- Transitioning to LED-lights has made lighting more sustainable
- Most lights need proper conditions and electricity to work
- They generate emissions and could be replaced by alternatives

Bioengineered Lighting

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Benefits

- Eukaryotic or prokaryotic bioluminescence
- Produces fluorescence only in the dark
- Plants are excellent, since they're carbon-negative = better than LEDs
- Can't replace high-intensity lights
- Viable alternative for underwater applications (algae, seaweed)
- Night lights, ambient lighting, garden lighting and decorative lighting

Bricks & Circuits

Bricks (IGEM)

Promoters:

- Constitutive promoter: **BBa_J23119**
- Light induced promoter: **BBa_K2332002 (pBlind)**
- 3rd promoter: **PsrpR**

Others:

- Light-activated gene: **El222**
- Fluorescent protein: **GFP**
- Degradation tag: **BBa_M0052**
- Repressor: **srpR**

Circuitry

- A circuit that initiates **GFP** expression in the dark

    -Under the influence of the light induced promoter **pBlind**

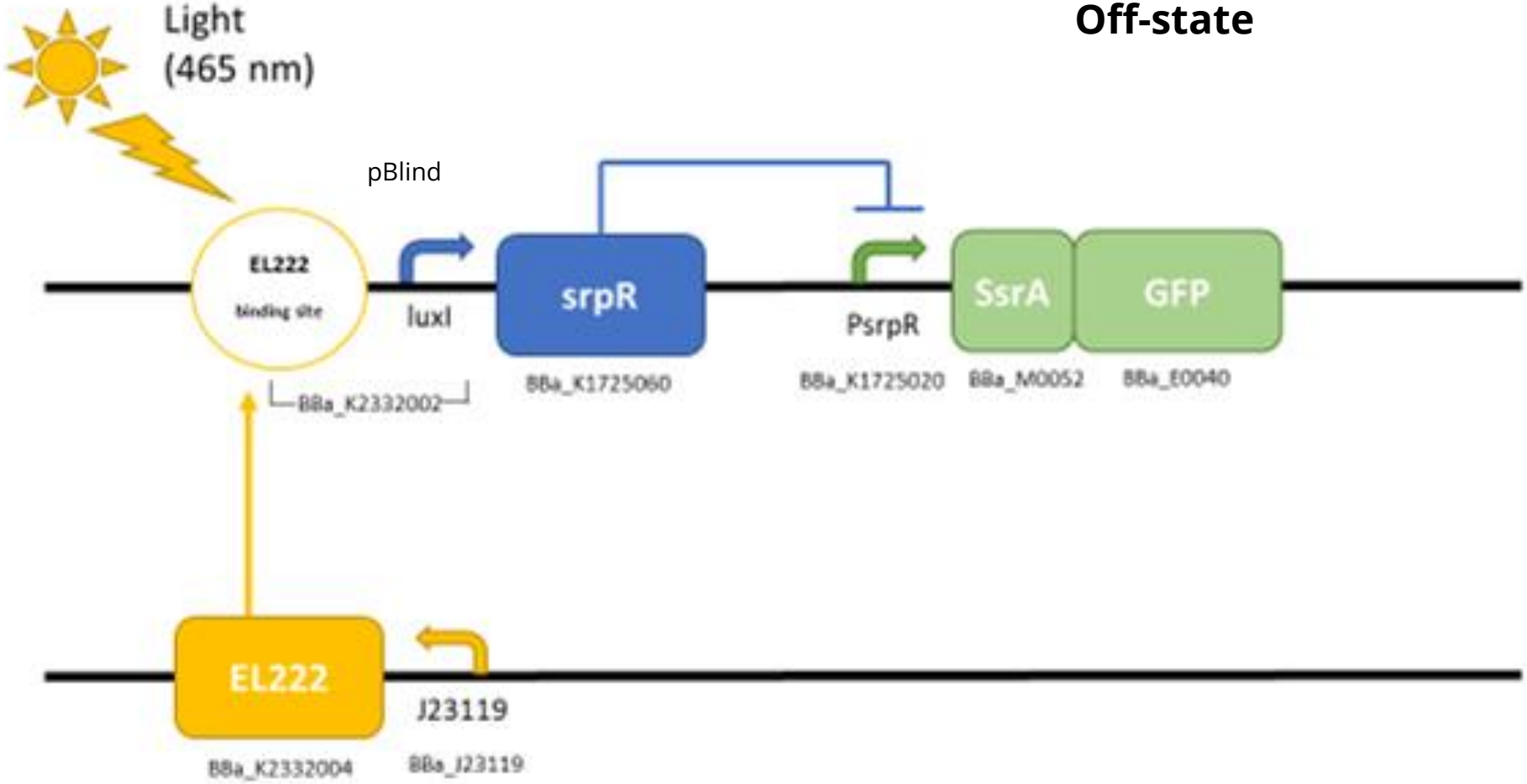
- The **GFP** will be fused with a degradation tag (**SsrA**) to ensure its degradation during the day

