# A multi-task learning approach to enhance sustainable biomolecule production in engineered microorganisms

ICML Workshop:
Tackling Climate Change with Machine Learning
July 2021

**Erin Wilson**
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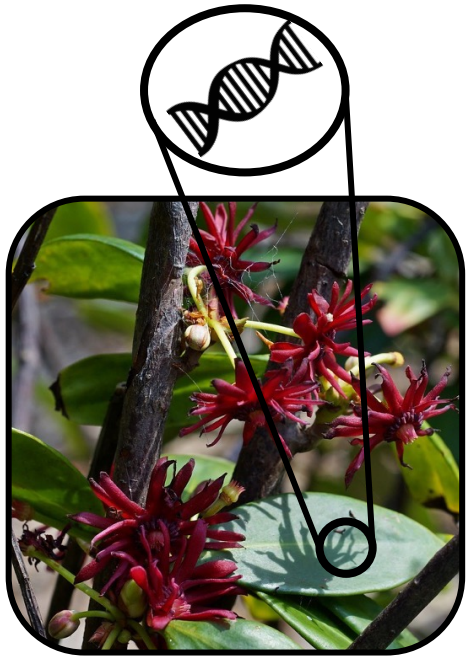
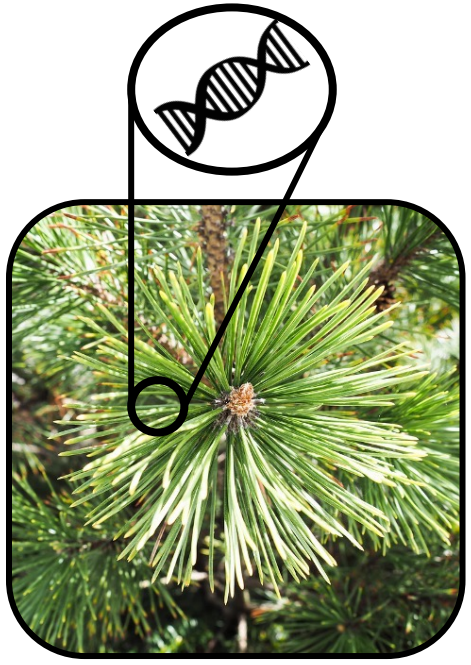
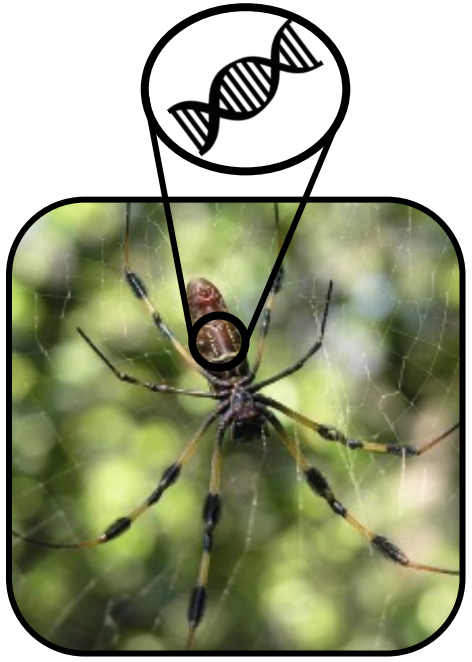
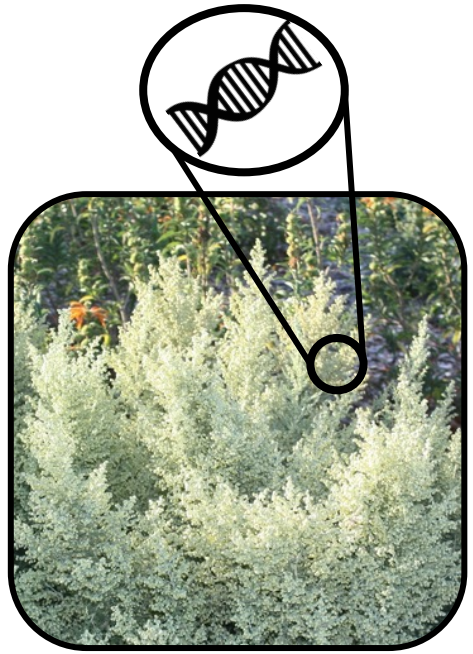

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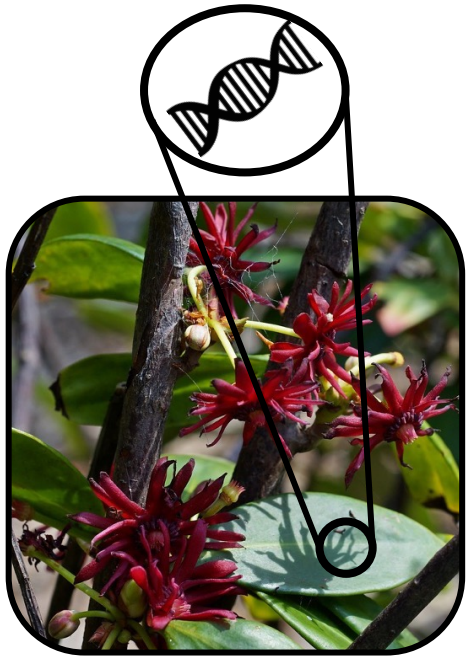
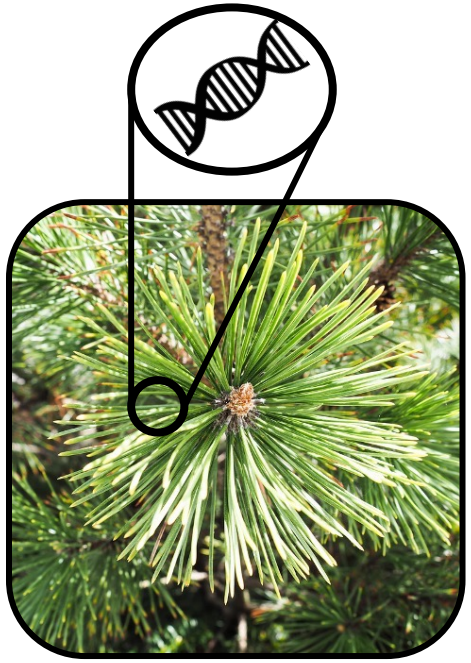
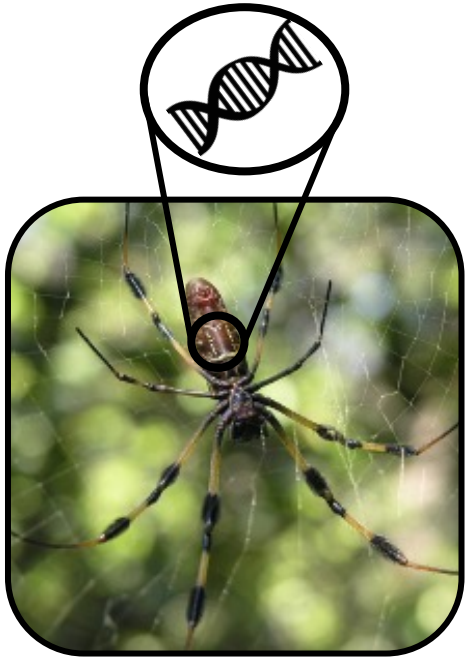
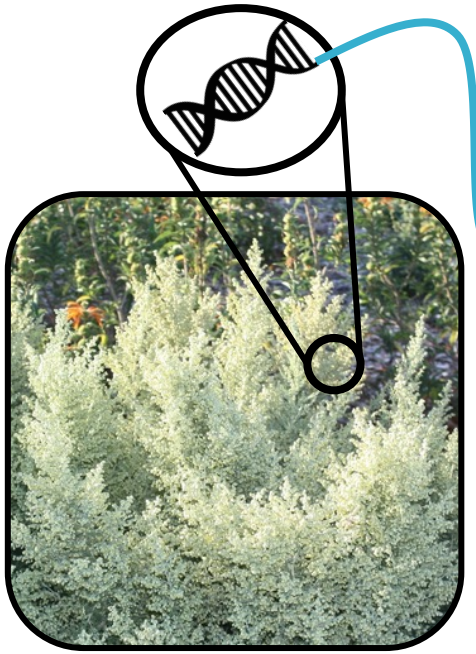
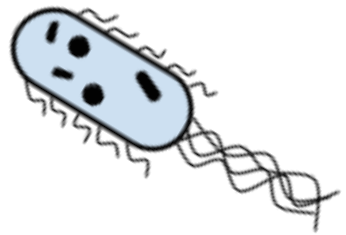





