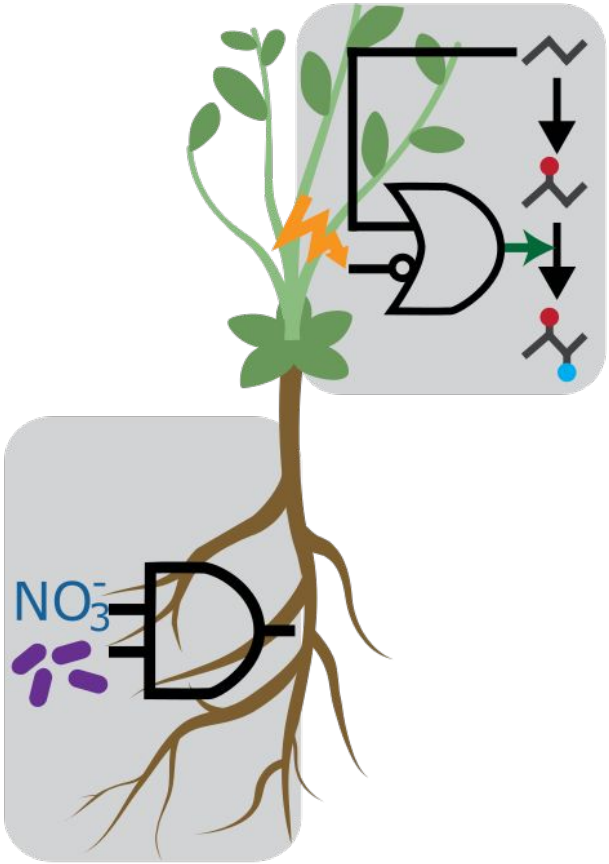
Synthetic Circuit Designs

Sarah Guiziou
Earlham Institute, Norwich.



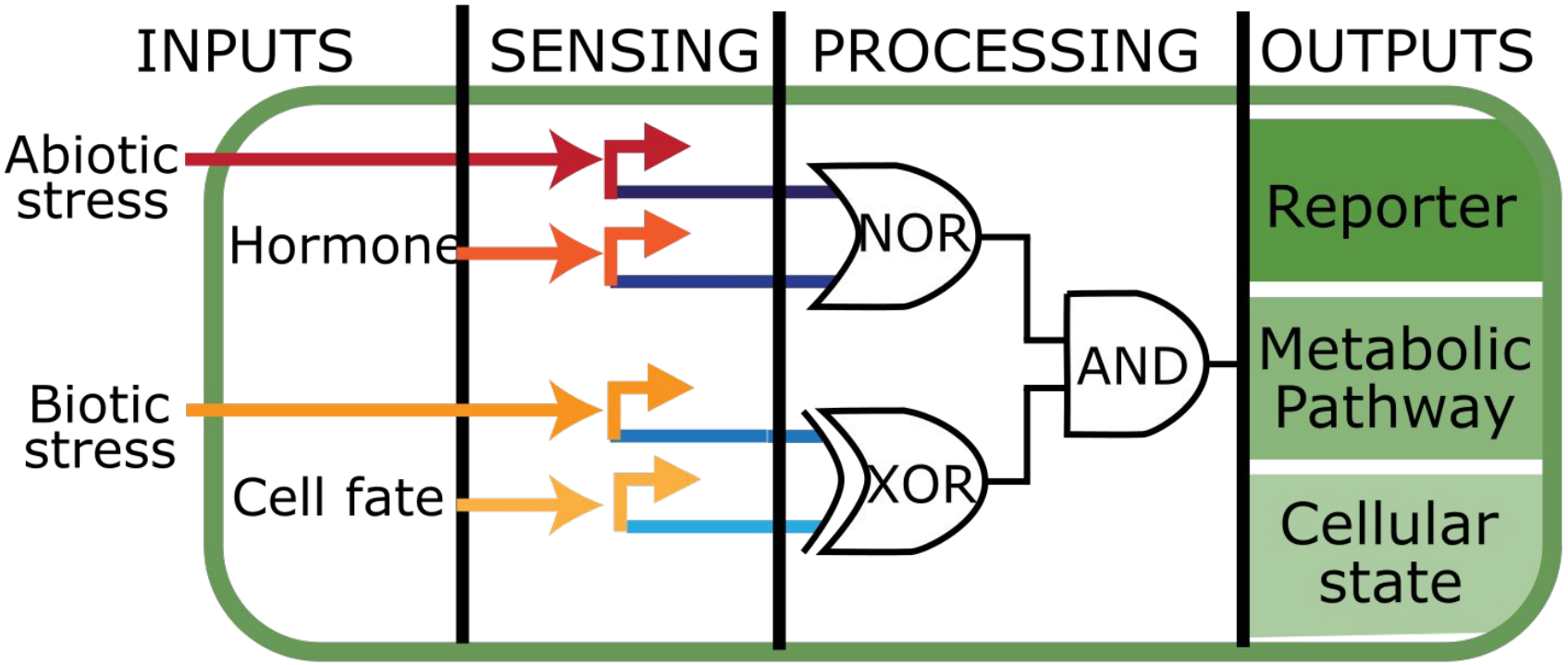
Earlham Institute
Decoding Living Systems

