Tips for good presentations:

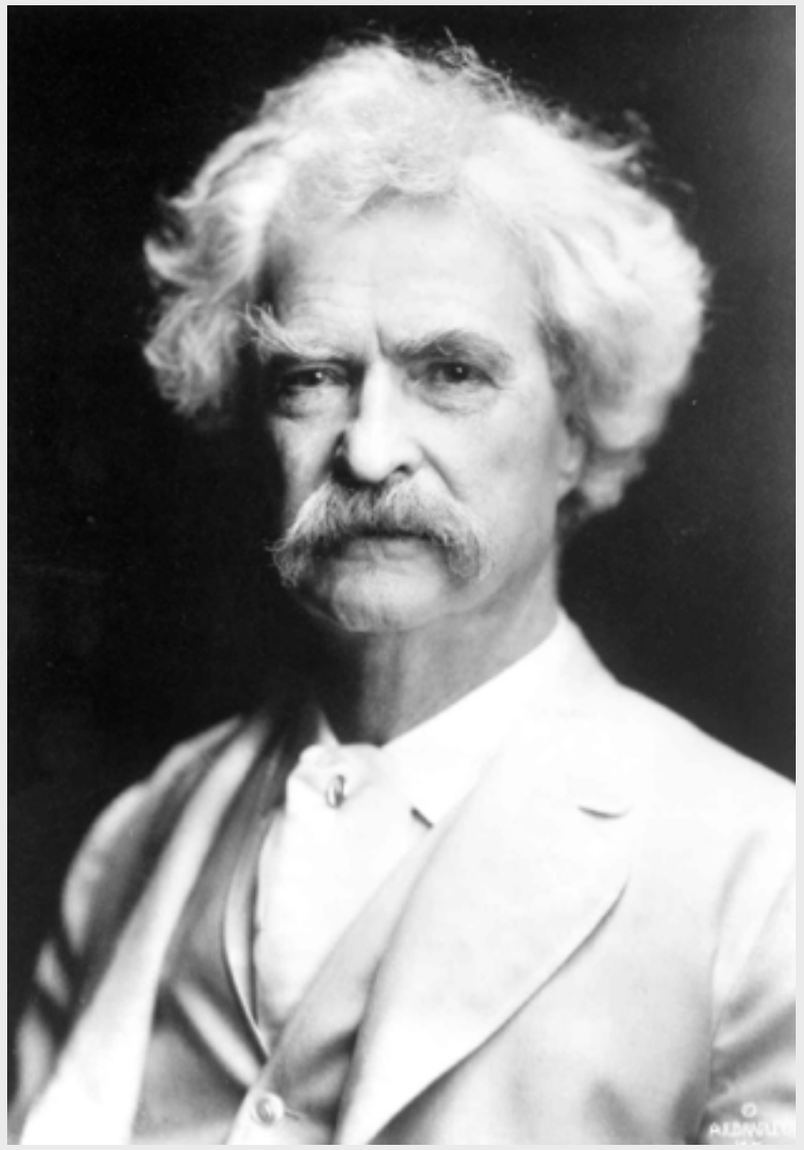
with an example talk on C. elegans optogenetics

Justin Bois

BE 159, Jan 13, 2016

It usually takes me more than three weeks
to prepare a good impromptu speech.

—Mark Twain

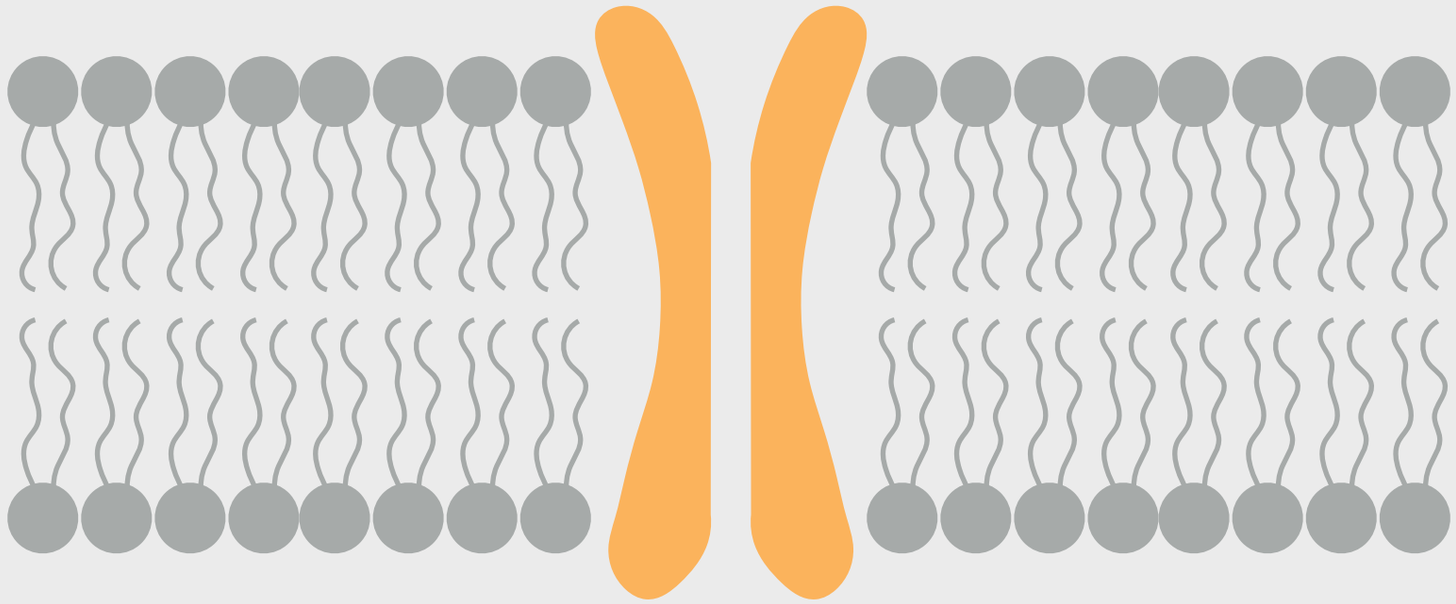


The Manchurian Candidate, United Artists, 1962

Chlamydomonas has an eyespot with Channelrhodopsin

Image: Wolfgang Bettighofer

Channelrhodopsin is an optically-activated ion channel



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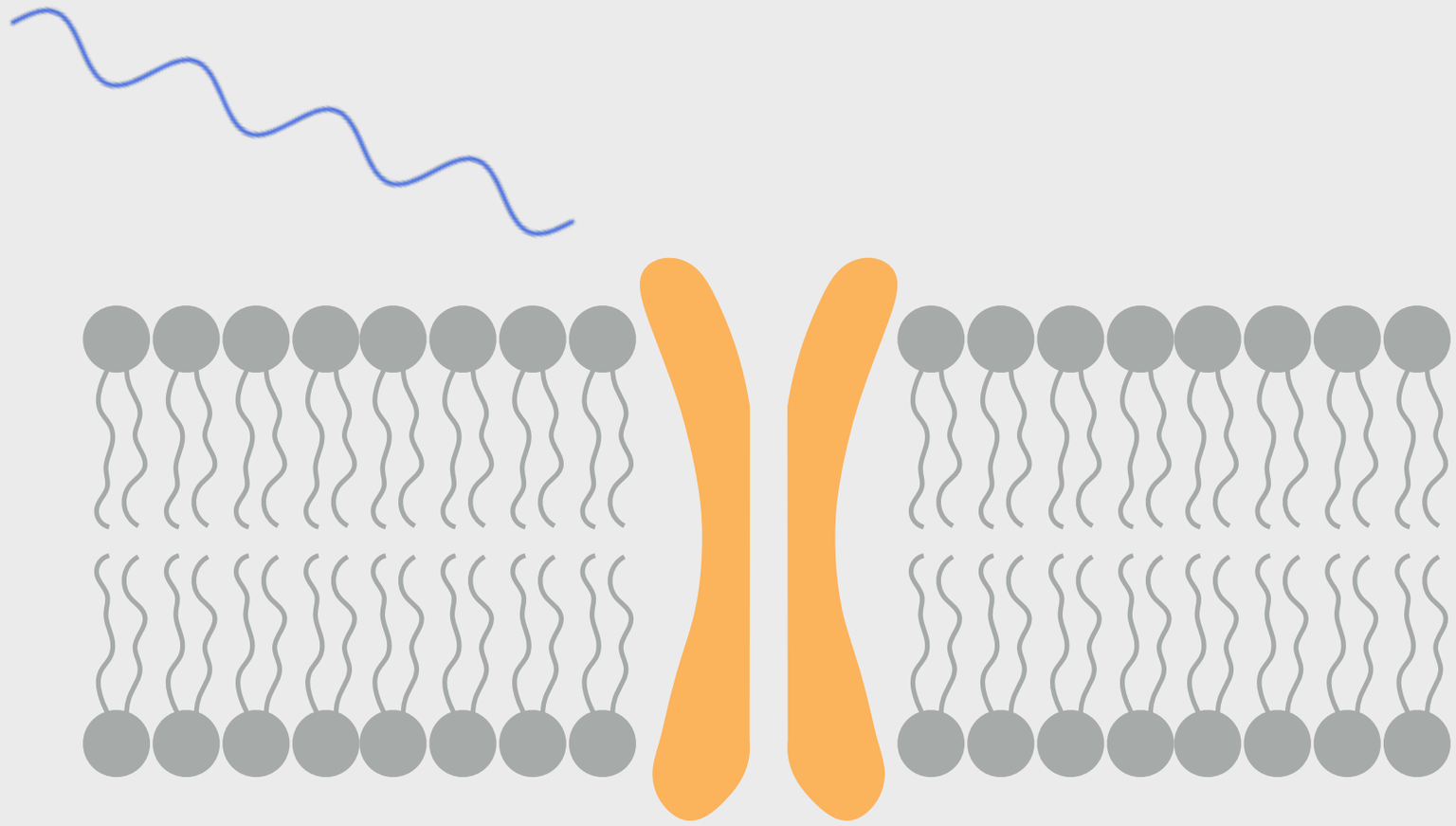