    -Wild-type **GFP** half-life: >24h, degradation-tagged **GFP** half-life: <1h

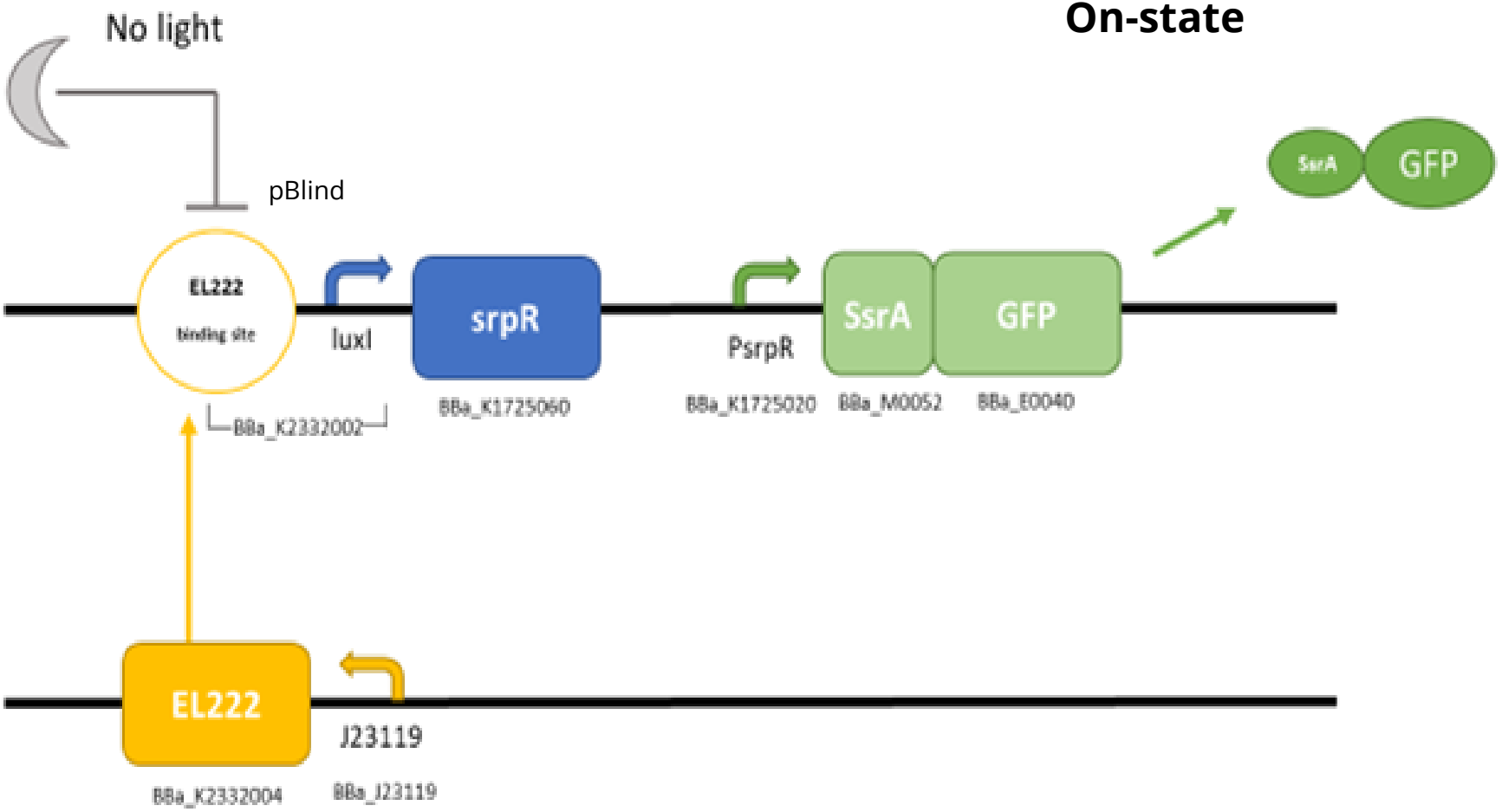
- The system will be inserted on plasmids and transformed into *E. coli*
- Parts will be assembled according to standard BioBrick assembly