Install DNA instructions in a microbe

Metabolic Engineering



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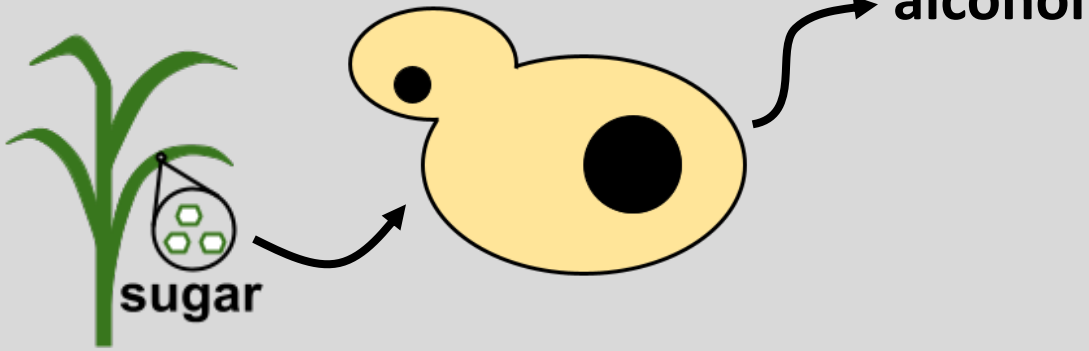
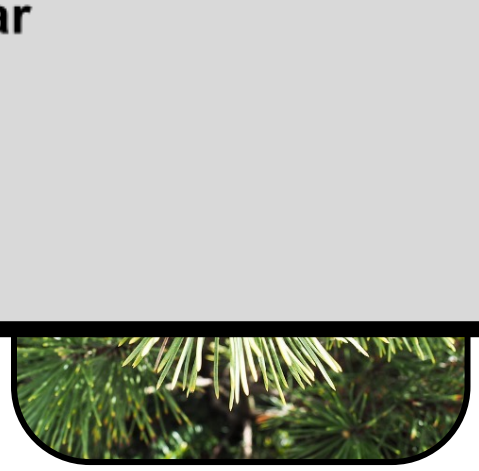
## Baker's Yeast







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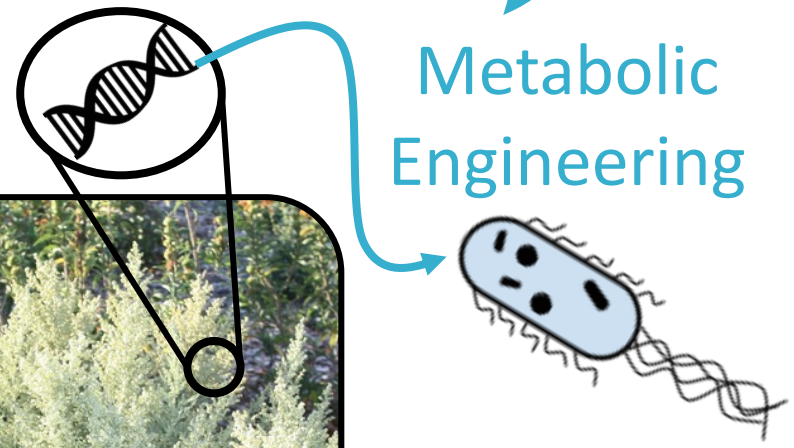

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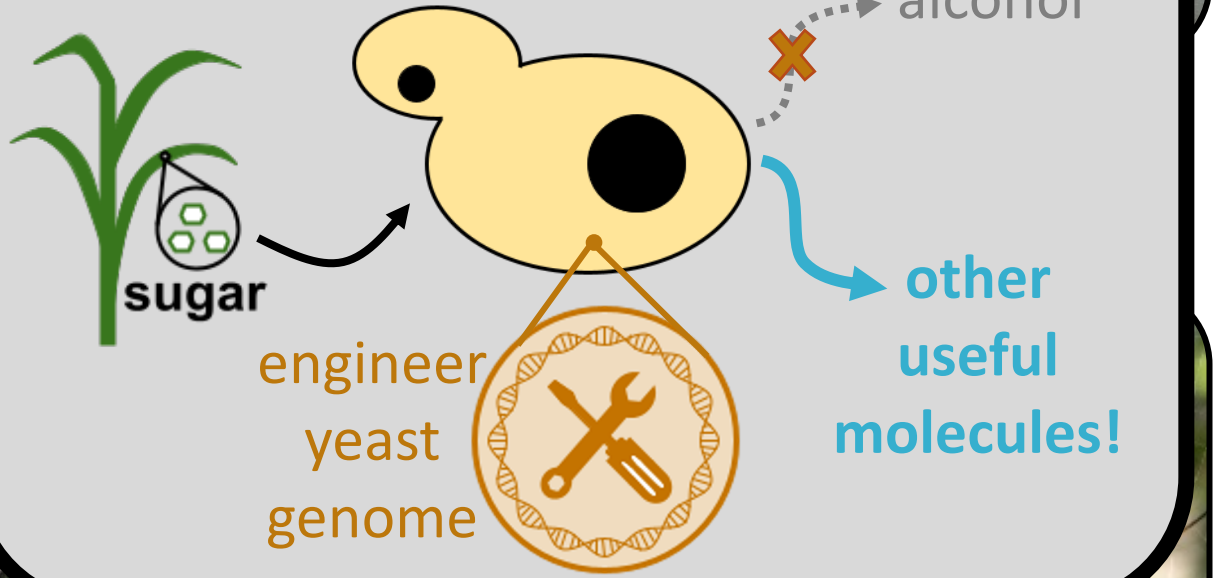



