



wormworks

Queen's iGEM Team
Kingston, Canada

current limitations
proposal
our process
potential
our accomplishments
communicating
summary

growing iGEM

Our goal: to encourage growth and expansion of the iGEM competition.

limitations

What are the limits of the most common iGEM chassis (*E. coli*)?

limitations

One cell = one compartment.

limitations

Plasmid capacity.

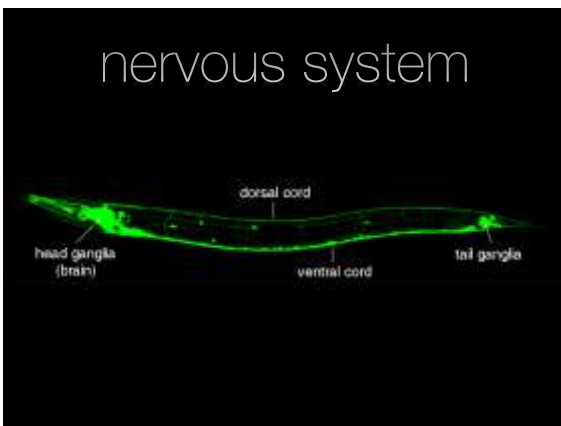
limitations

Movement speed and range.

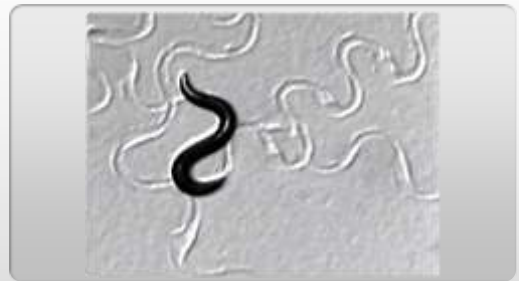
proposal



nervous system



locomotion



digestion



cell lineage



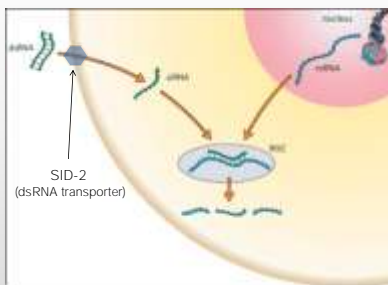
but is this practical?

working with worms

	Bacteria (<i>E. coli</i>)	<i>C. elegans</i>
Agar plates	✓	✓
Easy maintenance	✓	✓
Short life cycle	✓	✓
Antibiotic selection	✓	✓
Glycerol stocking	✓	✓

Familiar?

RNA interference



tissue-specific expression



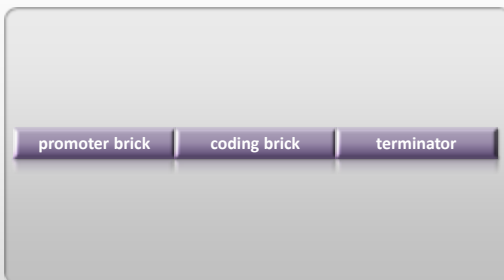
A property of many promoters

process

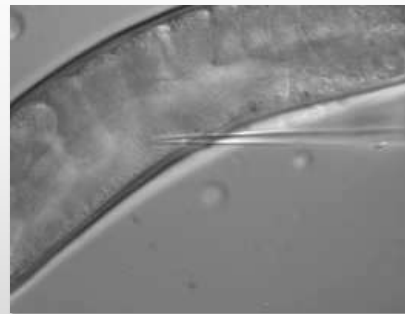
natural brick source



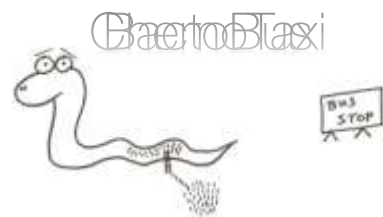
construct preparation



microinjection



potential



- Superior locomotion
- Extensive sensory capabilities
- Take advantage of *E. coli* parts

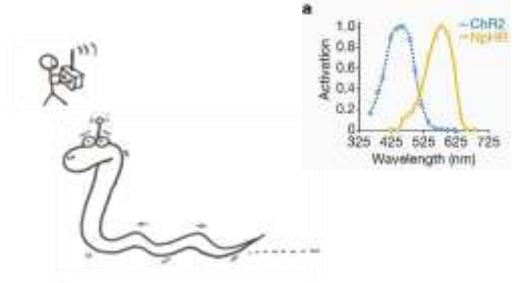
optogenetics

Inter-tissue communication
(e.g. nervous system to muscular system)

Ion channels:

- Channelrhodopsin-2 (ChR2)
- Halorhodopsin (NpHR)

optogenetics



promoters



Constitutive

pGpd-2 > pRab-7 > pSip-1

Inducible

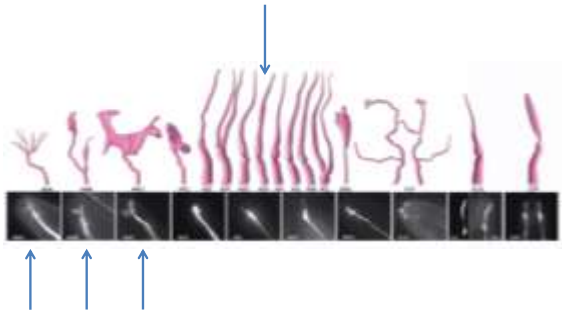
pHsp-3 (enhanced by chemical stress)

promoters



Tissue-Specific

- pMec-7 mechanosensory neurons
- pOdr-10 AWA olfactory neuron
- pStr-220 AWB olfactory neuron
- pStr-1 AWB chemosensory neuron
- pOdr-1 AWC chemosensory neuron
- pOsm-10 ASH osmosensory neuron
- pFlp-1 AVA sensory neuron
- pSra-10 AVB sensory neuron



reporters



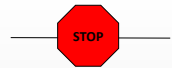
eGFP Green fluorescence marker
 eCFP Cyan fluorescence marker
 eYFP Yellow fluorescence marker
 mCherry Red fluorescence marker

effectors



ChR2 Channelrhodopsin-2
 NpHR Halorhodopsin

terminator



unc-54 3' UTR contains poly-A signal

parts submitted

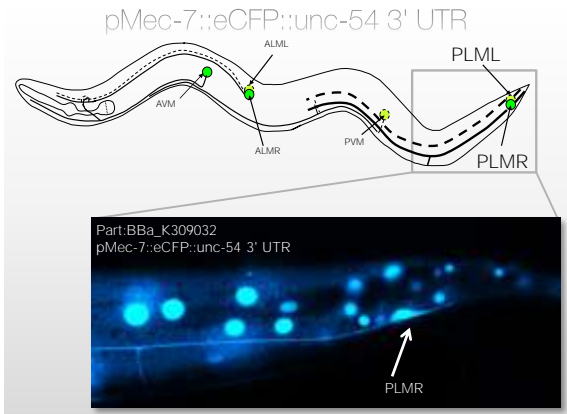
BBa_K309000	pMec-7	Promoter
BBa_K309001	pSra-10	Promoter
BBa_K309002	pGpd-2	Promoter
BBa_K309003	pStr-1	Promoter
BBa_K309004	ChR2::eYFP	Tagged effector
BBa_K309005	mCherry	Reporter
BBa_K309006	pSip-1	Promoter
BBa_K309007	ChR2	Effector
BBa_K309009	pOdr-10	Promoter
BBa_K309010	pFlp-1	Promoter
BBa_K309011	pHsp-3	Promoter

parts submitted

BBa_K309012	<i>unc-54</i> 3' UTR	Terminator
BBa_K309013	pOsm-10	Promoter
BBa_K309014	pOdr-1	Promoter
BBa_K309015	NpHR::eCFP	Tagged effector
BBa_K309016	eGFP	Reporter
BBa_K309017	pStr-220	Promoter
BBa_K309018	eYFP	Reporter
BBa_K309019	NpHR	Effector
BBa_K309020	eCFP	Reporter
BBa_K309021	pStr-220::eCFP::3'UTR	Full construct
BBa_K309022	pOdr-10::eCFP::3'UTR	Full construct

parts submitted

BBa_K309023	pGpd-2::eCFP::3'UTR	Full construct
BBa_K309024	pSip-1::eCFP::3'UTR	Full construct
BBa_K309025	pFlp-1::eCFP::3'UTR	Full construct
BBa_K309026	ChR2::eYFP::3'UTR	Tagged effector + terminator
BBa_K309027	pHsp-3::eCFP::3'UTR	Full construct
BBa_K309028	pOsm-10::eCFP::3'UTR	Full construct
BBa_K309029	mCherry::3'UTR	Reporter + terminator
BBa_K309030	eYFP::3'UTR	Reporter + terminator
BBa_K309031	pOdr-1::eCFP::3'UTR	Full construct
BBa_K309032	pMec-7::eCFP::3'UTR	Full construct



communicating

new standard (RFC 77)

Kozak sequence around start codon

GCC ACC AUG G

Optimizes translation

communicating



the worm community

- WormBase—huge gene databank
- WormBook—thorough research review/textbook
- WormAtlas—where to start with worms
- WormMethods—protocols
- GFPWorm—where promoters function
- Promoterome—known minimal promoters
- UTRome and UTRdb—3' UTRs

WormGuide



summary

- Feasibility?
- **We've been here before...**
- Fundamental parts
- New standard
- WormGuide
- Go forth!

acknowledgements

- Dr. Ian Chin-Sang, and all of our other advisors
- VWR, for discounts on reagents
- Octane Biotech, for their generous contribution
- Queen's University, for their on-going support
- And you, for watching.

thanks!