Learning Goals

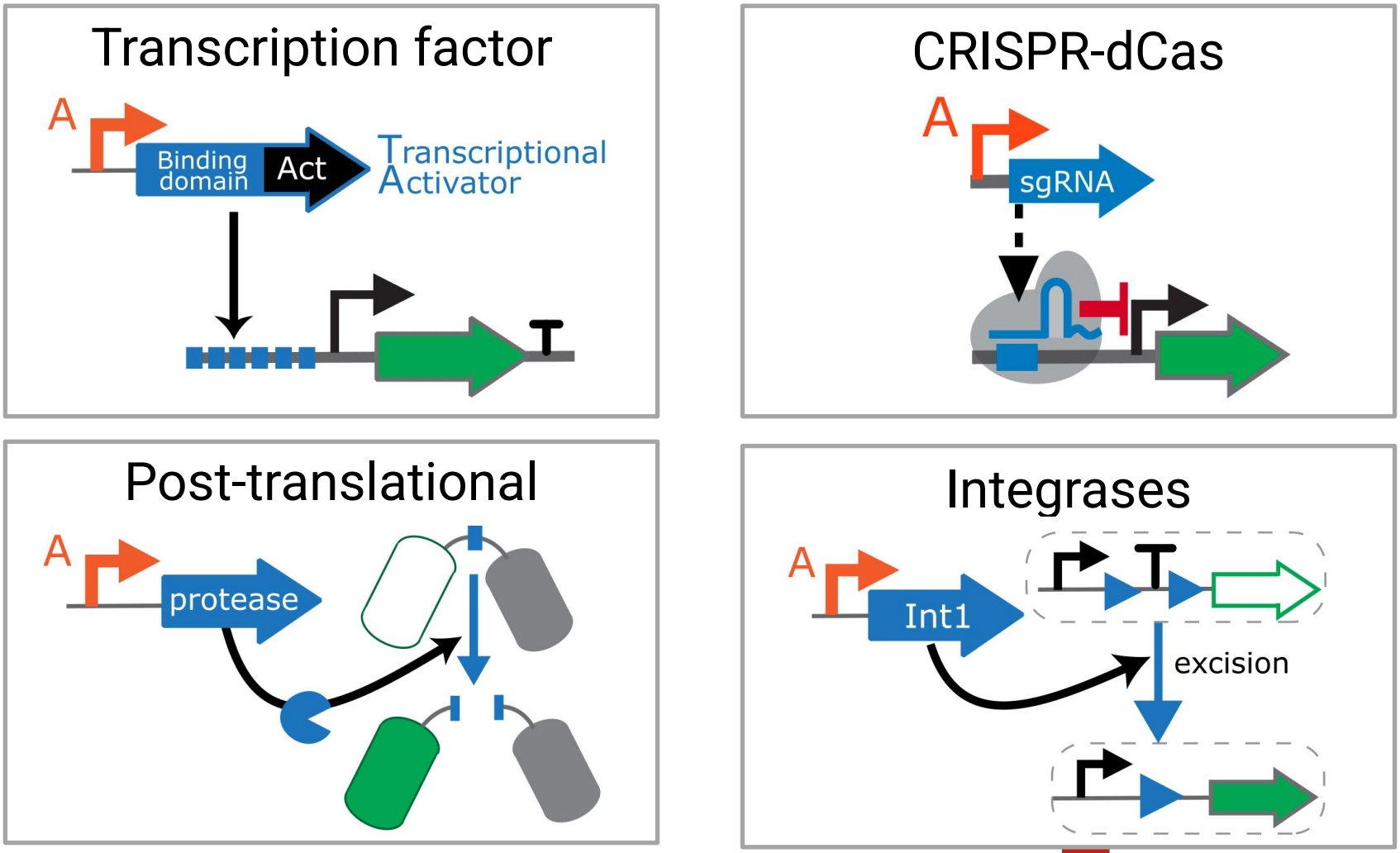
To understand:

- Structure of complex circuits: input, sensing, signal processing, output.
- The different tools to implement logic circuits:
  - TF-based circuits
  - CRISPR-Cas based circuits
  - Post-translational regulation circuits
  - Integrases
- Different circuit designs for Design, build, test, learn cycle

Synthetic signaling circuits.

