Thank you!

Also works in humans.

Kenneth Ahrains

the team

Alan Bush
German Sabio
Fernán Federici
Alejandro Colman-Lerner

Ignacio Sanchez
how much of your imagination fits into a single cell?
how many new features can be added to a cell?
Physically isolate sub-systems in different cells.
Crossfeeding
model

System feasibility

Explore possible behaviors

Identify critical parameters
System
feasibility
Explore possible behaviors
Identify critical parameters
\( p_{Trp} \)
d_{His}
AA concentration in medium

\[ K_{\text{His}} \]

\[ OD_{600} = A \times \frac{[\text{His}]^n}{K_{\text{His}} + [\text{His}]^n} \]

Growth rate

50%

\[ K_{\text{His}} \] vs. [His]

OD\text{600} after ON growth

[His] (mg/L)
\[
\begin{align*}
N_{\text{his}}^- &= k_{\text{max}} N_{\text{his}}^- \frac{H_{\text{is}}^n}{K_{\text{His}} + H_{\text{is}}^n}(1 - \frac{N_{\text{his}}^- + N_{\text{trp}}^-}{C_c}) - \text{death}N_{\text{his}}^- \\
N_{\text{trp}}^- &= k_{\text{max}} N_{\text{trp}}^- \frac{\text{Trp}^m}{K_{\text{Trp}} + \text{Trp}^m}(1 - \frac{N_{\text{his}}^- + N_{\text{trp}}^-}{C_c}) - \text{death}N_{\text{trp}}^- \\
\dot{\text{Trp}} &= p_{\text{Trp}} N_{\text{his}}^- - d_{\text{Trp}} N_{\text{trp}}^- k_{\text{max}} \frac{\text{Trp}^m}{K_{\text{Trp}} + \text{Trp}^m} \\
\dot{\text{His}} &= p_{\text{His}} N_{\text{trp}}^- - d_{\text{His}} N_{\text{trp}}^- k_{\text{max}} \frac{H_{\text{is}}^n}{K_{\text{His}} + H_{\text{is}}^n}
\end{align*}
\]

Parametros: estimados y de literatur
Culture density depends on $p$ [AA export rate].

$N_t (10^7)$

$I$  $II$  $III$  $Log[P]$
Strains proportion depends on $\frac{P_{\text{Trp}}}{P_{\text{His}}}$.
Growth lag time

The graph illustrates the growth of two populations, $N_{trp-}$ and $N_{his-}$, over time. The x-axis represents time in hours (0 to 200), and the y-axis represents the number of cells per ml. The graph shows a lag phase before the populations begin to grow exponentially. The lag time is indicated by the horizontal arrow between 0 and 100 hours.
PoPS in extra cellular AA

ENHANCES initiation of translation

ENABLES secretion of payload

AA rich peptide water soluble
Kozak

SECRETION tag

PAYLOAD

Enhances initiation of translation

Enables secretion of payload

AA rich peptide water soluble
• Yeast α-factor mating pheromone (MFα1)

• BBa_J63003

Kozak
- BBa_K416003
  - Yeast α-factor mating pheromone (MFα1)
Payload

- PolyHb
- His-tag
- TrpZipper2
- PolyWb
His

New

- PolyHb

New

- His-tag
Kozak
Secretion tag
Trojan peptide
- Polyanine
- HIV TAT
- penetratin
Payload

ENHANCES payload uptake
Trojan peptide

- Polyarginine
- HIV TAT
- penetratin

New

New

New
Final Devices

- MFα1 kozak
  - K792001
- MFα1 secretion
  - K792002
- TAT trojan
  - K792003
- TrpZipper2
  - K792006
- BBa_J63003
- BBa_K416003
- Polyarginine
  - K792004
- PolyWb
  - K792008
- MFα1 kozak
  - K792001
- MFα1 secretion
  - K792002
- TAT trojan
  - K792003
- HisTag
  - K792005
- BBa_J63003
- BBa_K416003
- Polyarginine
  - K792004
- PolyHb
  - K792007
## Final Devices

<table>
<thead>
<tr>
<th>MFα1 kozak</th>
<th>MFα1 secretion</th>
<th>TAT trojan</th>
<th>TrpZipper2</th>
</tr>
</thead>
<tbody>
<tr>
<td>K792001</td>
<td>K792002</td>
<td>K792003</td>
<td>K792006</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BBa_J63003</th>
<th>BBa_K416003</th>
<th>Polyarginine</th>
<th>PolyWb</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>K792004</td>
<td>K792008</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MFα1 kozak</th>
<th>MFα1 secretion</th>
<th>TAT trojan</th>
<th>HisTag</th>
</tr>
</thead>
<tbody>
<tr>
<td>K792001</td>
<td>K792002</td>
<td>K792003</td>
<td>K792005</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BBa_J63003</th>
<th>BBa_K416003</th>
<th>Polyarginine</th>
<th>PolyHb</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>K792004</td>
<td>K792007</td>
</tr>
</tbody>
</table>

### Iconic Representation

The image above illustrates various devices and their associated components, categorized under different systems (TRP and HIS). Each component is labeled with its specific identifier and position, emphasizing an iconic representation of the devices and their interactions.
Devices work!
Devices enhance crossfeeding
new technologies
real world problems
Also works in humans!

Thank you!