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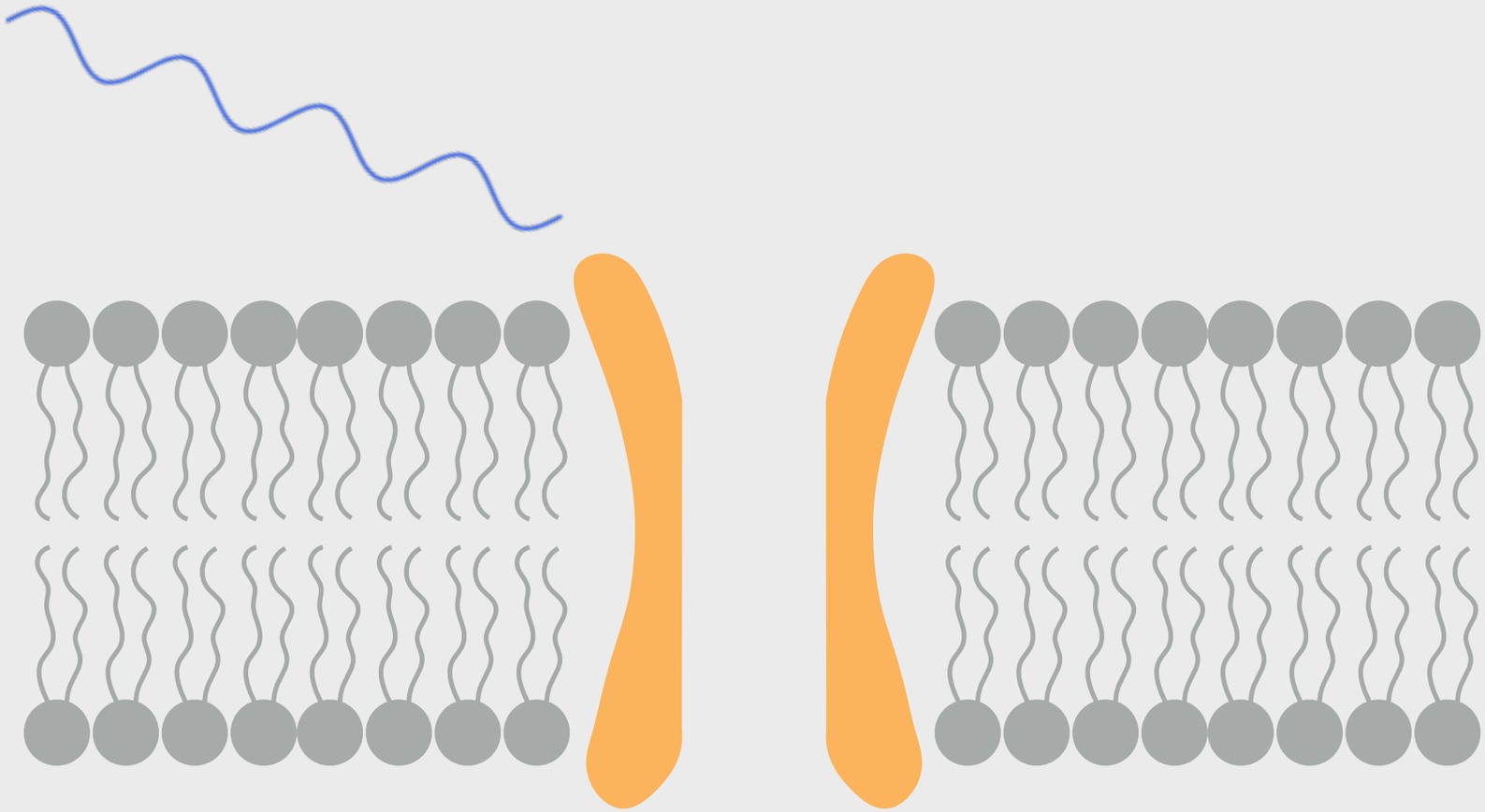

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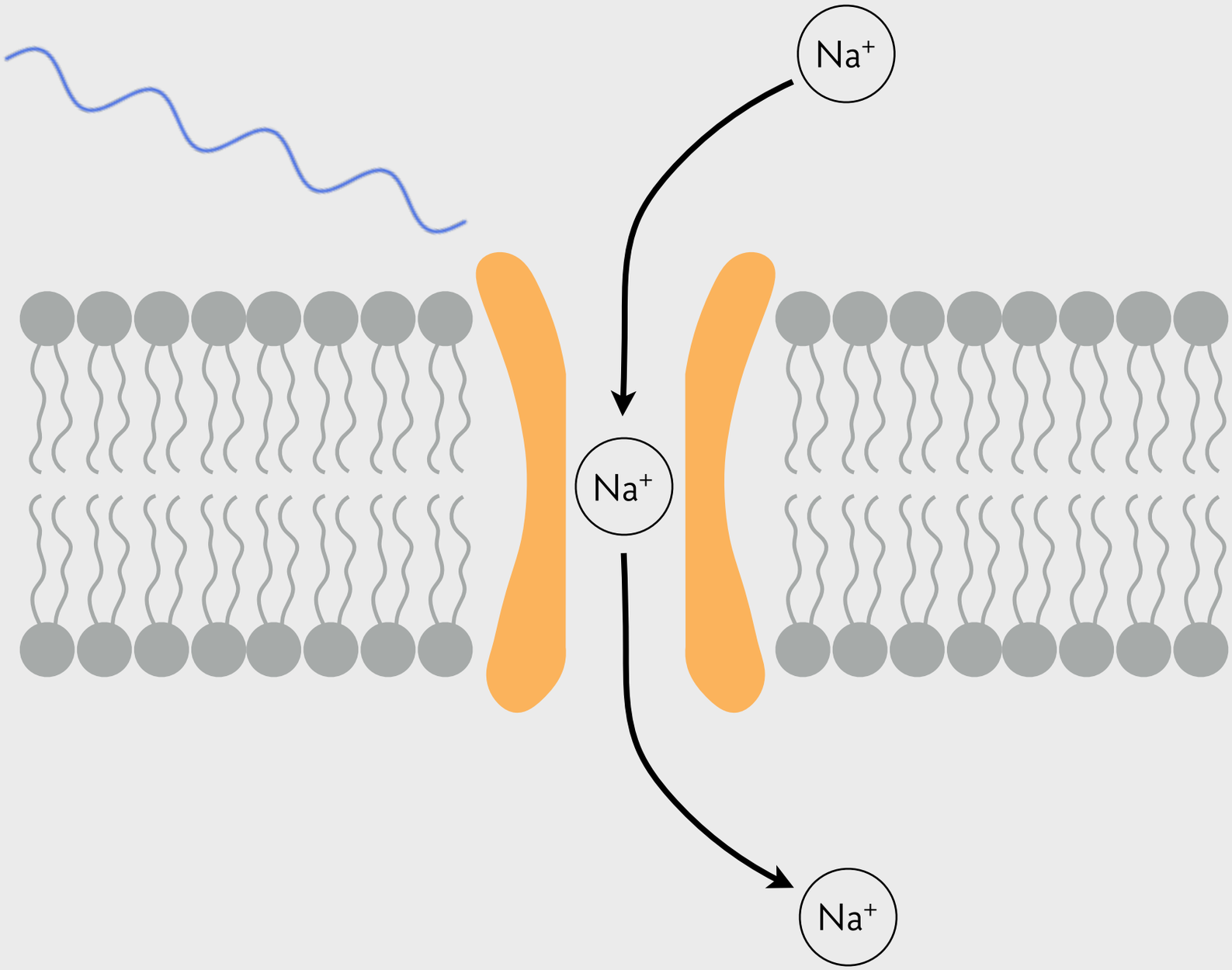
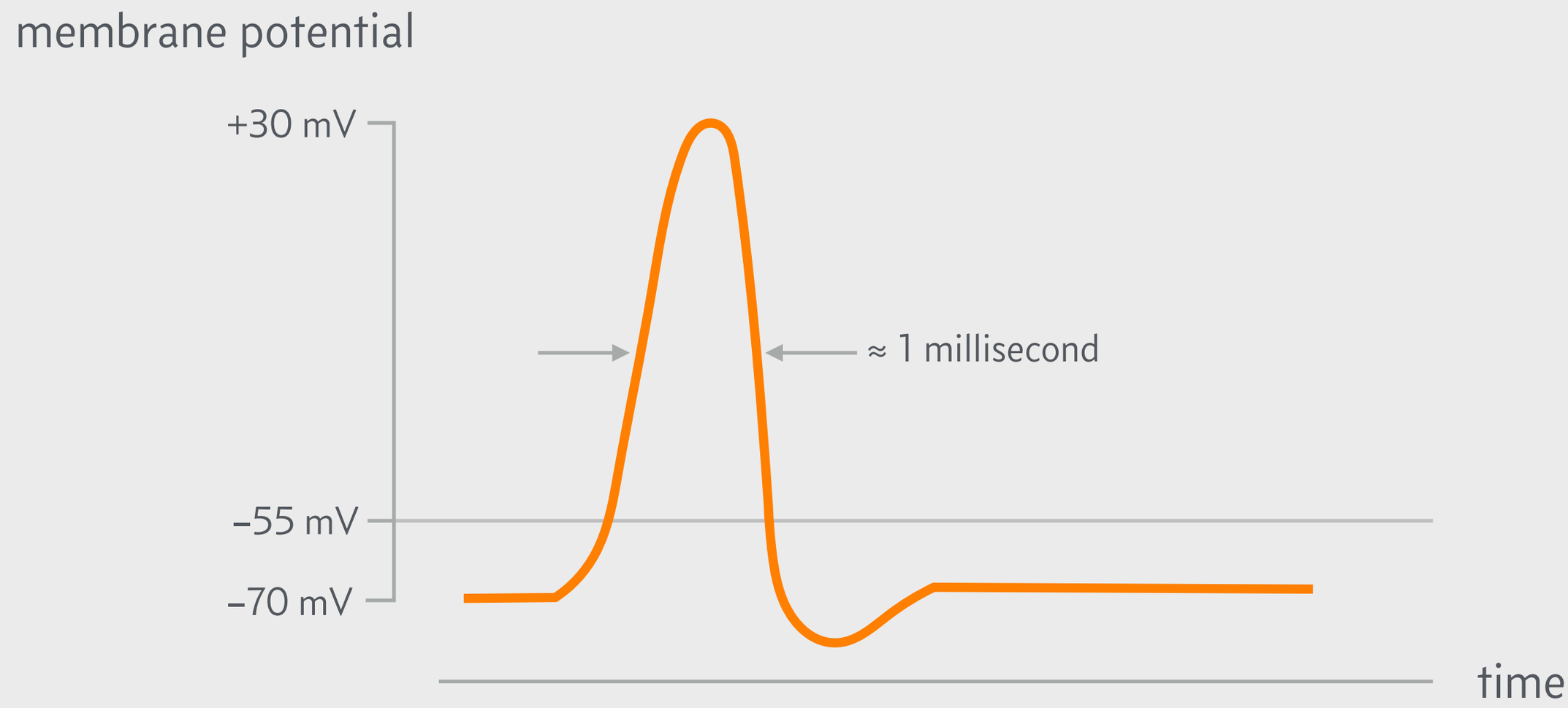


Induced charge difference mimics an action potential



Optogenetics: put opsins in specific neurons

Karl Deisseroth

Photo by Ioulex, *New Yorker*, 2015

Optogenetics is used to control the thirst sensation

Oka, et al., *Nature*, 2015

How does proximity of the Channelrhodopsin to motor neurons affect response?