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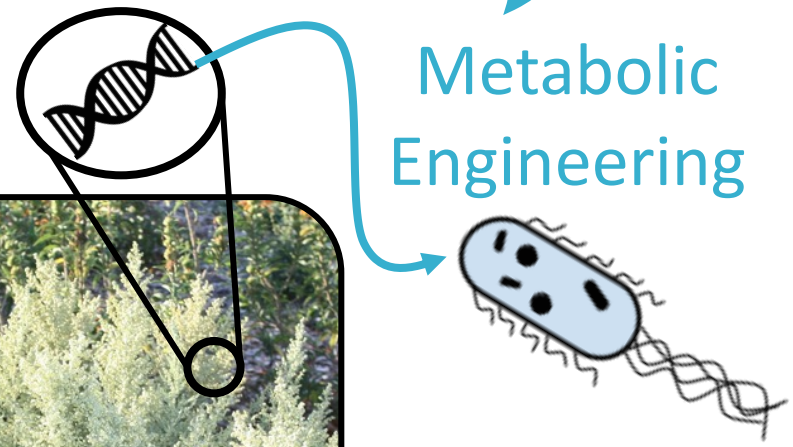
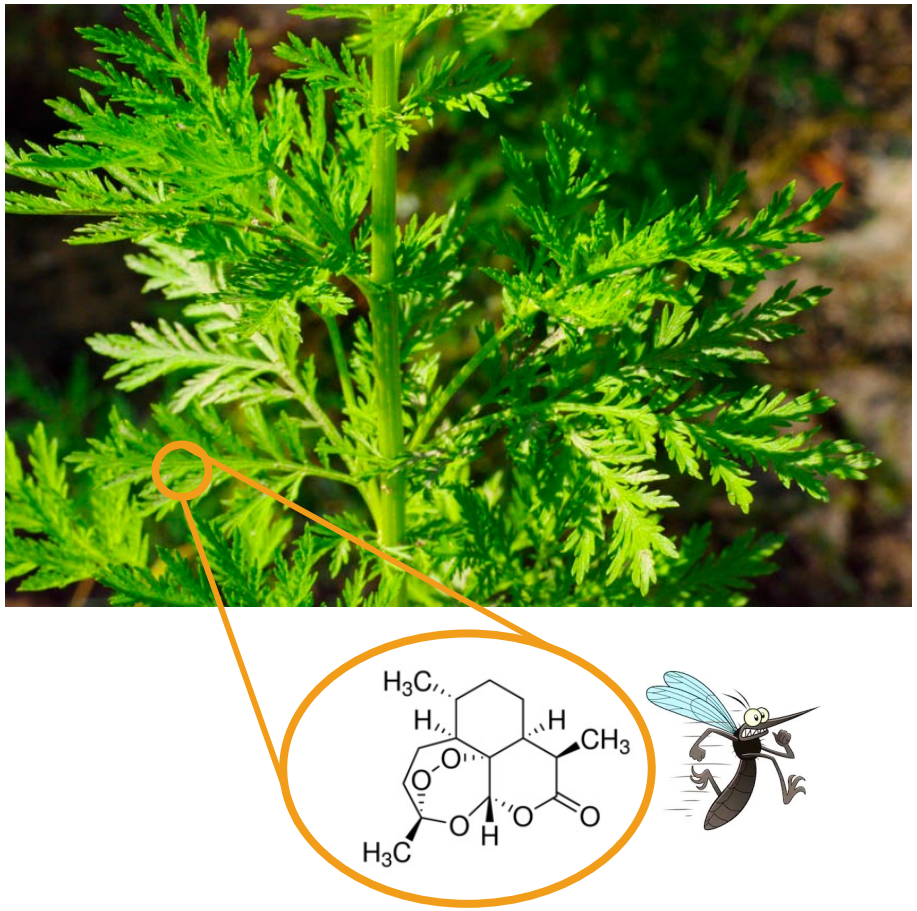


# Artemisinin production: an early success story!

***Artemisia annua***




**Artemisinin:**
**anti-malaria drug**

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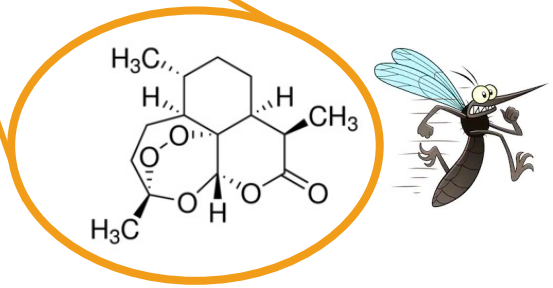
**artemisinin production genes**



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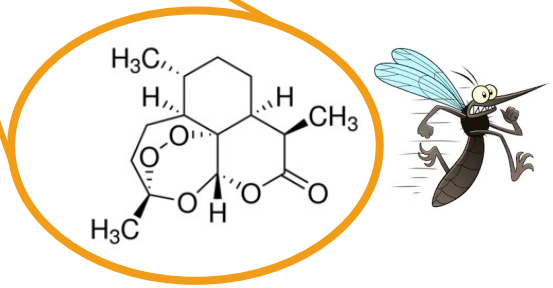


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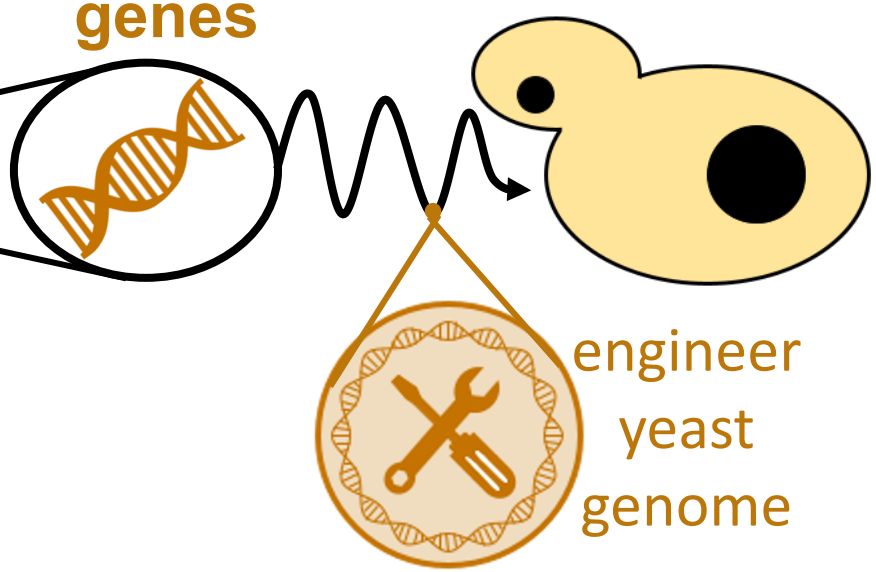

engineer yeast genome

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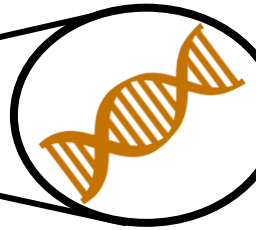