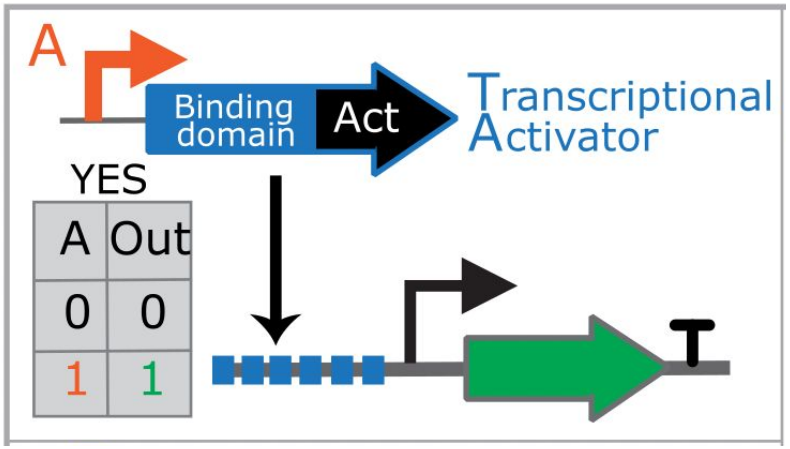


Different tools for signal processing.

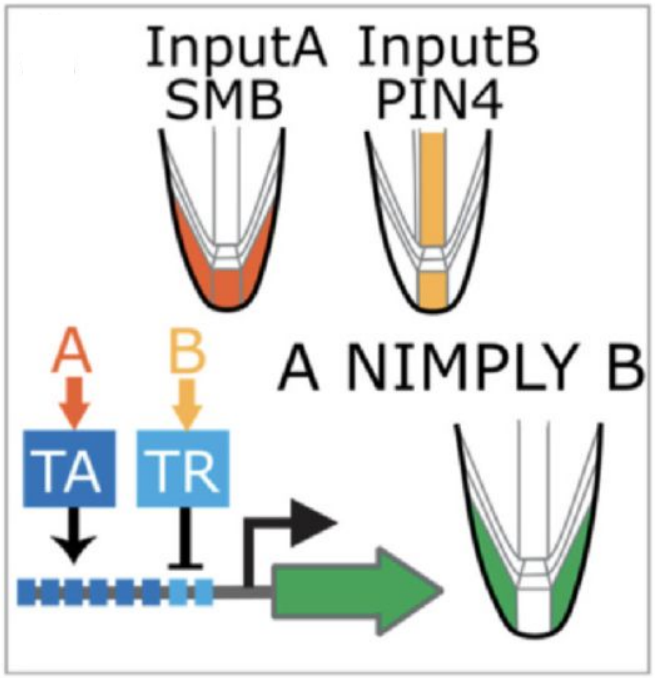


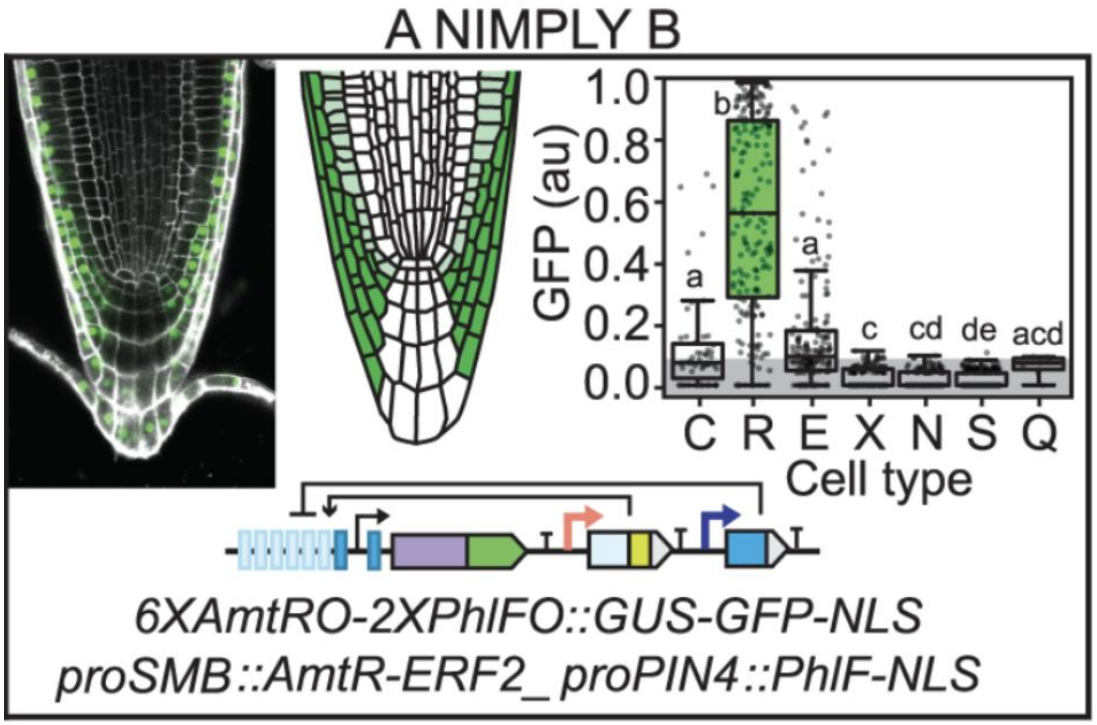
Guiziou, Current Opinion in Biotech. 2024