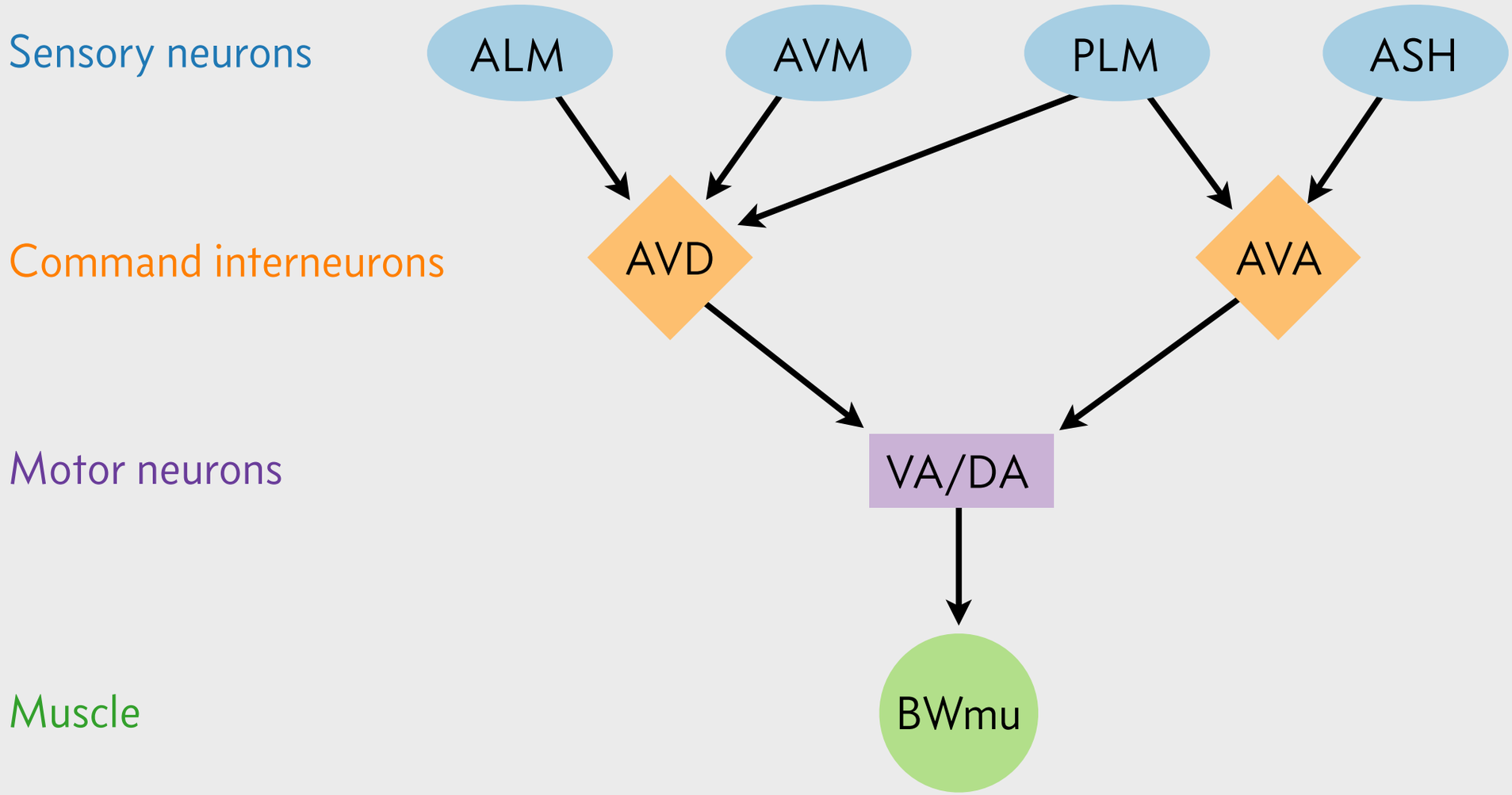
C. elegans is an ideal organism for optogenetics

Complete set of genetic tools

Simple nervous system

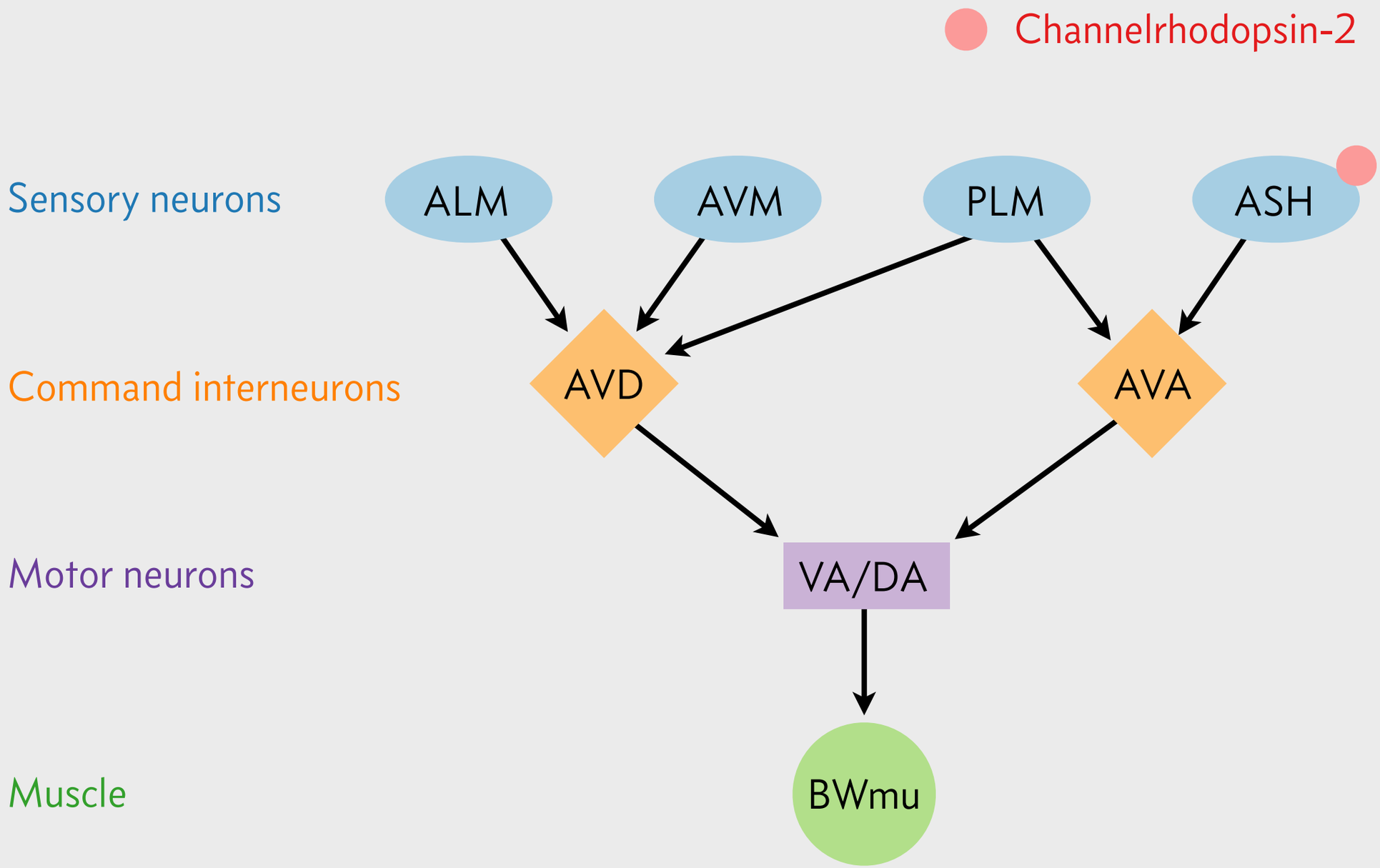
Transparent!

The *C. elegans* reversal circuit is well-mapped and simple



Adapted from WormAtlas

Channelrhodopsin can be expressed in specific neurons



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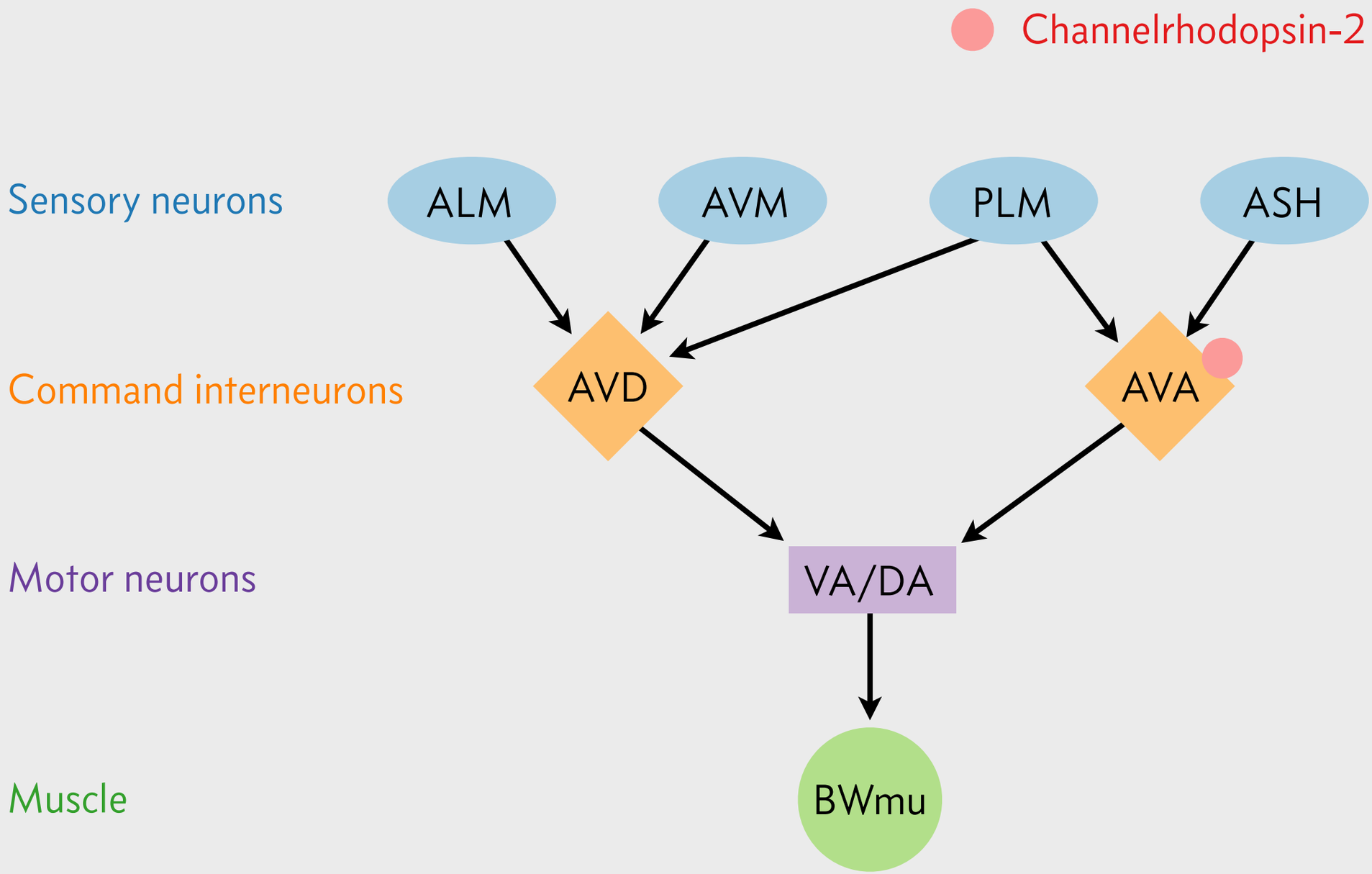