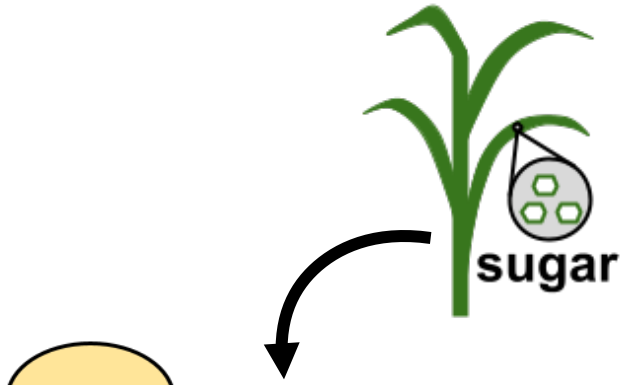


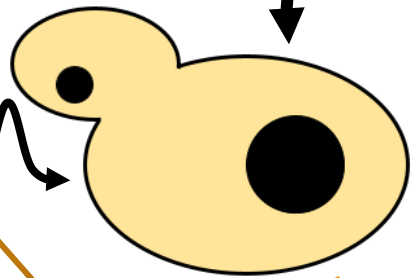

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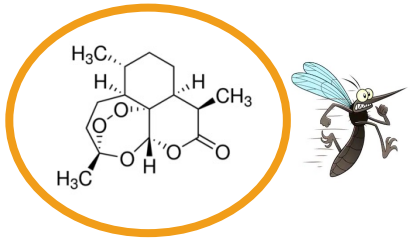

**Artemisinin production in yeast!**

# Metabolic Engineering: The Big Picture

**For any molecule made by any organism in Nature, there exist some DNA instructions for how to make it…**

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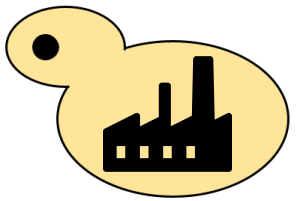
***Hypothetically,* you can try to install those instructions in a microbe and engineer it into a biomolecule factory.**



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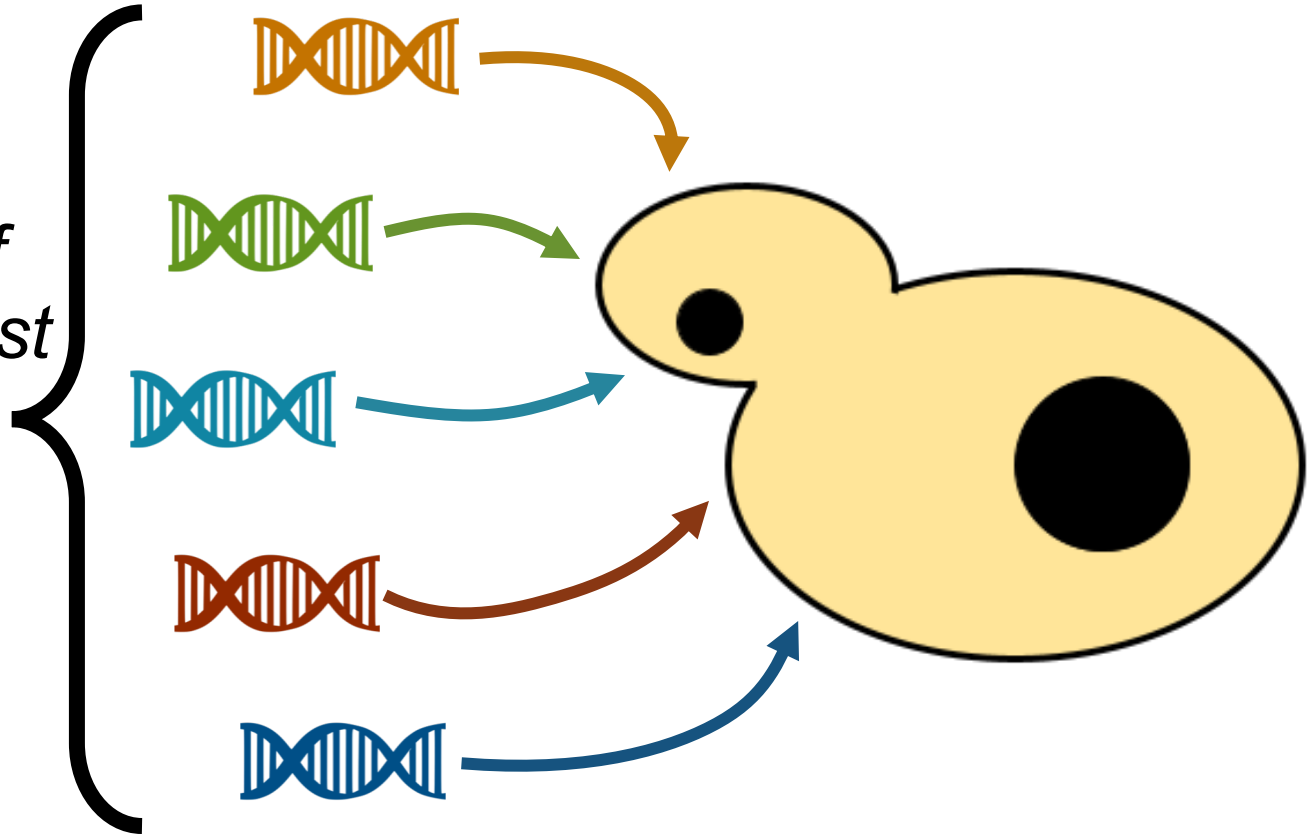
*Expression of new genes must be carefully controlled*