Transcription factor as a tool to implement logic circuits.



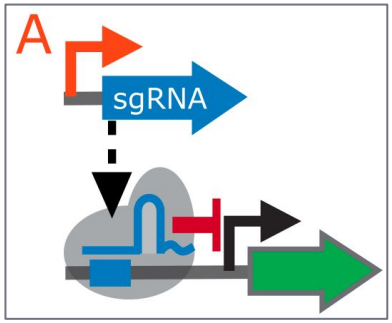
Example of A NIMPLY B in *A. thaliana*

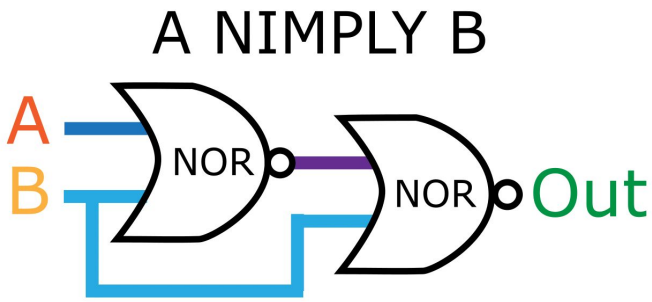


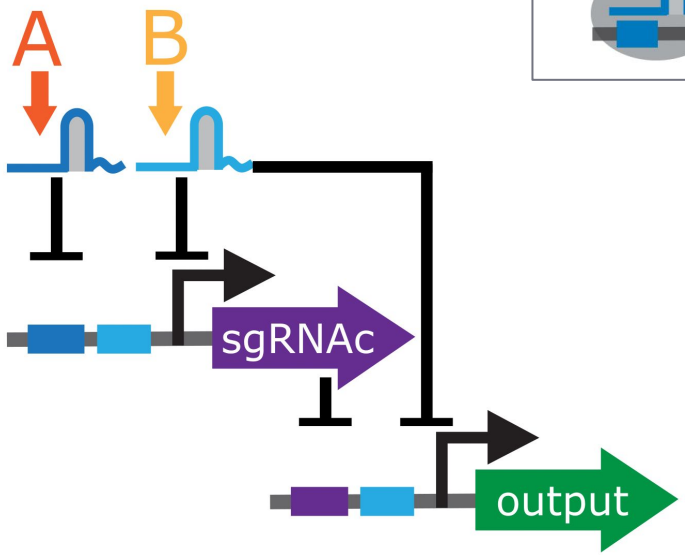


Brophy, Science 2022