Adapted from WormAtlas

The experiment costs less than $300

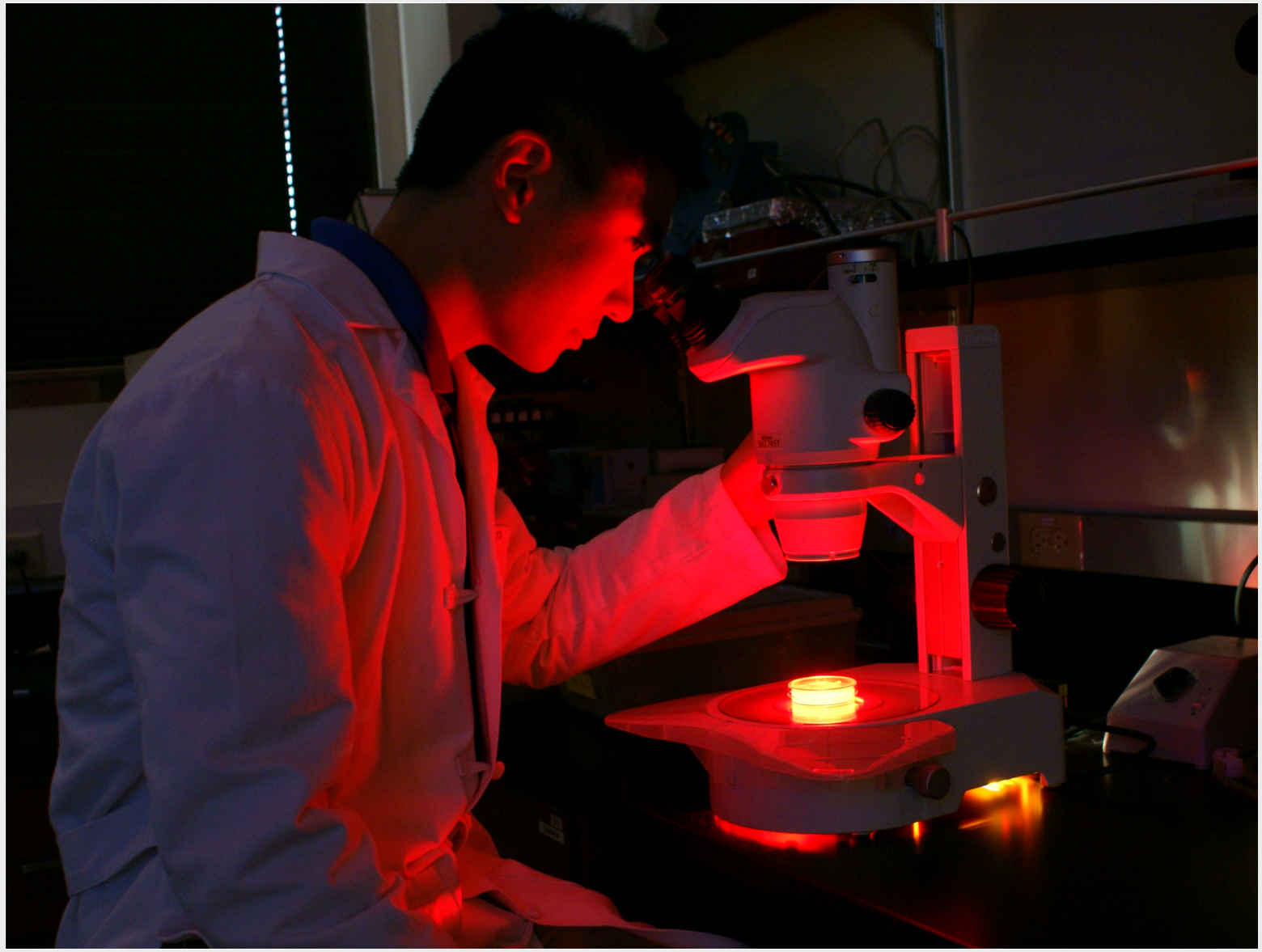
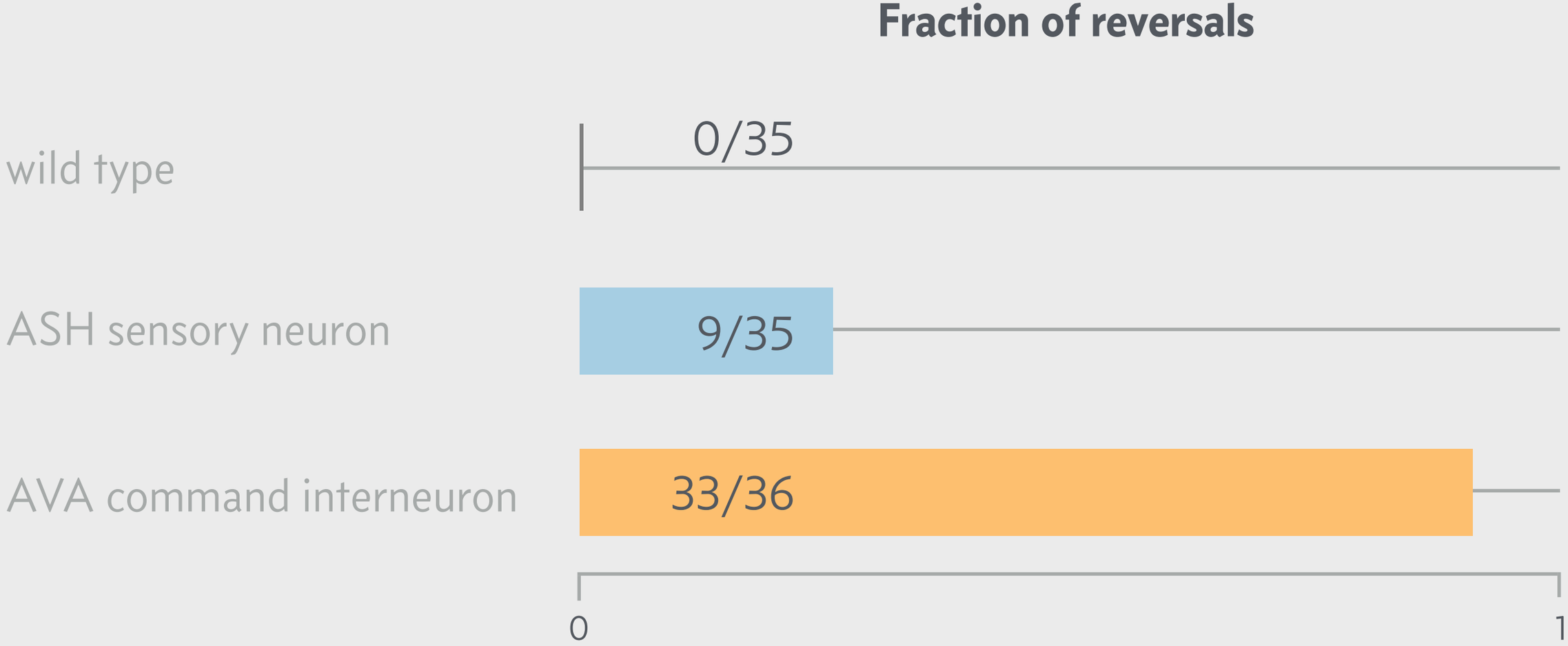


Photo: Griffin Chure

The command interneuron shows the strongest response



We use Bayes's theorem to quantify reversal probability

$$P(A \mid B) = \frac{P(B \mid A)\, P(A)}{P(B)}$$

$A = p_{\text{rev}} =$ probability of reversal
$B = n, r =$ r reversals in n trials

We use Bayes's theorem to quantify reversal probability

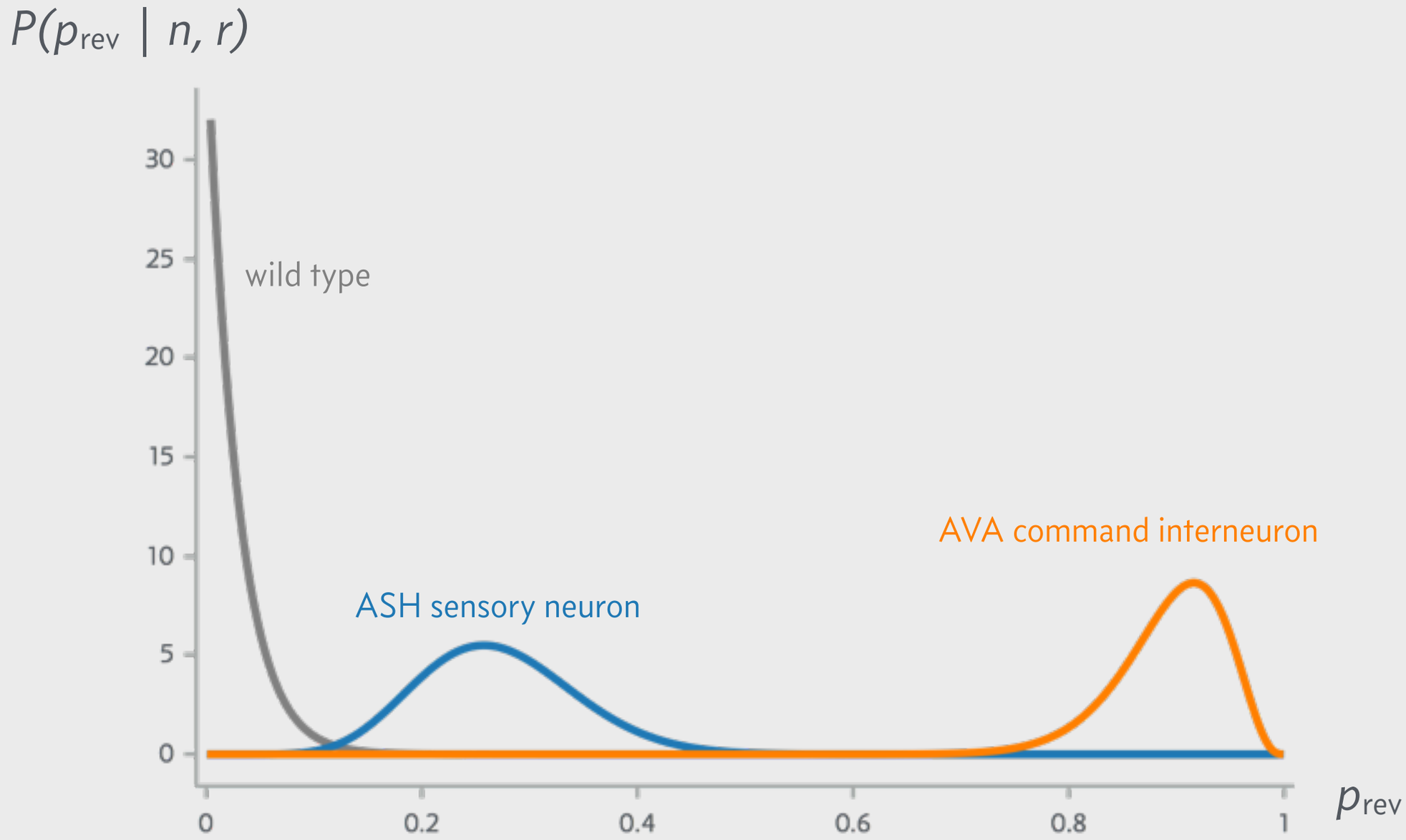
$$P(p_{\text{rev}} \mid n, r) = \frac{P(n, r \mid p_{\text{rev}})\, P(p_{\text{rev}})}{P(n, r)}$$

$$= \frac{\text{Binomial}(r \mid n, p_{\text{rev}}) \times \text{Uniform}(0, 1)}{\text{Uniform}(0, n{+}1)}$$