# Engineering microorganisms *efficiently* can be a challenge

**Genetic grammar:**
system of DNA signals to control expression

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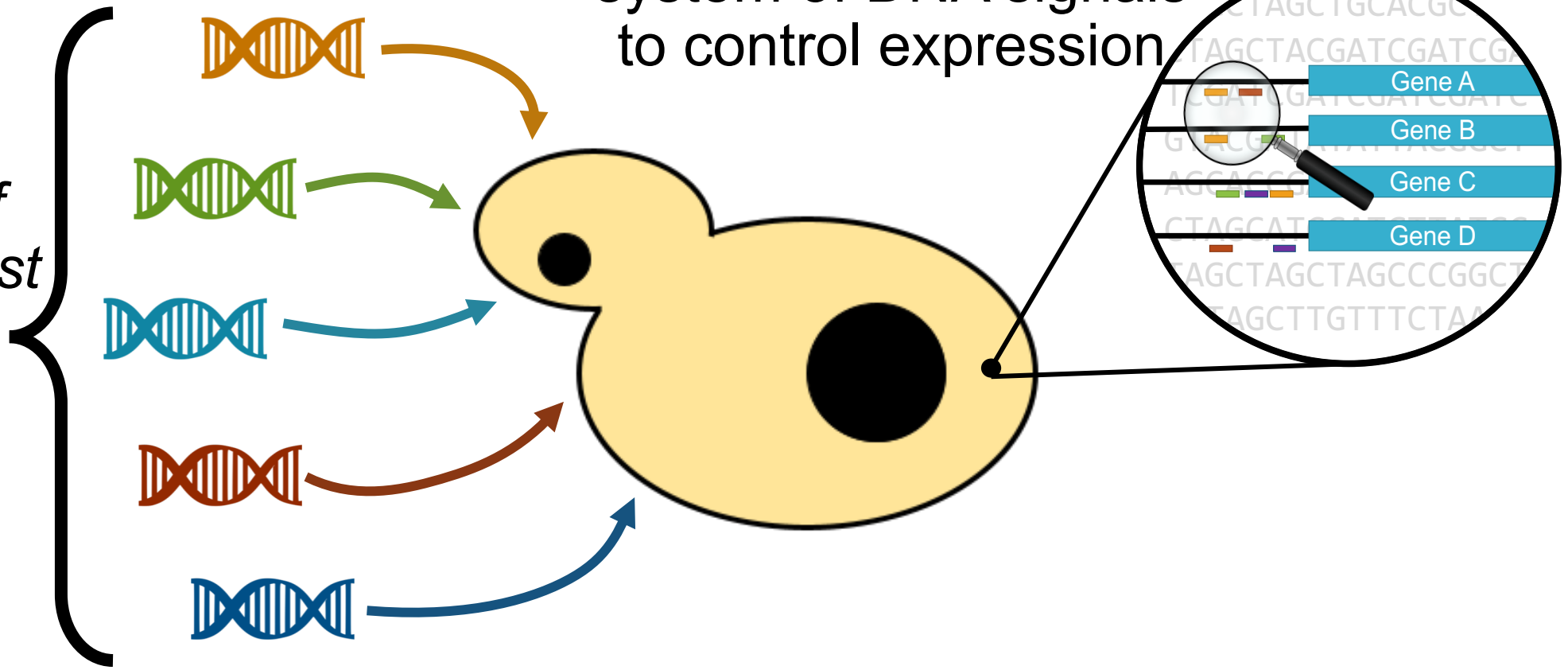
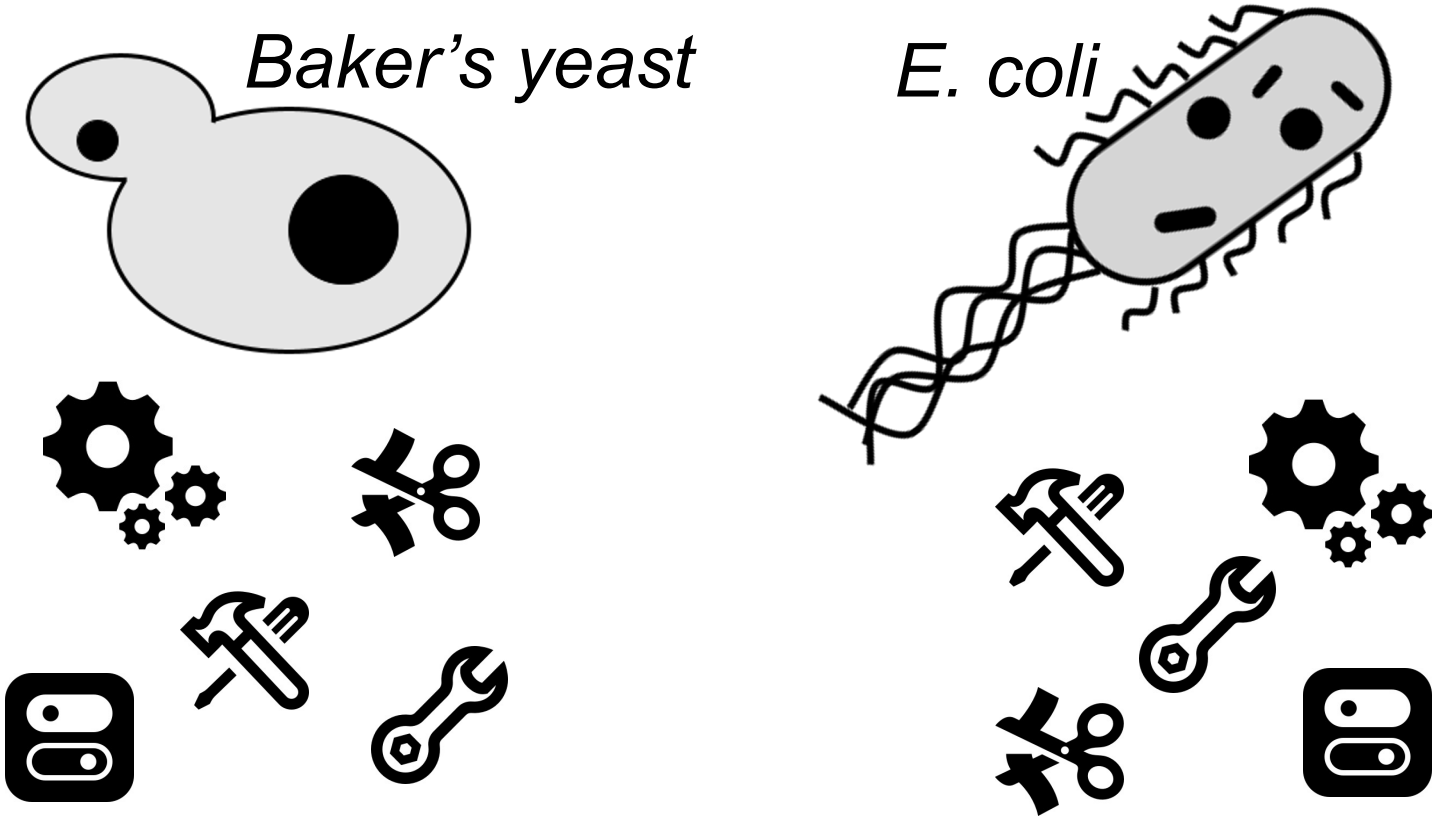