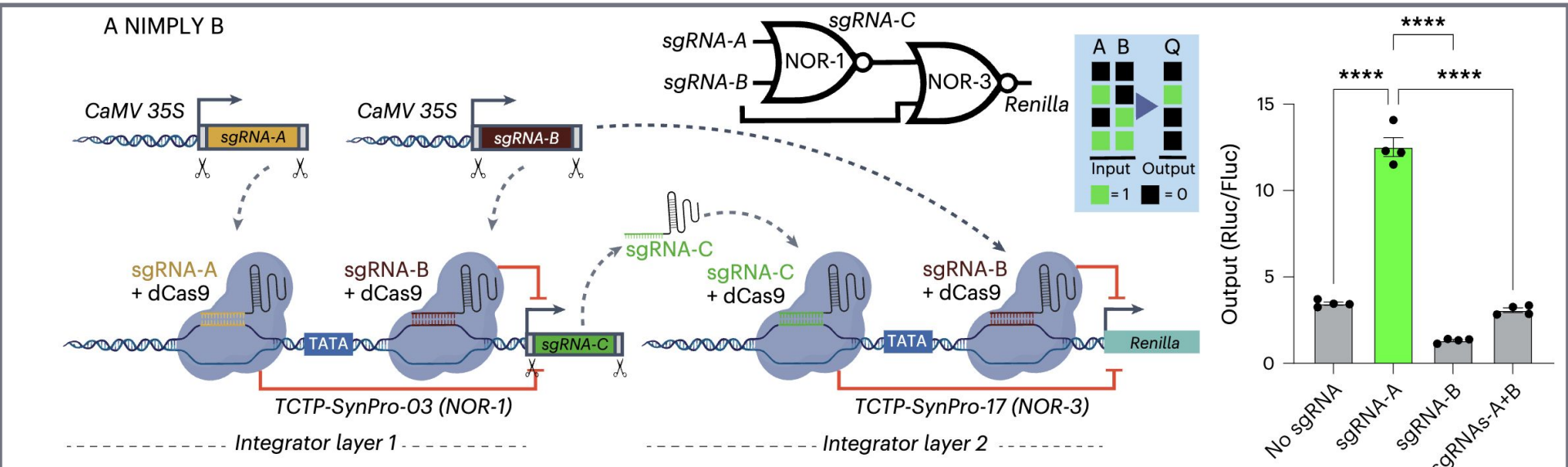
CRISPR interference to implement logic circuits.





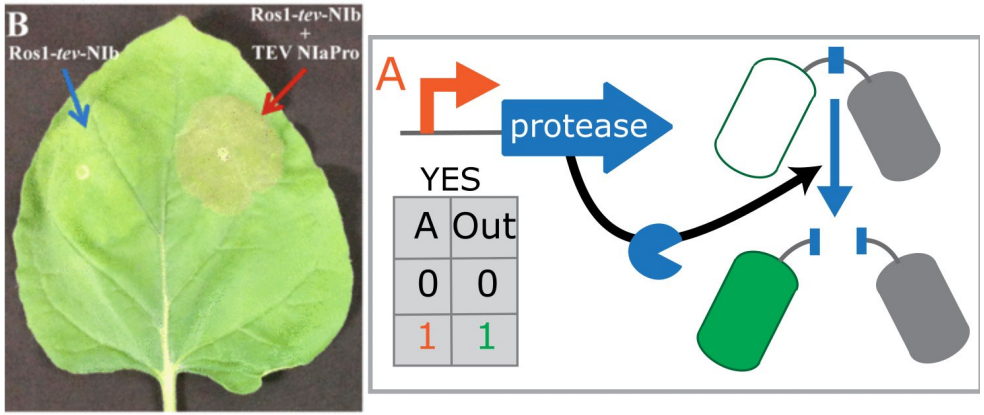


Khan, Nature biotech. 2024



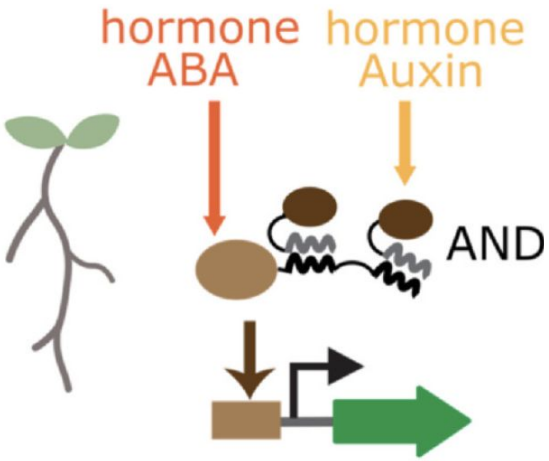
Post-translational regulation.

