

BioBricks

***CHEM-E8125 –  
Synthetic Biology***

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# Gastric cancer inhibitor

## Situation:

- 5th most common cancer and 3rd most common cause of cancer death globally

## Problem:

- Chronic alcohol consumption increases the risk of gastric cancer

## What:

- Acetaldehyde classified as group 1 carcinogen to humans

## How:

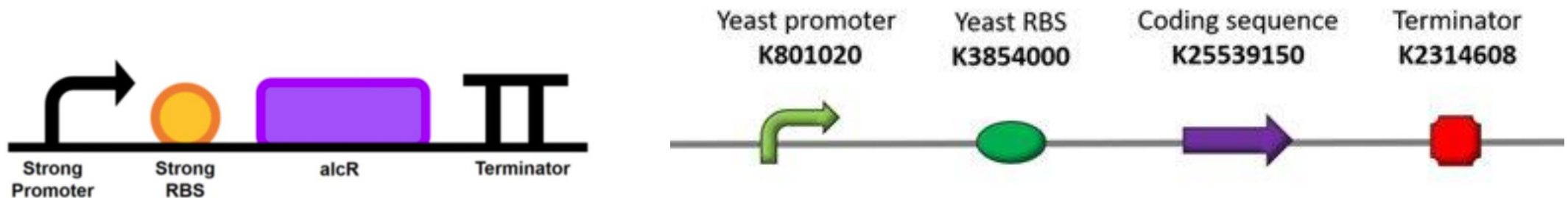
- Alcohol stimulates the uptake of carcinogens and enhances the aldehyde level

## Solution:

# Parts and how they work

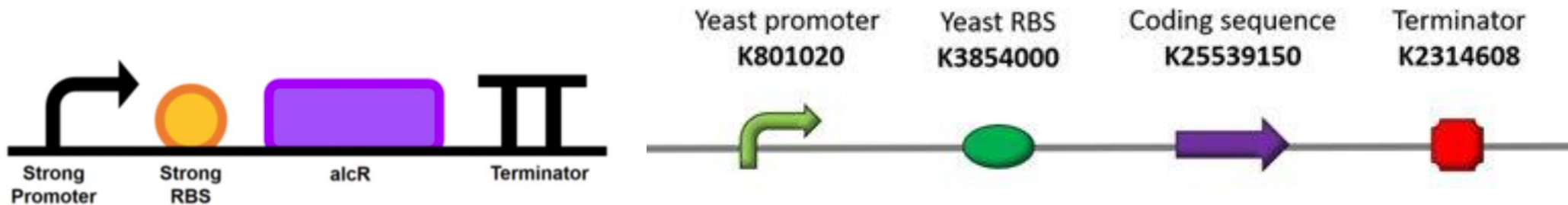
A NOT gate is a type of logic gate that produces an output that is the opposite of its input. In synthetic biology, this can be achieved using a regulatory protein that blocks the expression of a gene of interest in the absence of a specific input signal. Here's how to assemble a NOT gate with *S. cerevisiae* as the host organism:

- Clone the regulatory protein coding sequence (BBa\_K2539150) downstream of the promoter (BBa\_K801020) using standard molecular cloning techniques. This will create a transcriptional unit that is controlled by the promoter.
- Clone the gene of interest (BBa\_K2539150) downstream of a second promoter (alcA) regulated by the regulatory protein (AlcR). This will create a second transcriptional unit that expresses the acetaldehyde dehydrogenase.
- Clone the terminator (BBa\_K3854000) downstream of both transcriptional units to ensure that transcription stops at the end of the gene.
- Transform the resulting plasmid into yeast cells using standard transformation techniques.