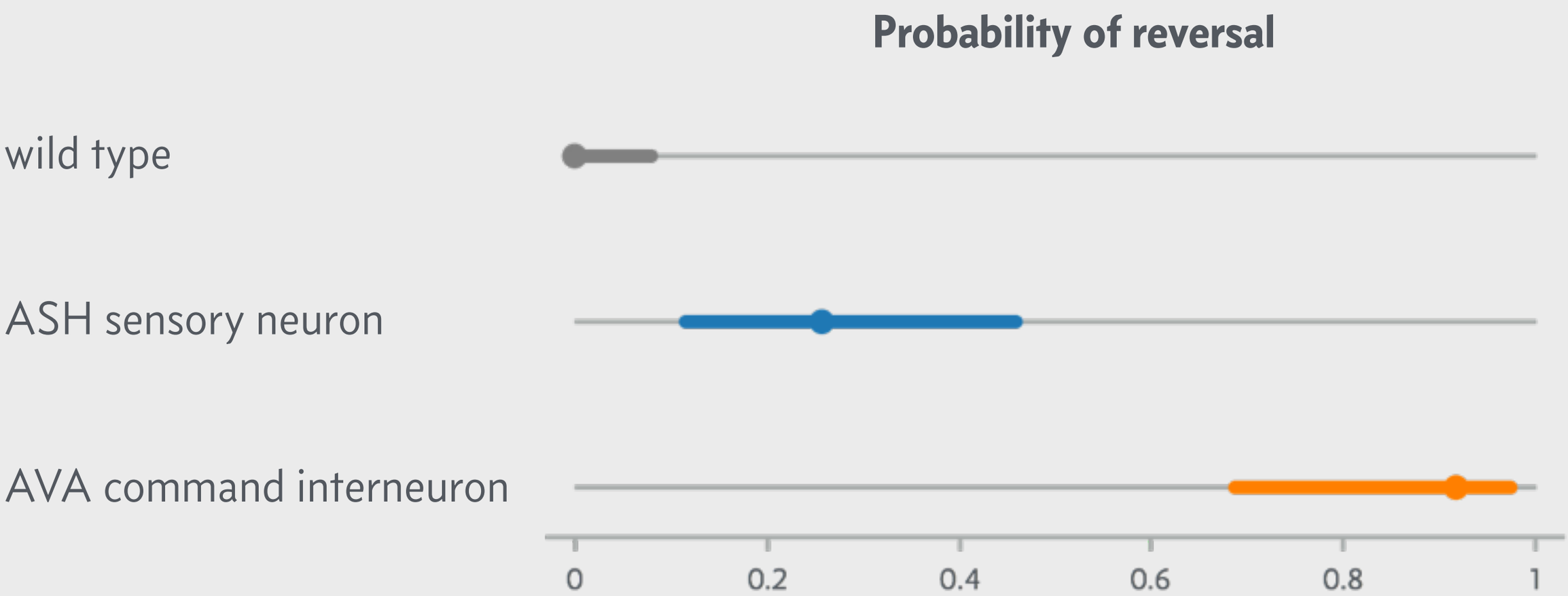
p_{rev} = probability of reversal

n, r = r reversals in n trials

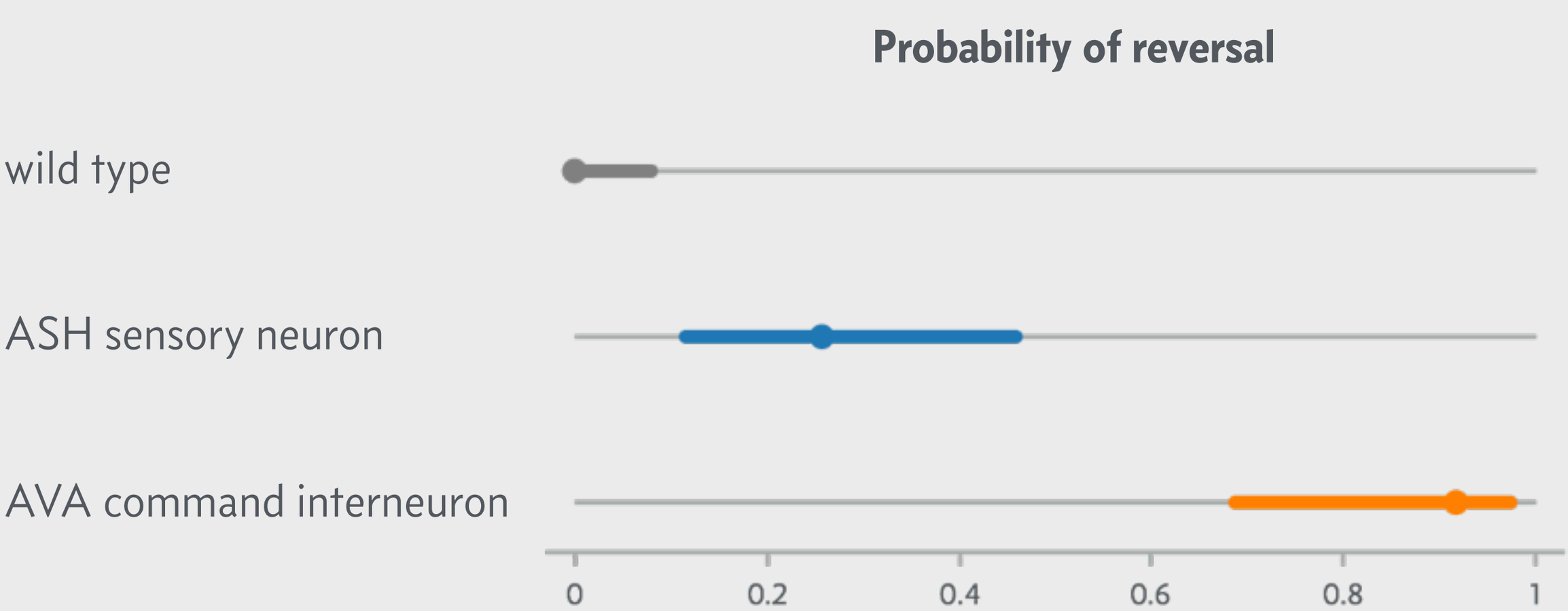
A Bayesian analysis give a complete description of reversal probability



95% confidence intervals reveal quantitative difference in reversal probability

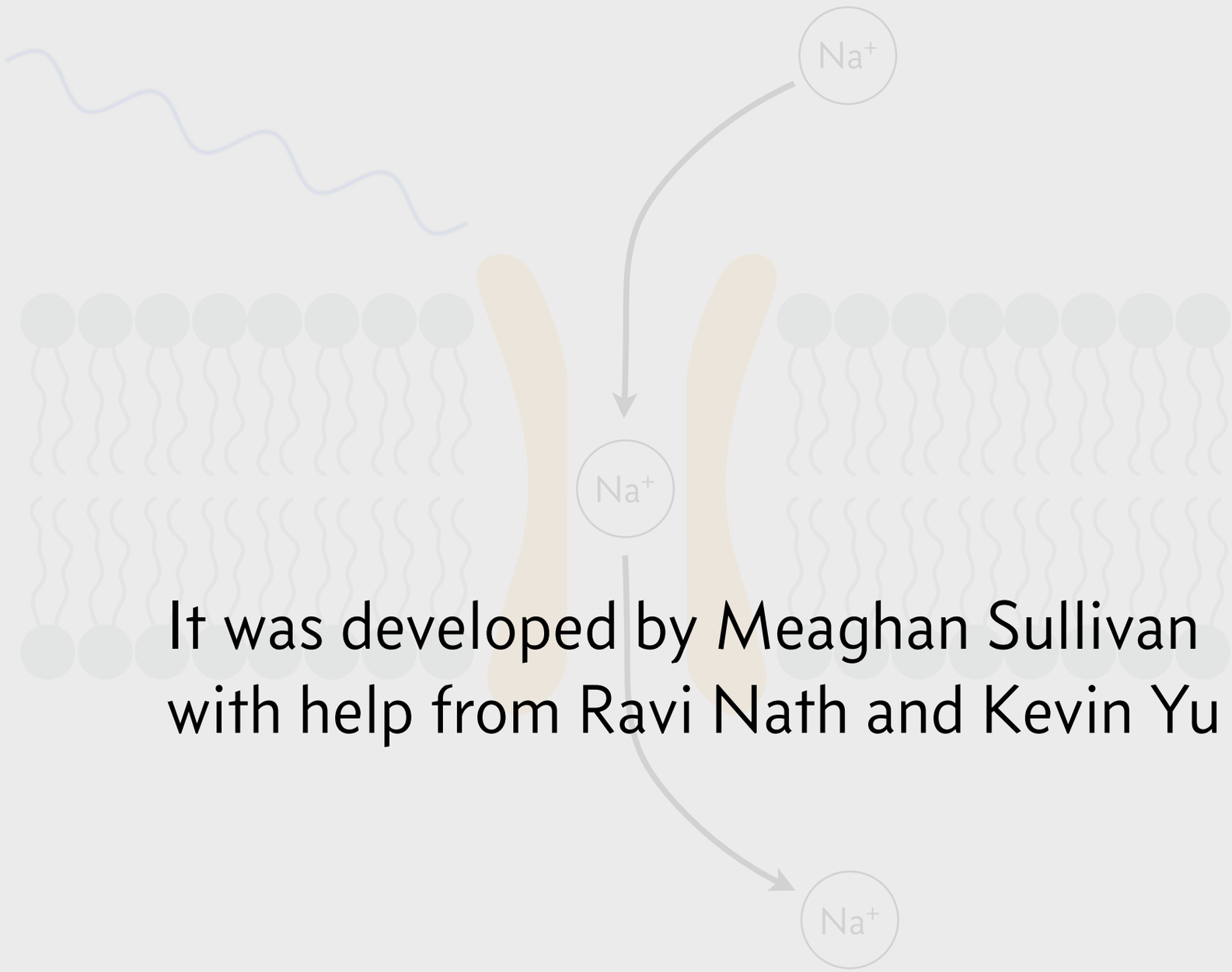


How does proximity of the Channelrhodopsin to motor neurons affect response?



Stimulation of the command interneuron is more than twice as likely to invoke a response.