# Popular microorganisms have many genetic tools available



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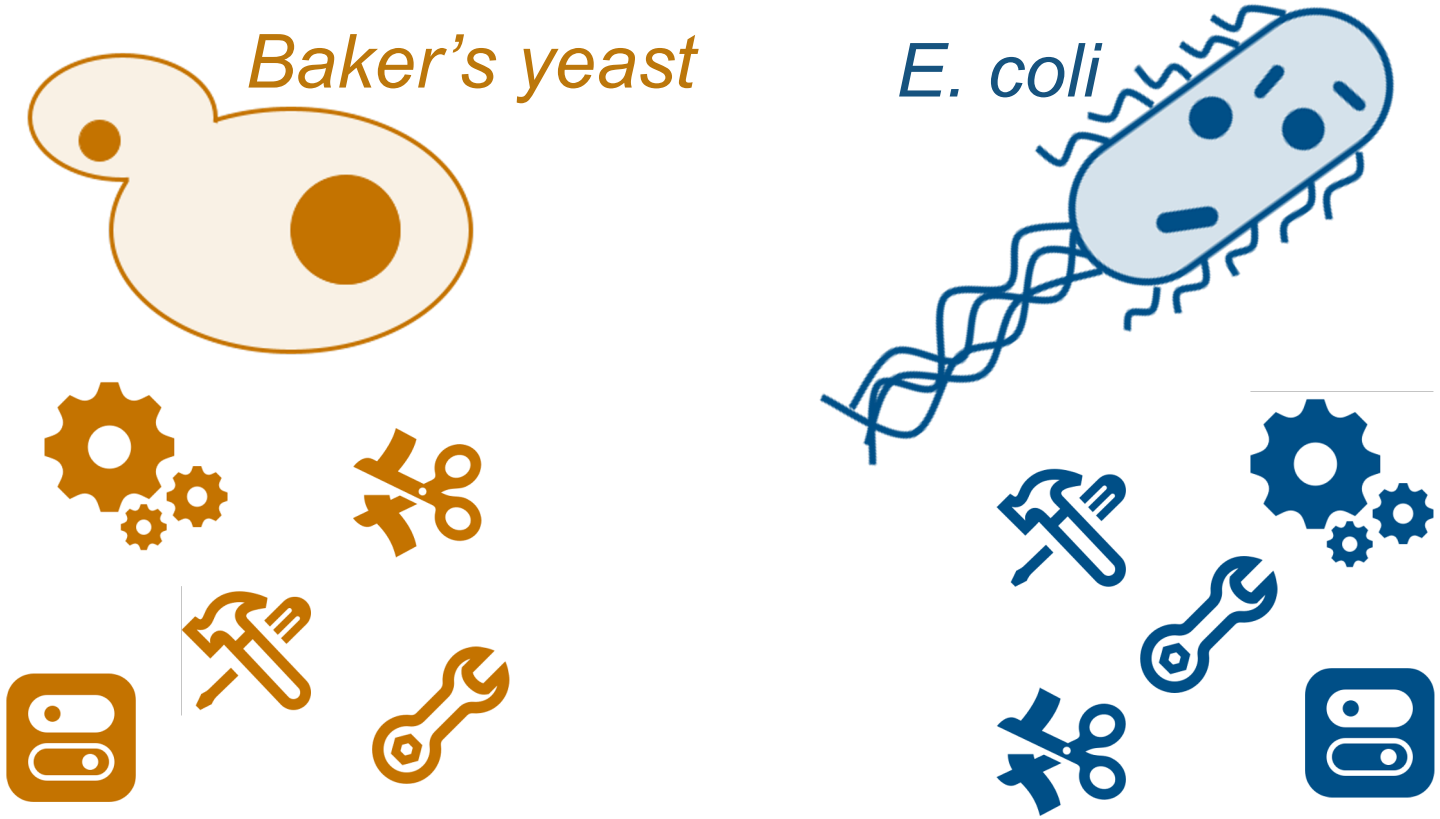

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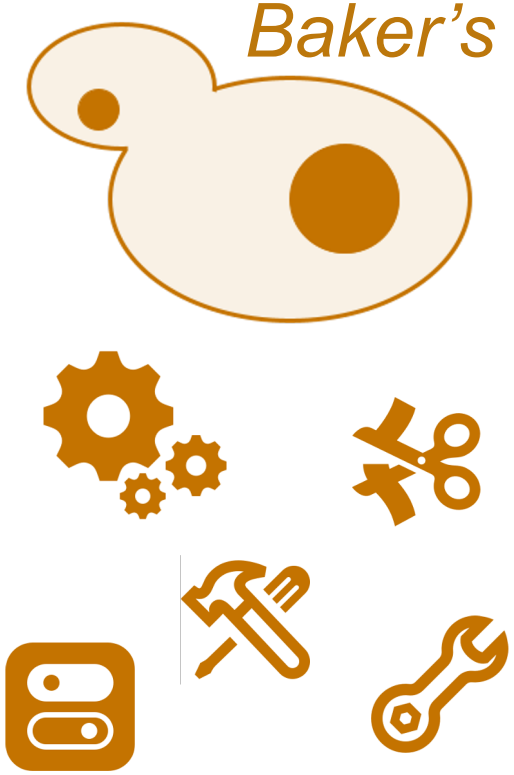
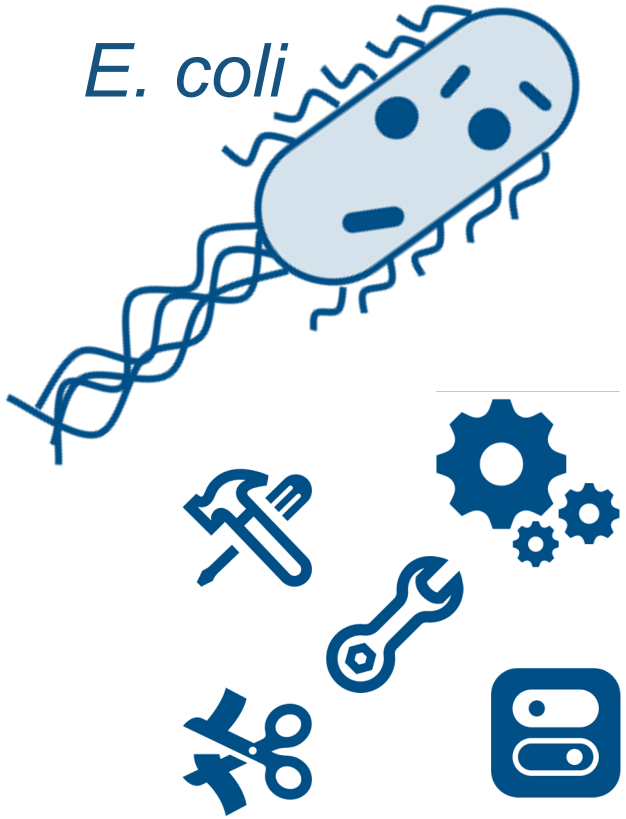
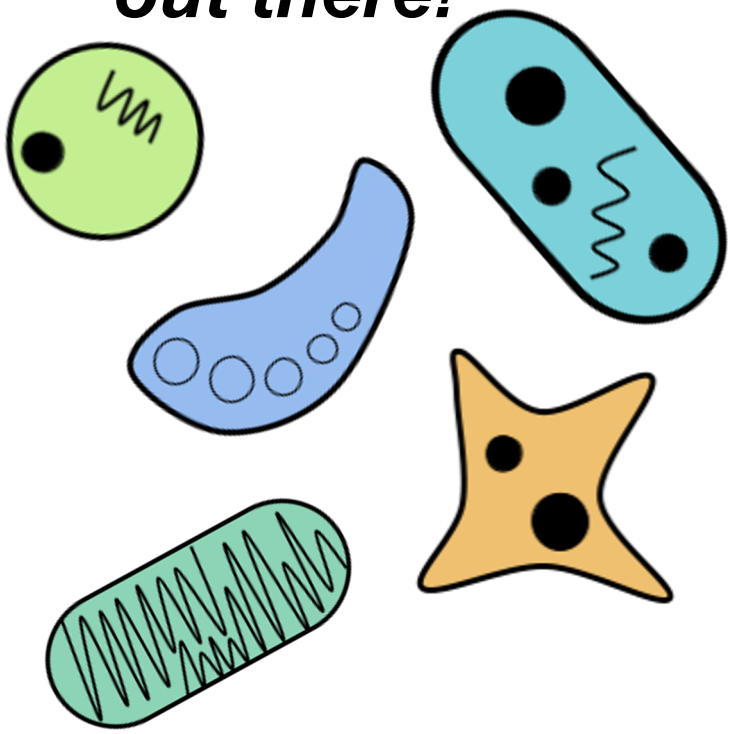
*Baker's yeast*