How it functions

Off-state


Light
(465 nm)
pBlind
EL222
binding site
luxI
srpR
PsrpR
SsrA
GFP
BBa_K2332002
BBa_K1725060
BBa_K1725020
BBa_M0052
BBa_E0040
EL222
J23119
BBa_K2332004
BBa_J23119

On-state


No light
pBlind
EL222
binding site
BBa_K2332002
luxI
srpR
BBa_K1725060
PsrpR
BBa_K1725020
SsrA
BBa_M0052
GFP
BBa_E0040
SsrA
GFP
EL222
BBa_K2332004
J23119
BBa_J23119

The Logic

First Gate: AND

Input		Output
EL222	Light	Repressor (srpR)
1	1	1
0	1	0
1	0	0
0	0	0

- The circuit has two gates, this is the first
- The inputs are **EL222** and **light**
- Repressor **srpR** only active in the presence of both inputs

Second Gate: NOT

Input	Output
Repressor (srpR)	SsrA/GFP
1	0
0	1

- The second gate
- When the repressor **srpR** is active, there is no output
- Next, a combination of both gates

Third Gate: AND + NOT

EL222	Light	Repressor (srpR)	SsrA/GFP
1	1	1	0
0	1	0	1
1	0	0	1
0	0	0	1

- Promoter **BBa_J23119** is constitutive and is functioning with **sigma 70**
- Activated in all growth conditions, thus **EL222** is always expressed
- WE should only consider the two highlighted rows


Thank
You!

References

Andersen, J. B., Sternberg, C., Poulsen, L. K., Bjorn, S. P., Givskov, M., & Molin, S. (1998). New unstable variants of green fluorescent protein for studies of transient gene expression in bacteria. *Applied and environmental microbiology*, *64*(6), 2240–2246. https://doi.org/10.1128/AEM.64.6.2240-2246.1998

Constitutive promoter: (BBa_J23119) : This promoter enables the gene EL222 to be expressed all the time. It works in Escherichia coli with the factor Sigma 70 RNAP, which is the major factor of Escherichia Coli. It is expressed in most growth conditions.
http://parts.igem.org/Part:BBa_J23119

EL222: (BBa_K2332002) : http://parts.igem.org/Part:BBa_K2332004

Light induced promoter: http://parts.igem.org/Part:BBa_K2332002

GFP: http://parts.igem.org/Part:BBa_E0040:Design
Degradation tag: http://parts.igem.org/Part:BBa_M0052

3rd promoter : another example (PsrpR promoter) (BBa_K2525015) : http://parts.igem.org/Part:BBa_K2525015
Repressor (srpR): http://parts.igem.org/Part:BBa_K1725060