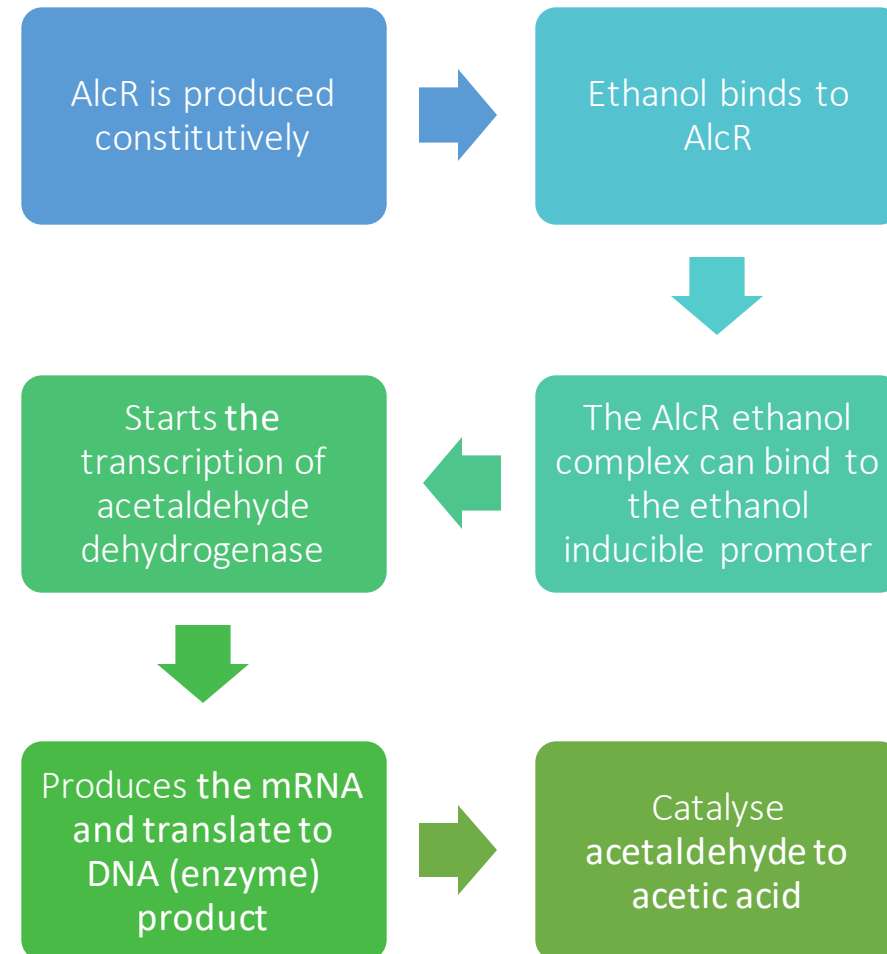


# How does the construct work

- When ethanol is absent, the regulatory protein, which is constitutively expressed does not bind to the inducible promoter's operator, thus no transcription of the acetaldehyde dehydrogenase.
- When ethanol is present, it will bind to the activator protein and enable its binding to the promoter, allowing transcription of the acetaldehyde dehydrogenase.

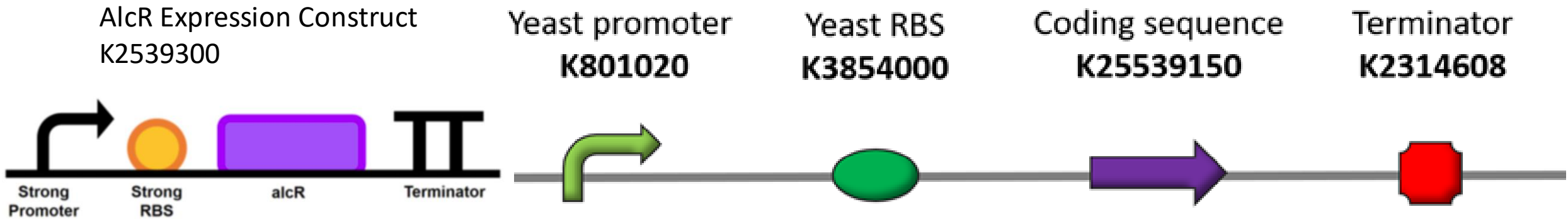


# How the system works



If no ethanol is present --> no production of acetaldehyde dehydrogenase

# Design



AlcR = regulatory protein, which senses ethanol and binds to the yeast ethanol inducible promoter

The promoter is constitutive promoter.

Ethanol inducible

(CCACC) Kozak sequence

The ribosome binds here and starts transcription --> translation.

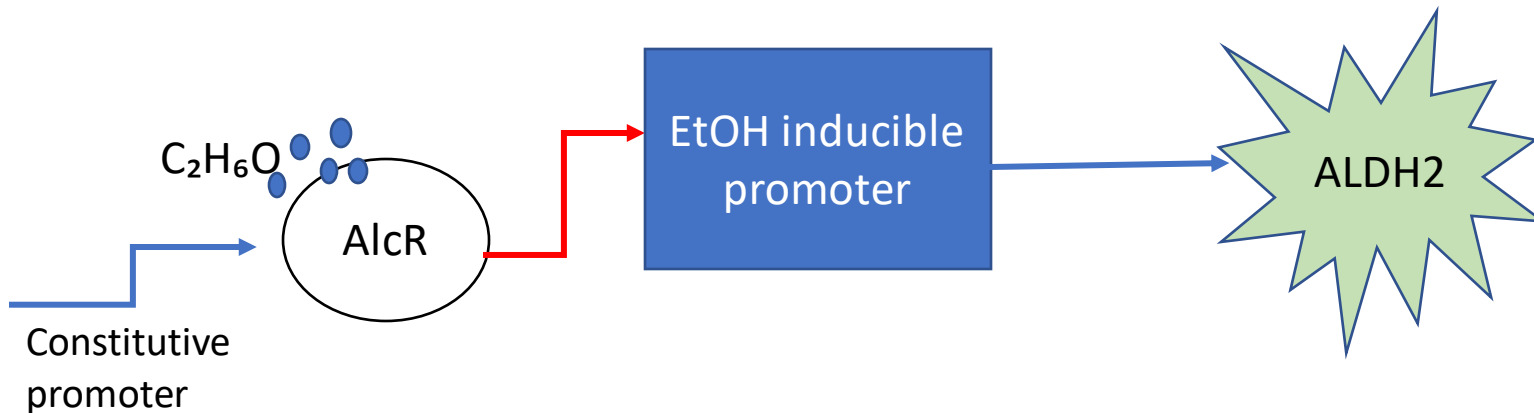
Acetaldehyde Dehydrogenase

Terminator Tmini

# Truth table

- AND-gate truth table

Input (AlcR)	Input (EtOH)	Output (ALDH)
1	0	0
1	1	1
0	1	0
0	0	0



# References

- <https://pubmed.ncbi.nlm.nih.gov/28538665/>
- <https://pubmed.ncbi.nlm.nih.gov/32861308/>