*E. coli*

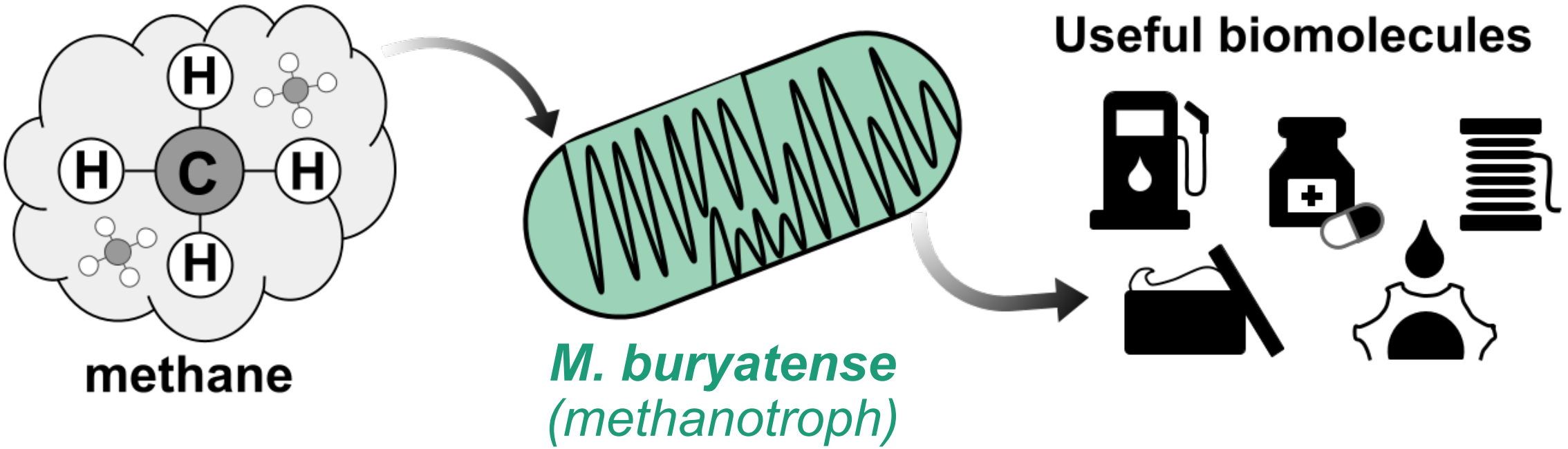


***Many other microbes out there!***

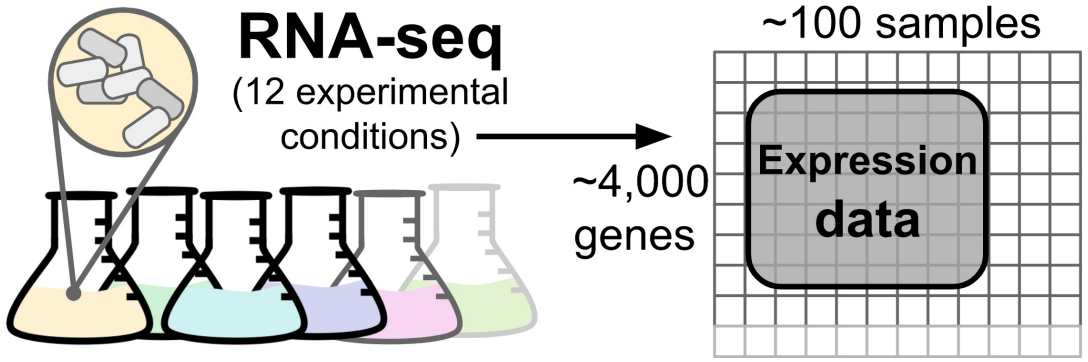


***Methanotroph:*** *bacteria that consume methane*

# Methanotroph metabolic engineering: convert methane into useful biomolecules



# **Project goal:** computationally decode *M. buryatense* genetic grammar



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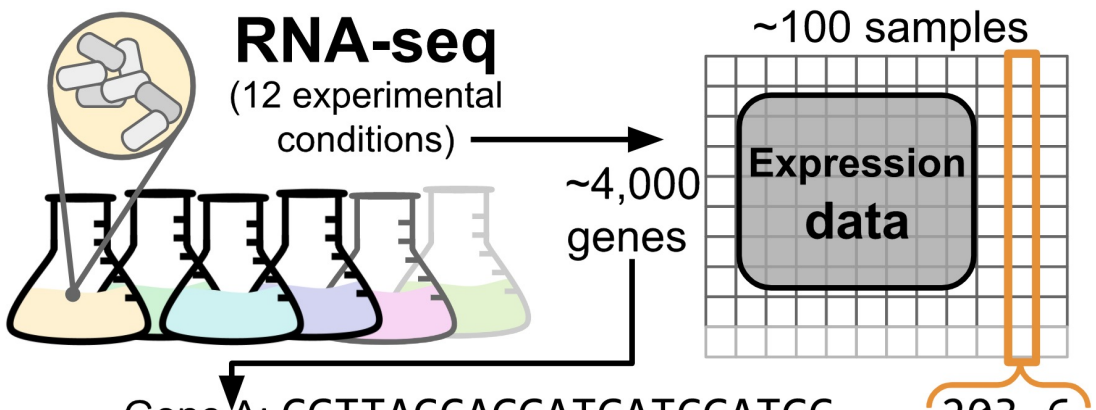


Nearby DNA sequence signal regions

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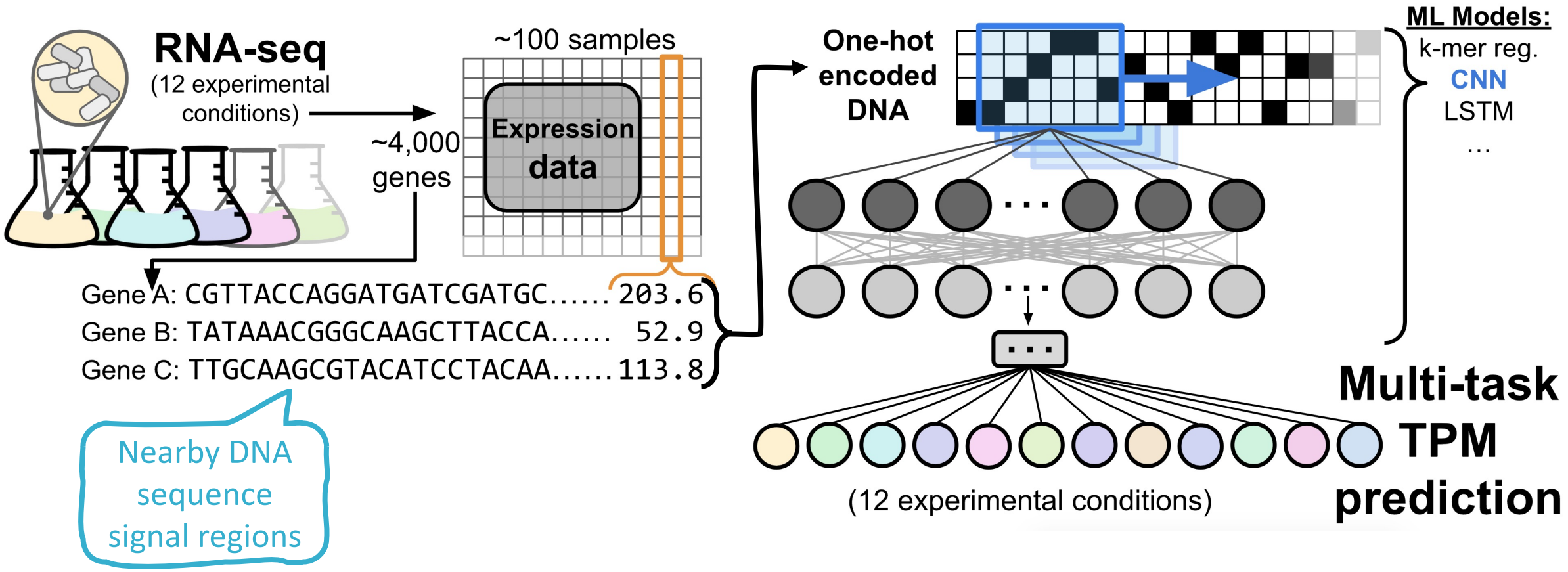