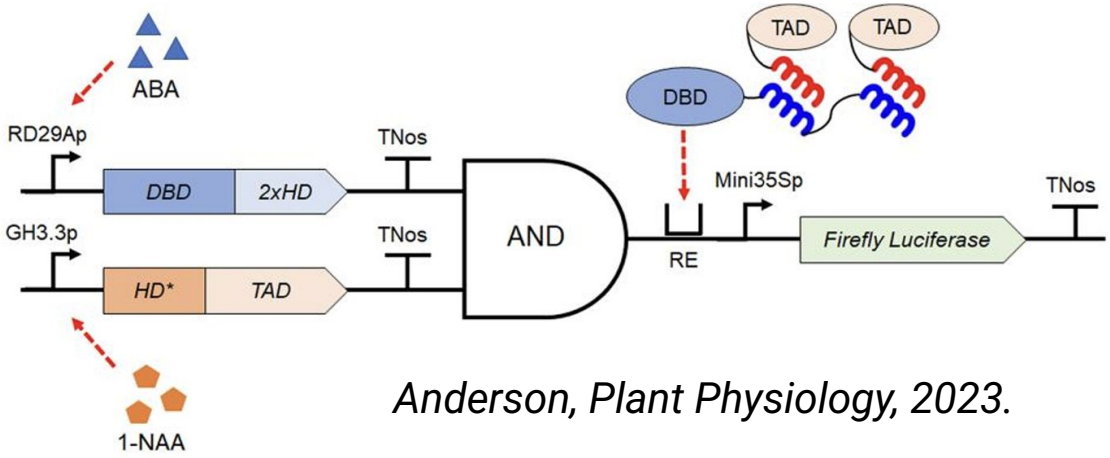
Using proteases



Cordero, ACS SynBio, 2018.

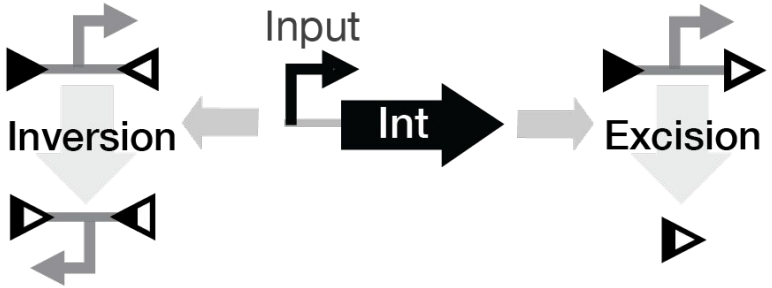
Using split proteins with interacting domains



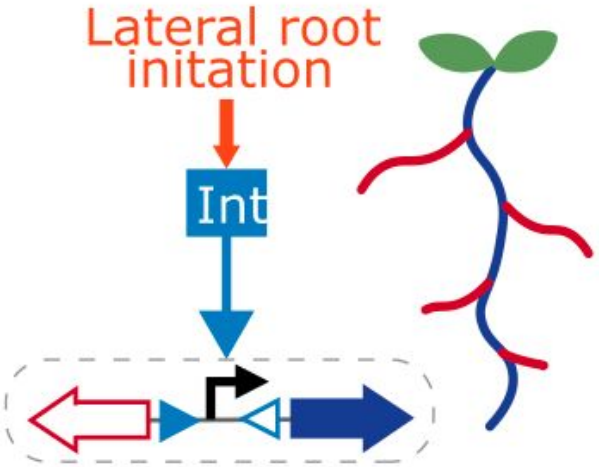


Anderson, Plant Physiology, 2023.

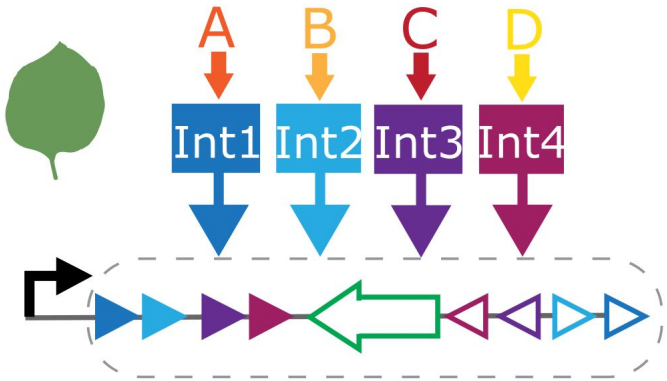
Integrase mediates irreversible DNA switch:

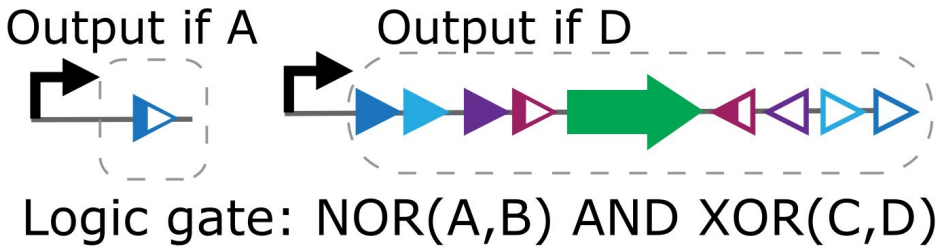


Allowing cell-lineage tracing



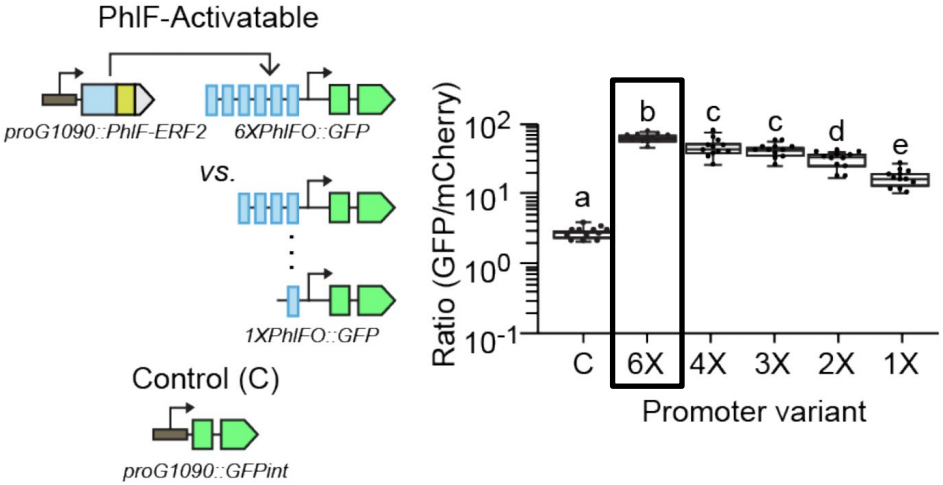
Allowing tracking of the occurrence of multiple signals

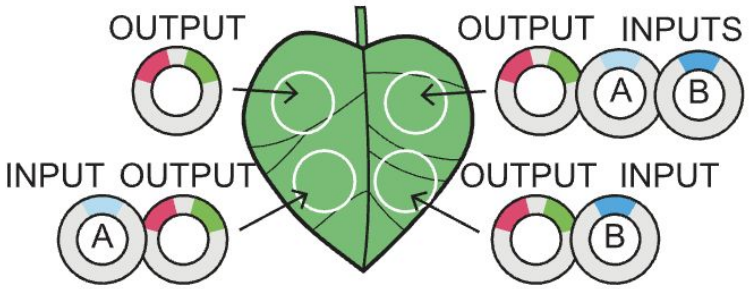




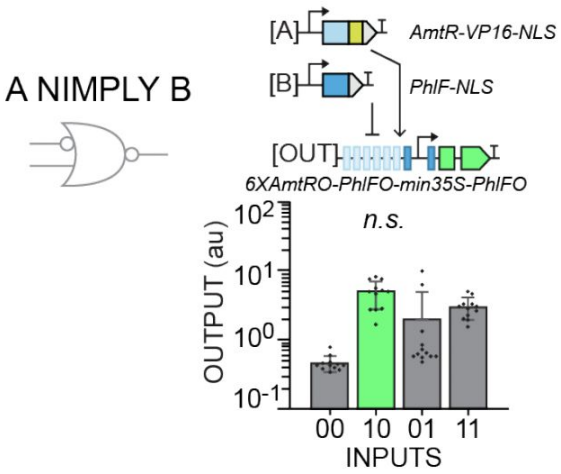
How to optimise circuit design?

