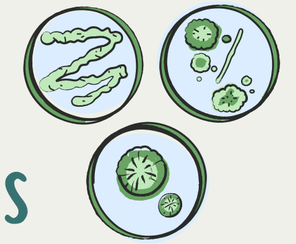
ADVANCED BIOSENSORS

Detecting RNA signatures of allergens and toxins for food QC.



BIOREACTORS

Regulating cells by metabolic state, for fermentation control.



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SMART THERAPEUTICS

Evidence the platform generalizes: pathological cells.



One Compiler. Infinite Possibilities

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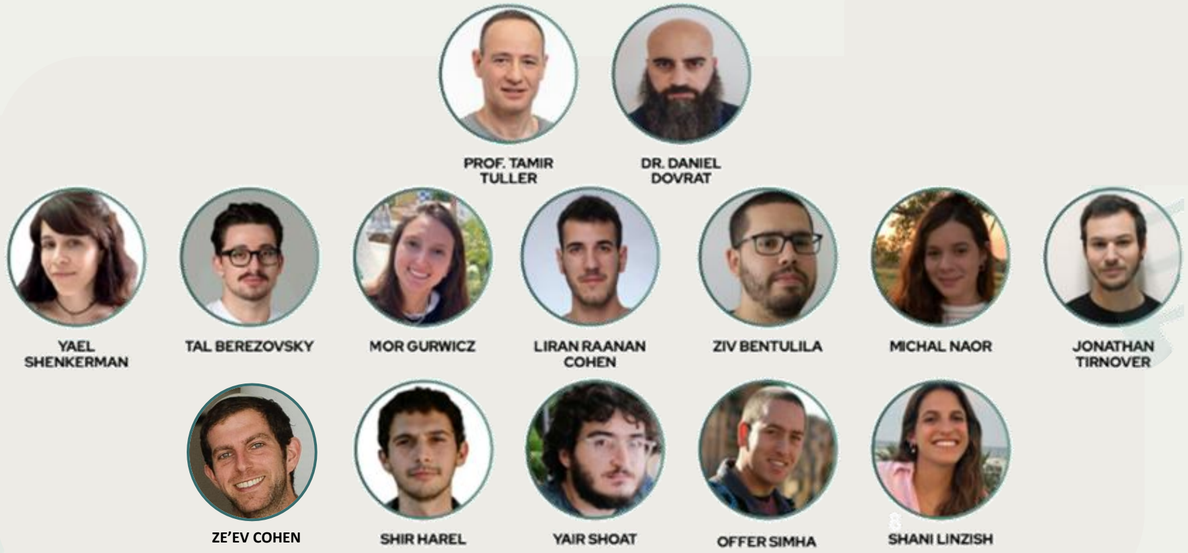

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