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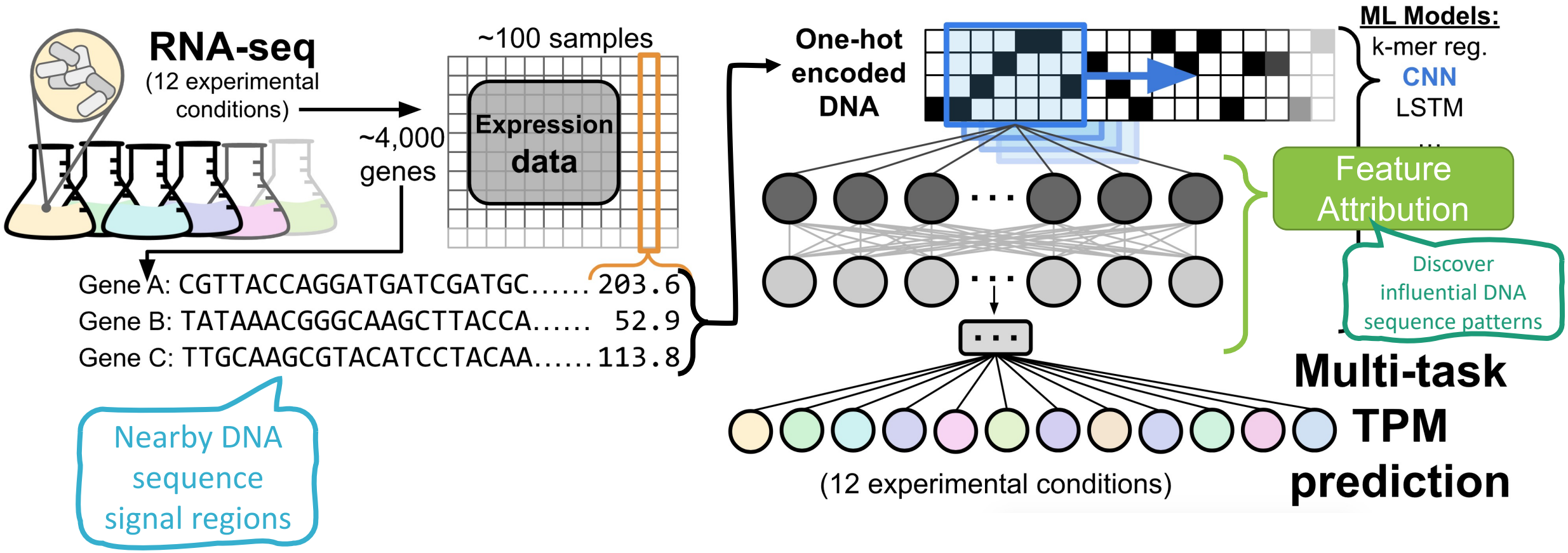

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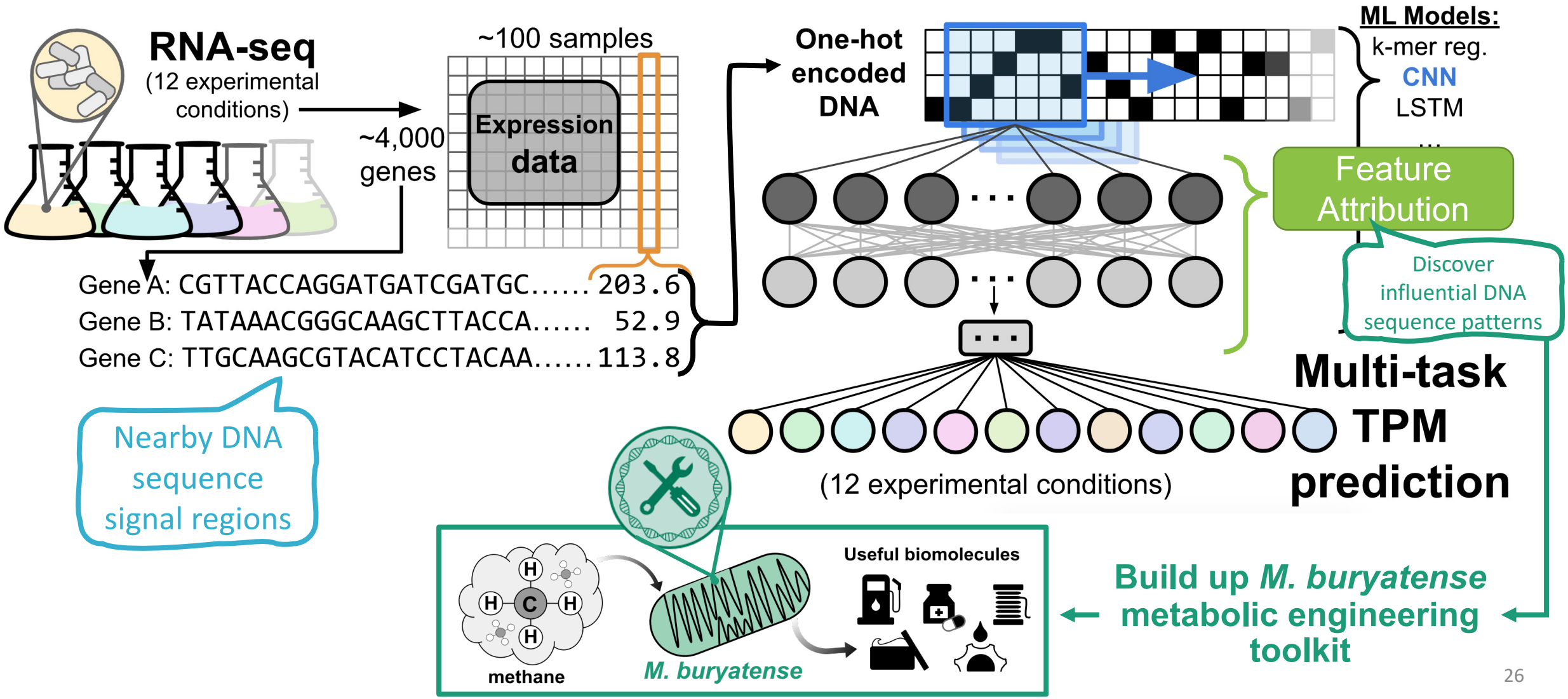

# Thank you!

## Acknowledgements


### My Advisors

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Microbiology

**David Beck**
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### The Lidstrom Lab

### CCAI Mentor

**Nathan Hodas**
PNNL

NSF GRFP


## Questions?


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