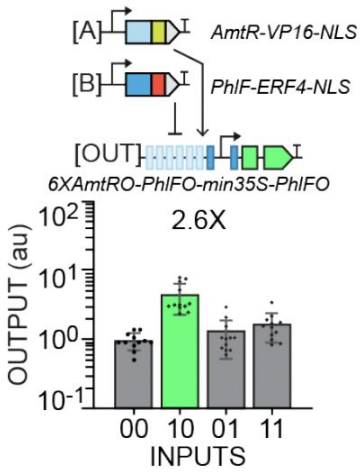
Brophy, Science 2022

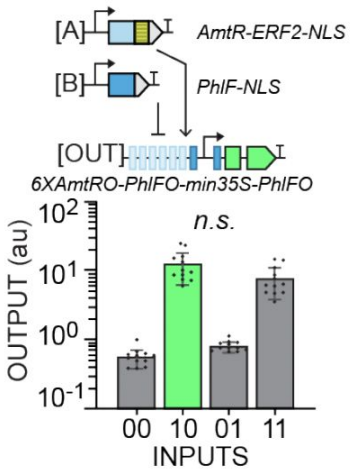


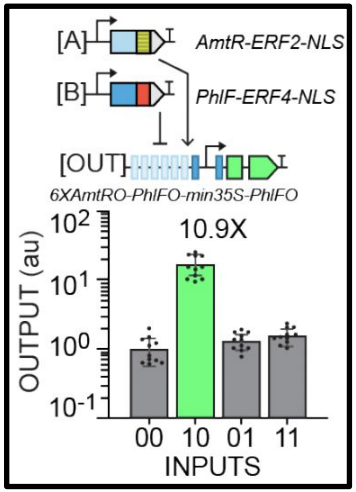


A NIMPLY B



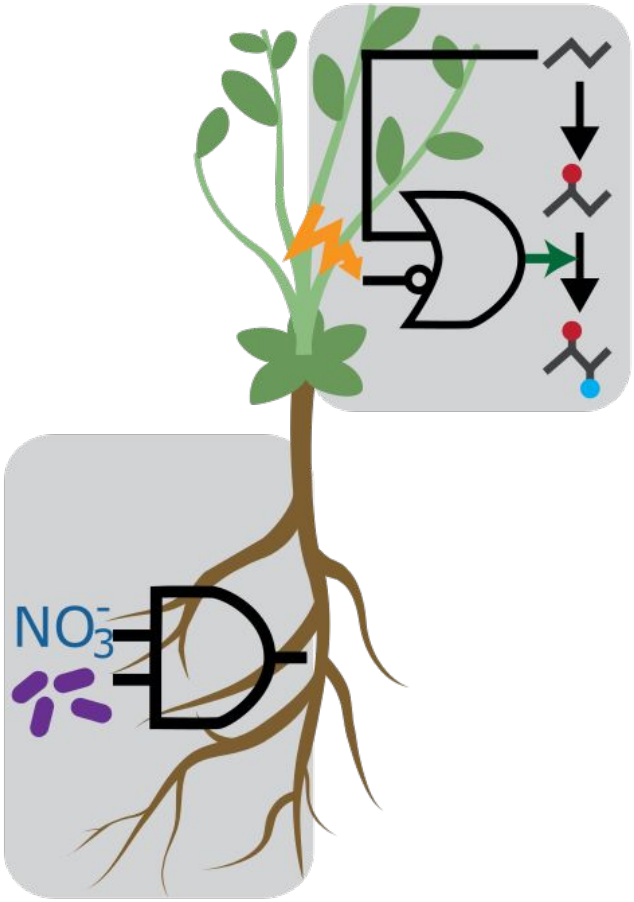


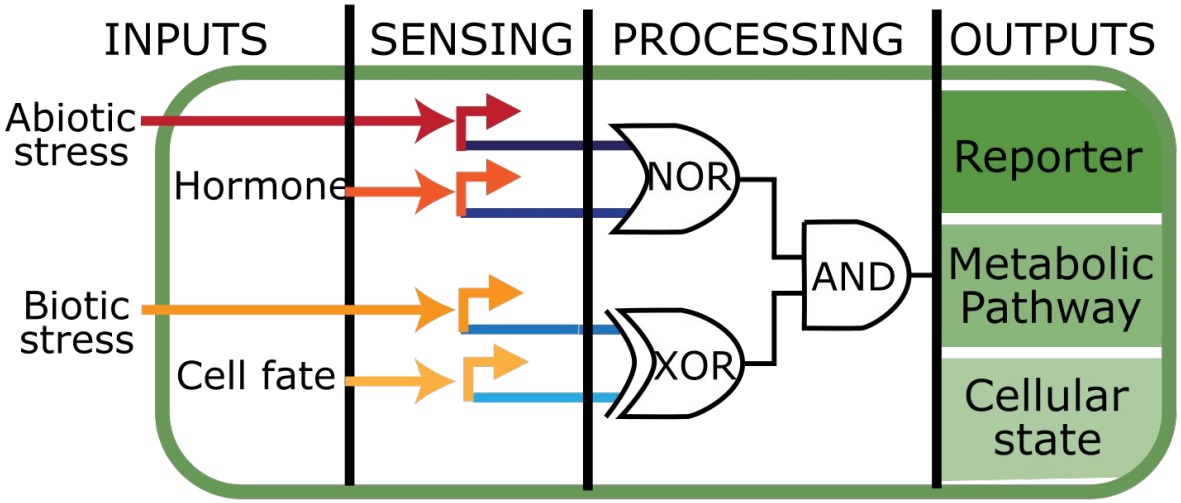




Earlham Institute

Synthetic Circuit Designs





Earlham Institute