This experiment was conducted by the students of Bi 1x 2015



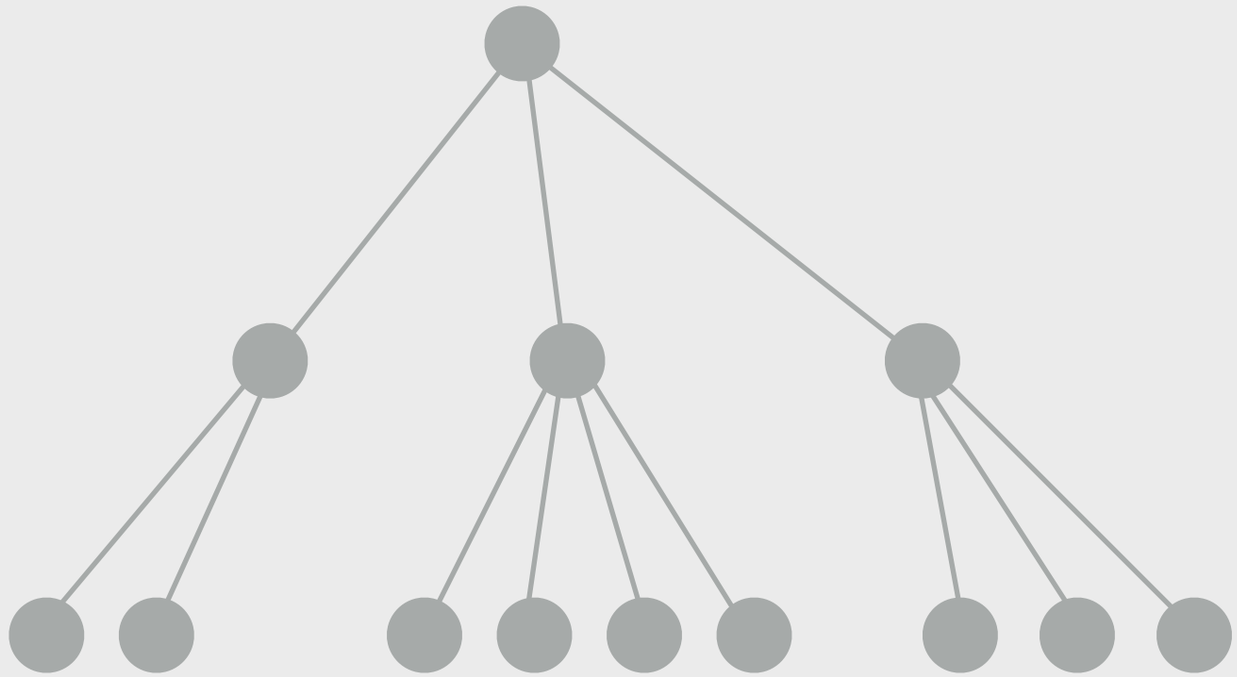
It was developed by Meaghan Sullivan with help from Ravi Nath and Kevin Yu

The talk content has a top-down hierarchical structure

Main message

Main points

Subpoints

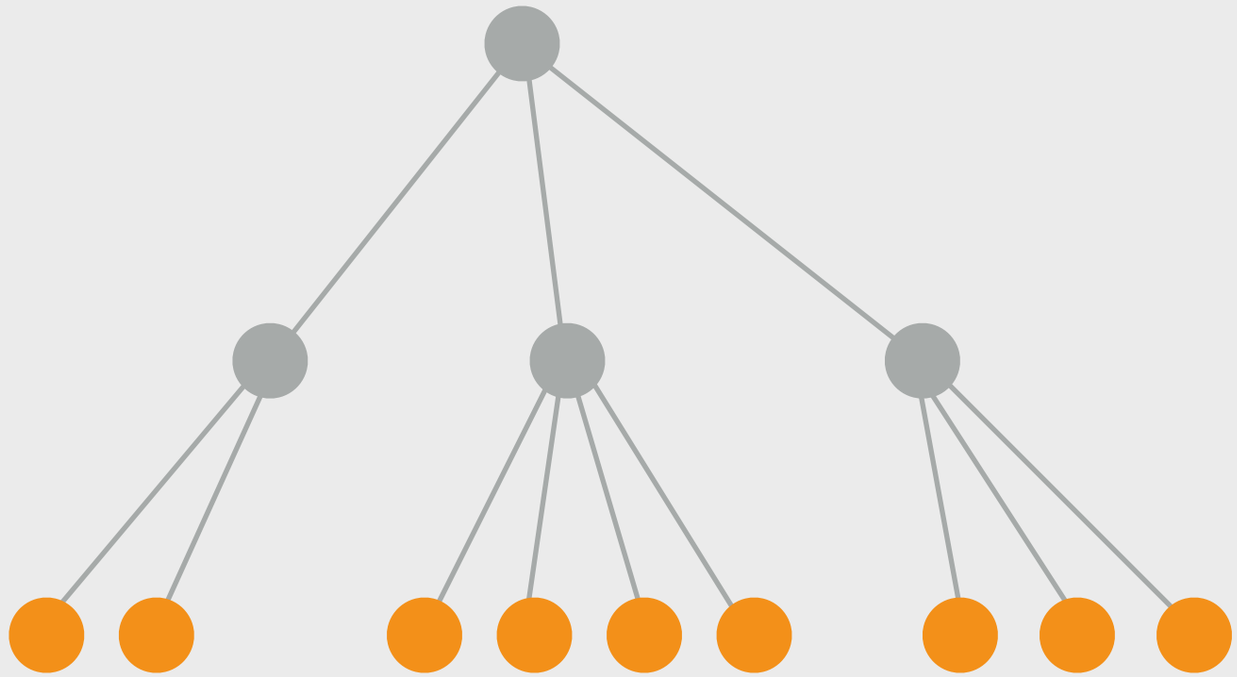


You should have one slide for each subpoint

Main message

Main points

Subpoints



One idea, one slide.

The talk structure is linear

Introduction

Attention getter

Need

Task

Main message

Body

Main point 1

• • •

Main point 2

• • •

Main point 3

• • •

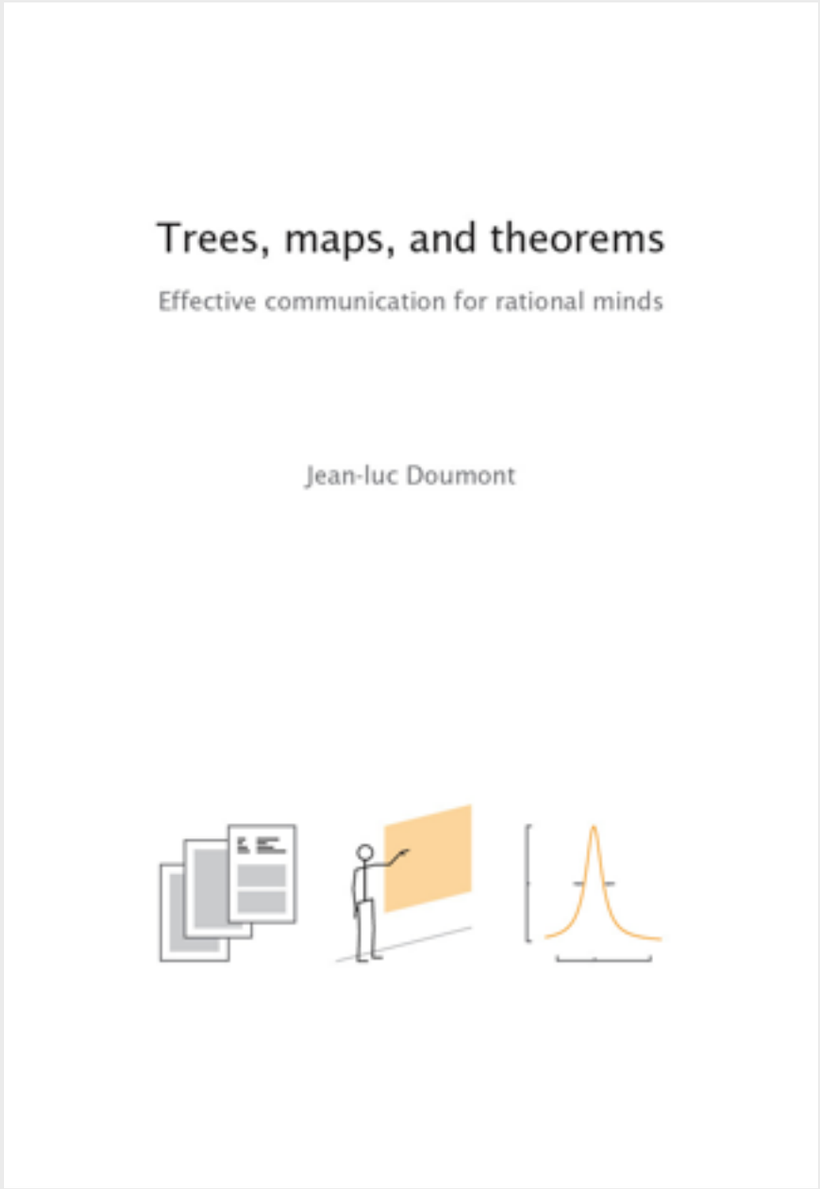
Closing

Review

Conclusion

Close

Jean-luc Doumont's work is an excellent resource



C. elegans

- Well-established model organism
- Has 302 neurons
- Easy to manipulate
- Can put opsins in single neurons using a host of available genetic tools
- It is transparent, so no need for fiberoptic wires.

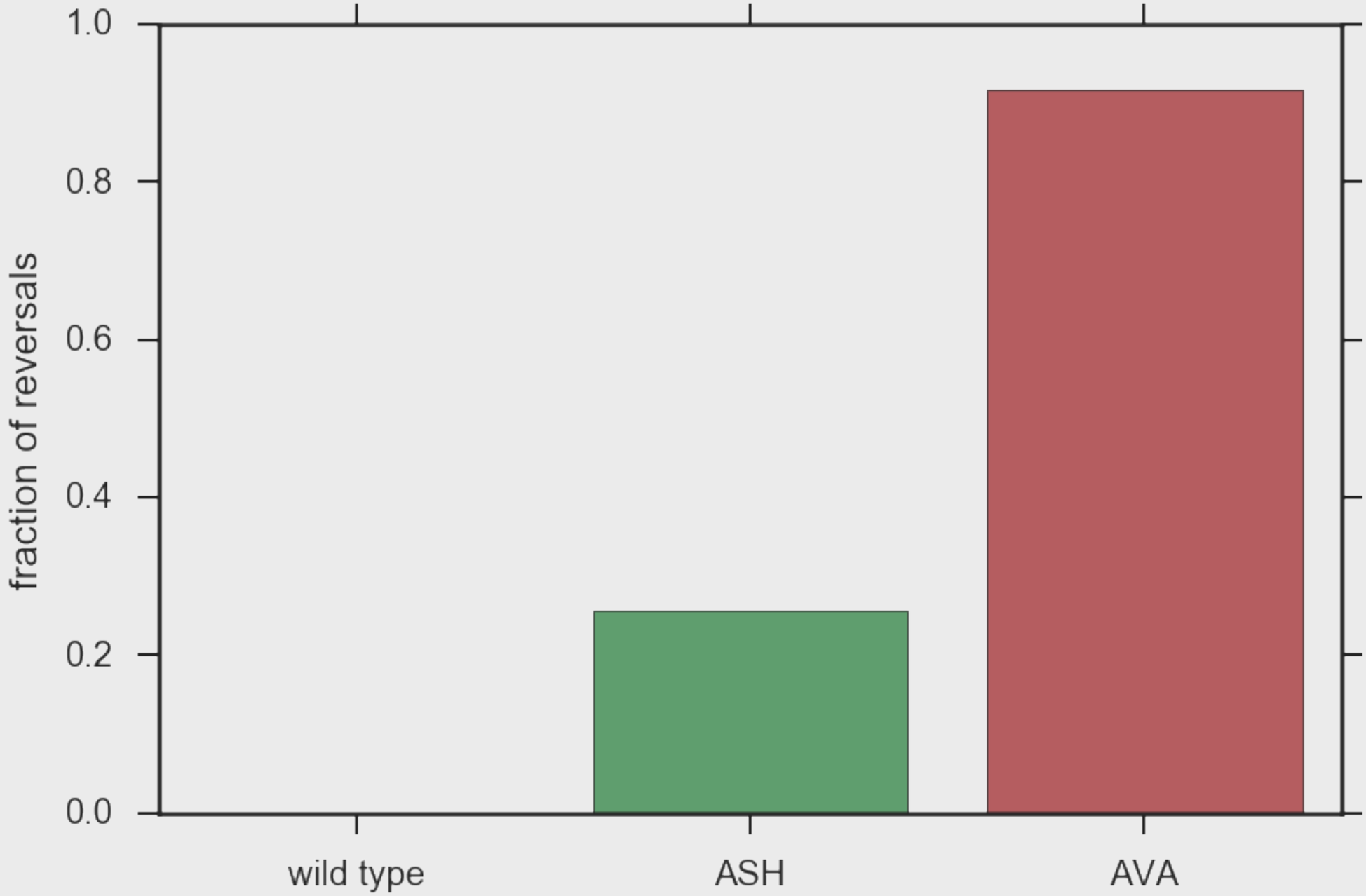
C. elegans is an ideal organism for optogenetics

Complete set of genetic tools

Simple nervous system

Transparent!

This is a bad bar chart



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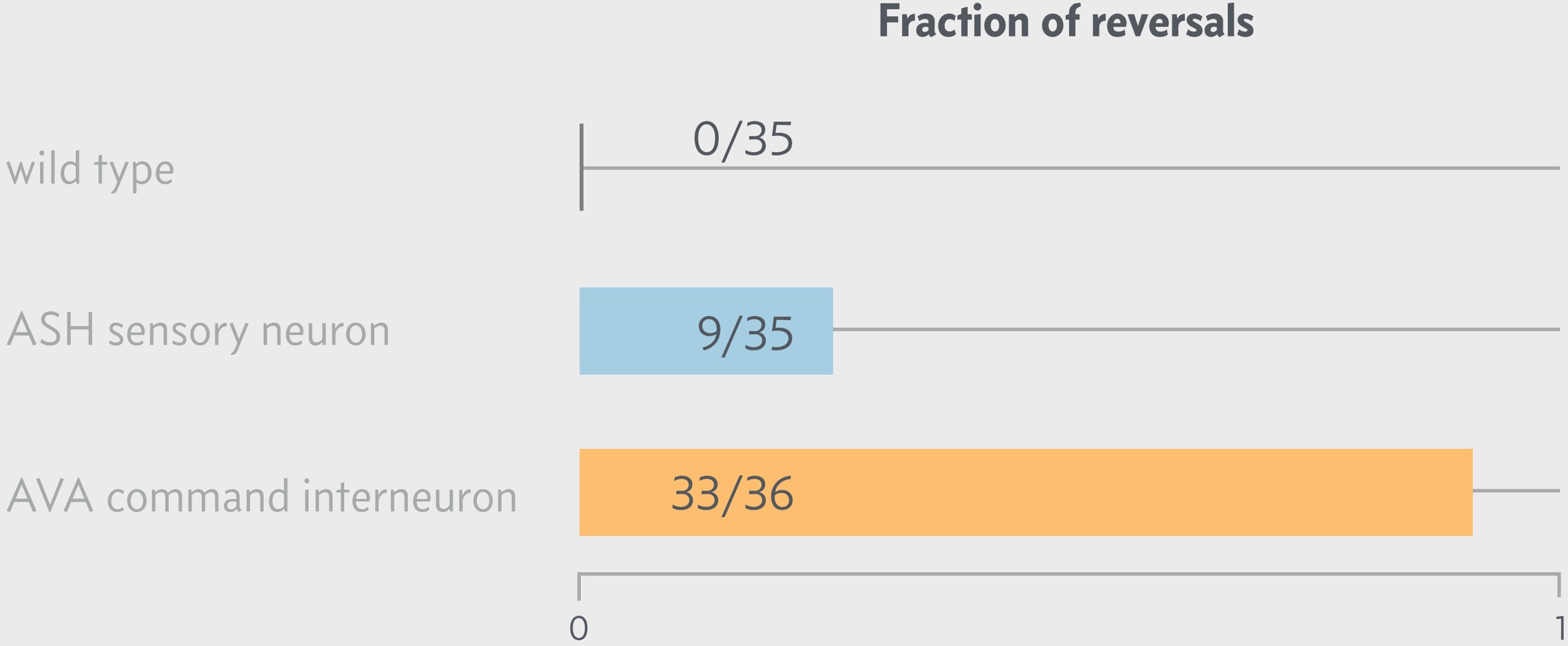
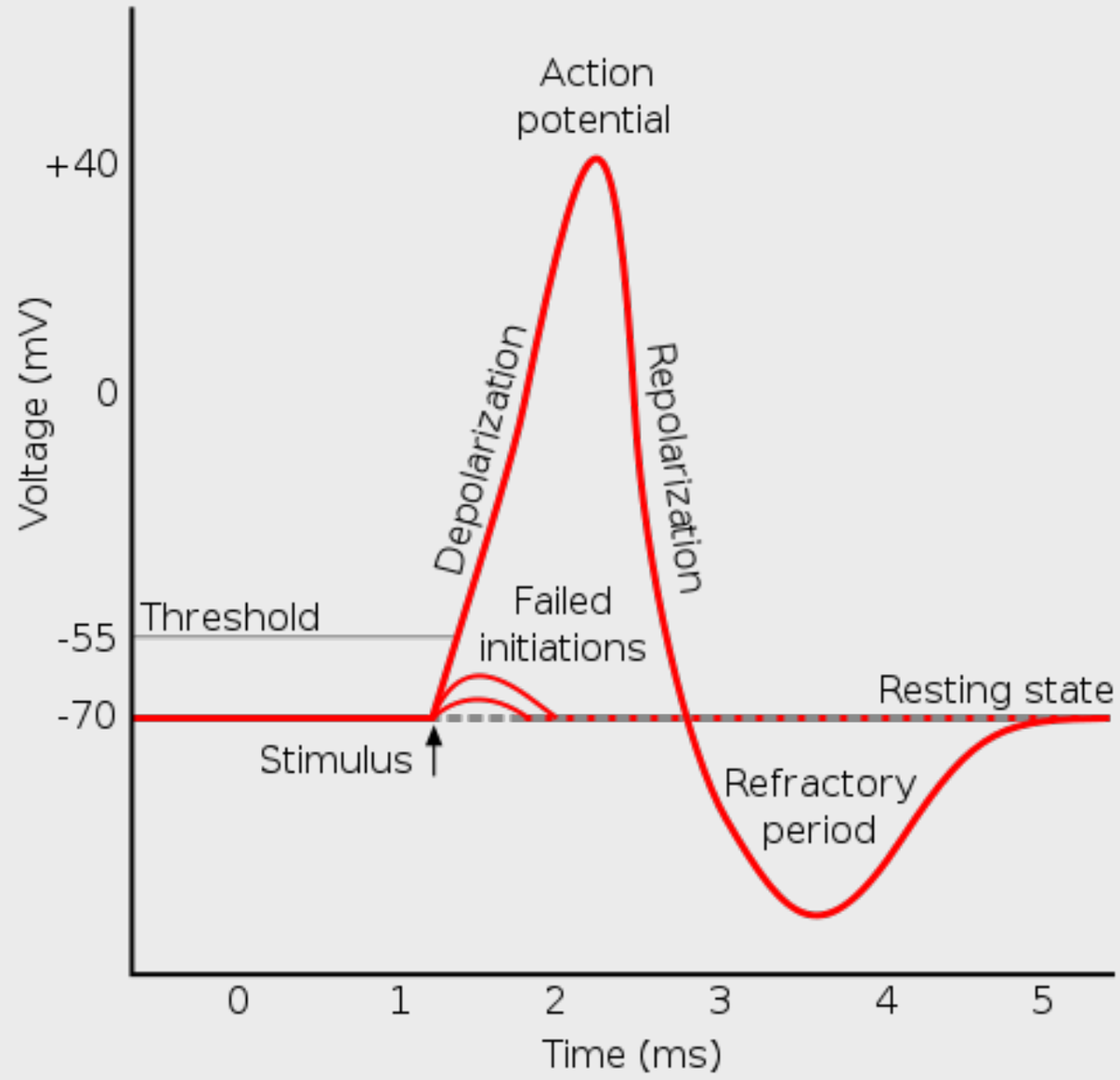


This is a bad schematic of an action potential



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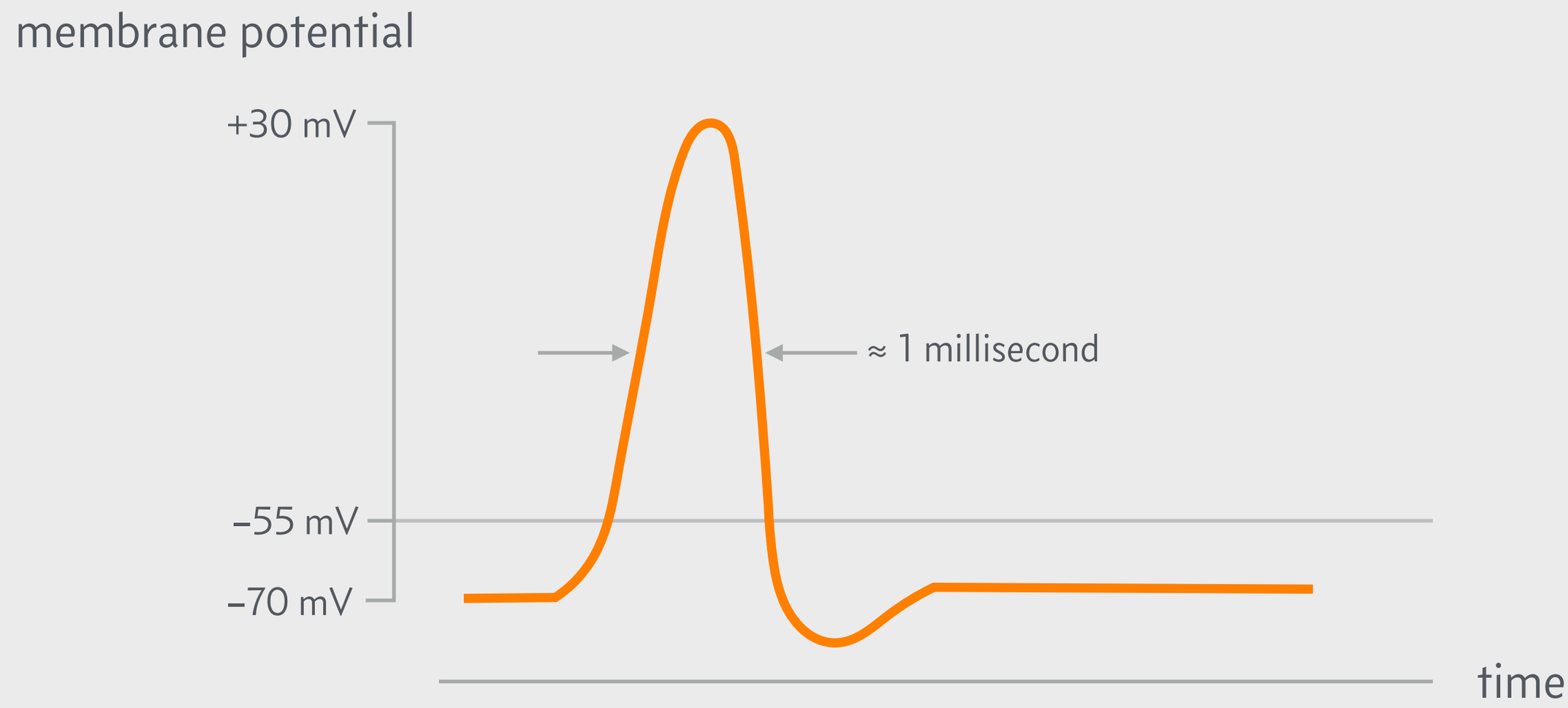
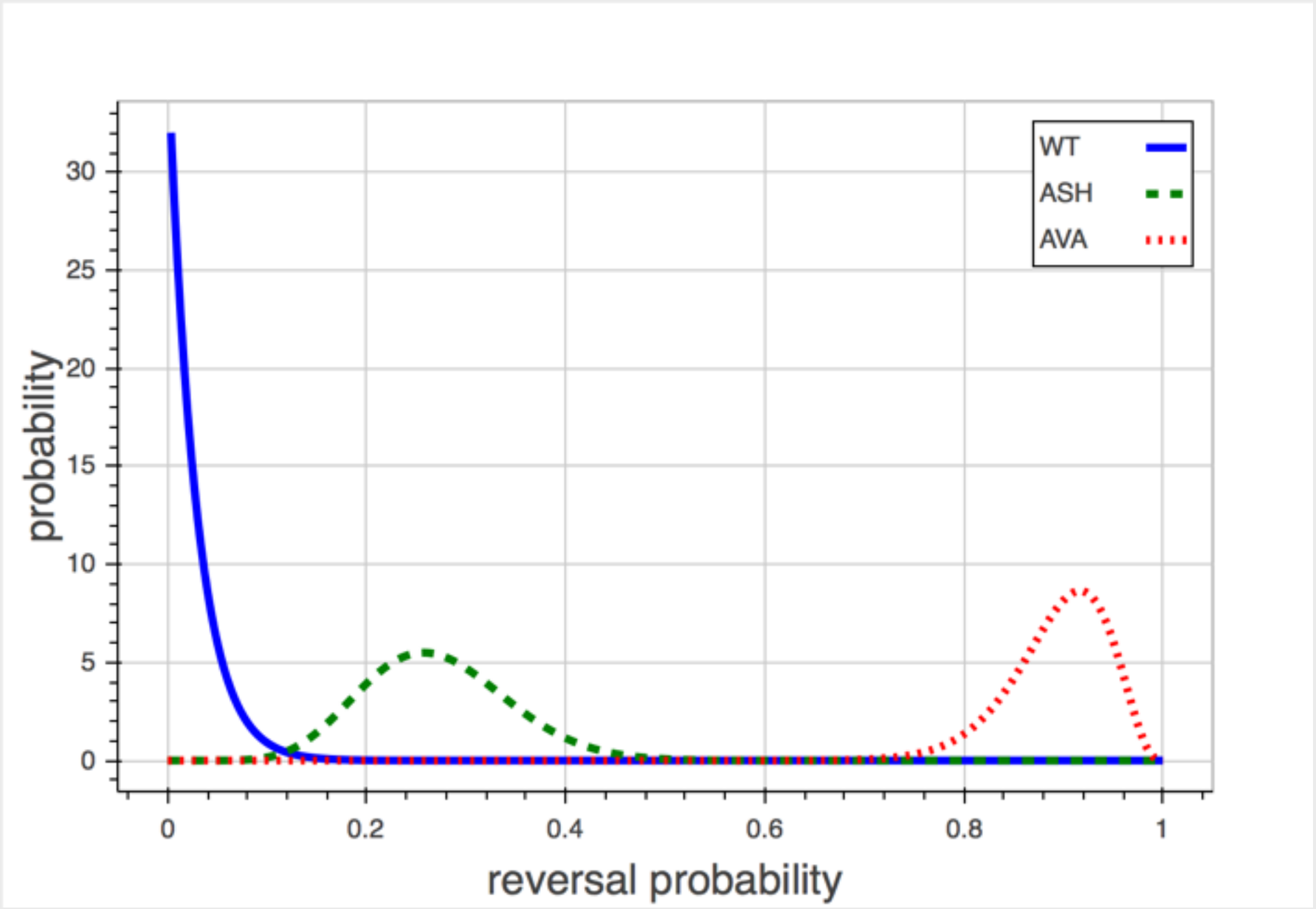


This is an ugly, noisy plot



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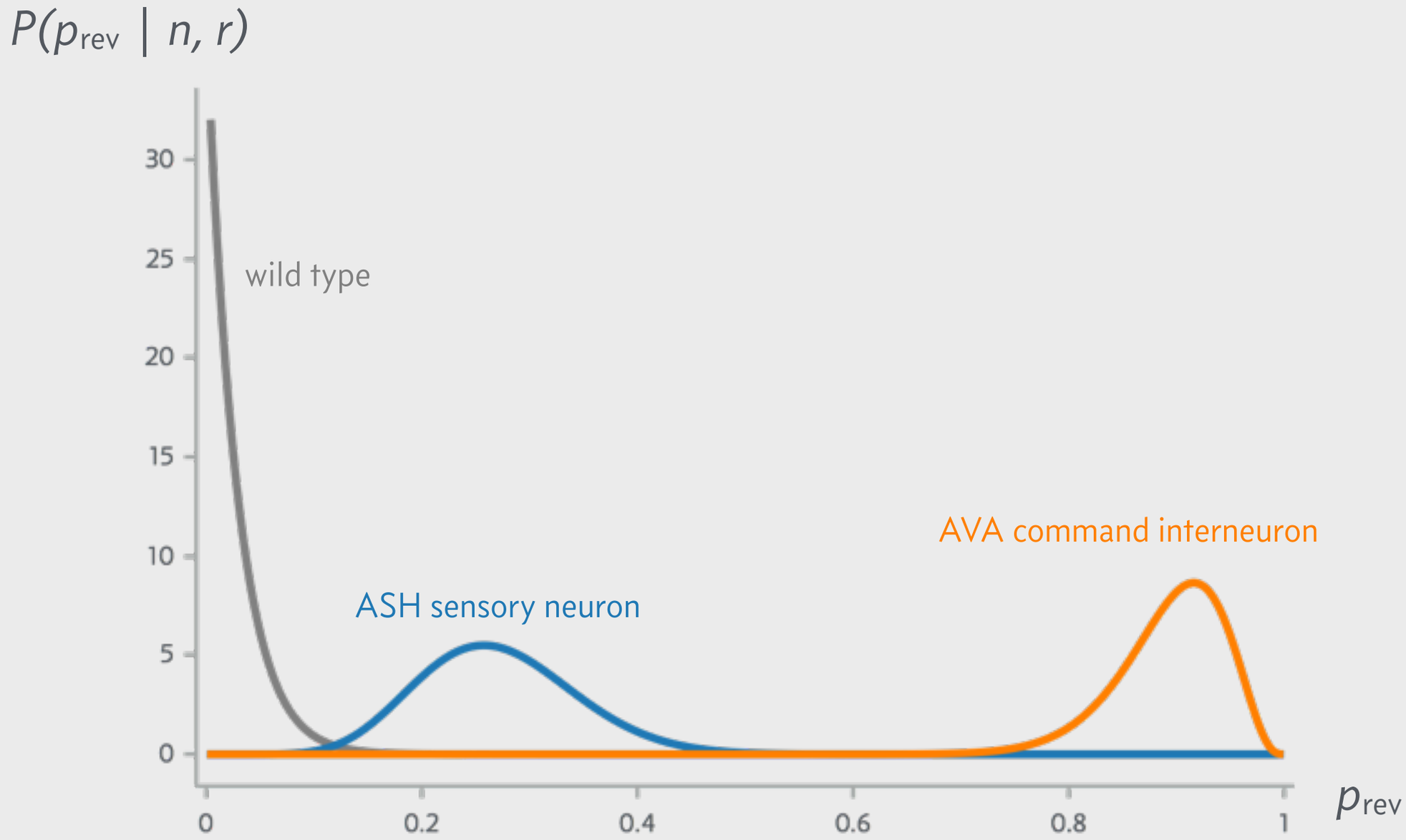
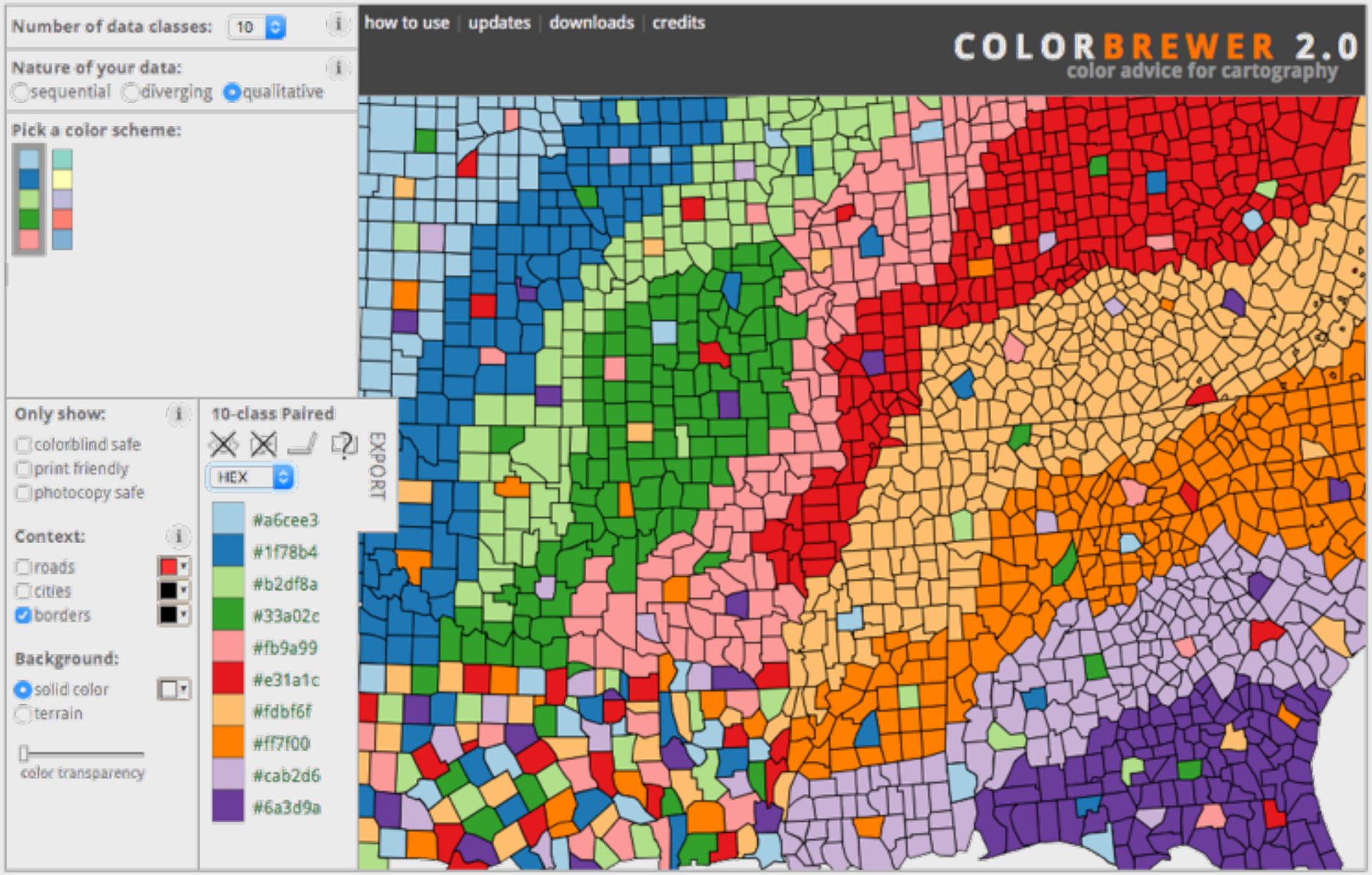


Let professionals pick your colors



Support
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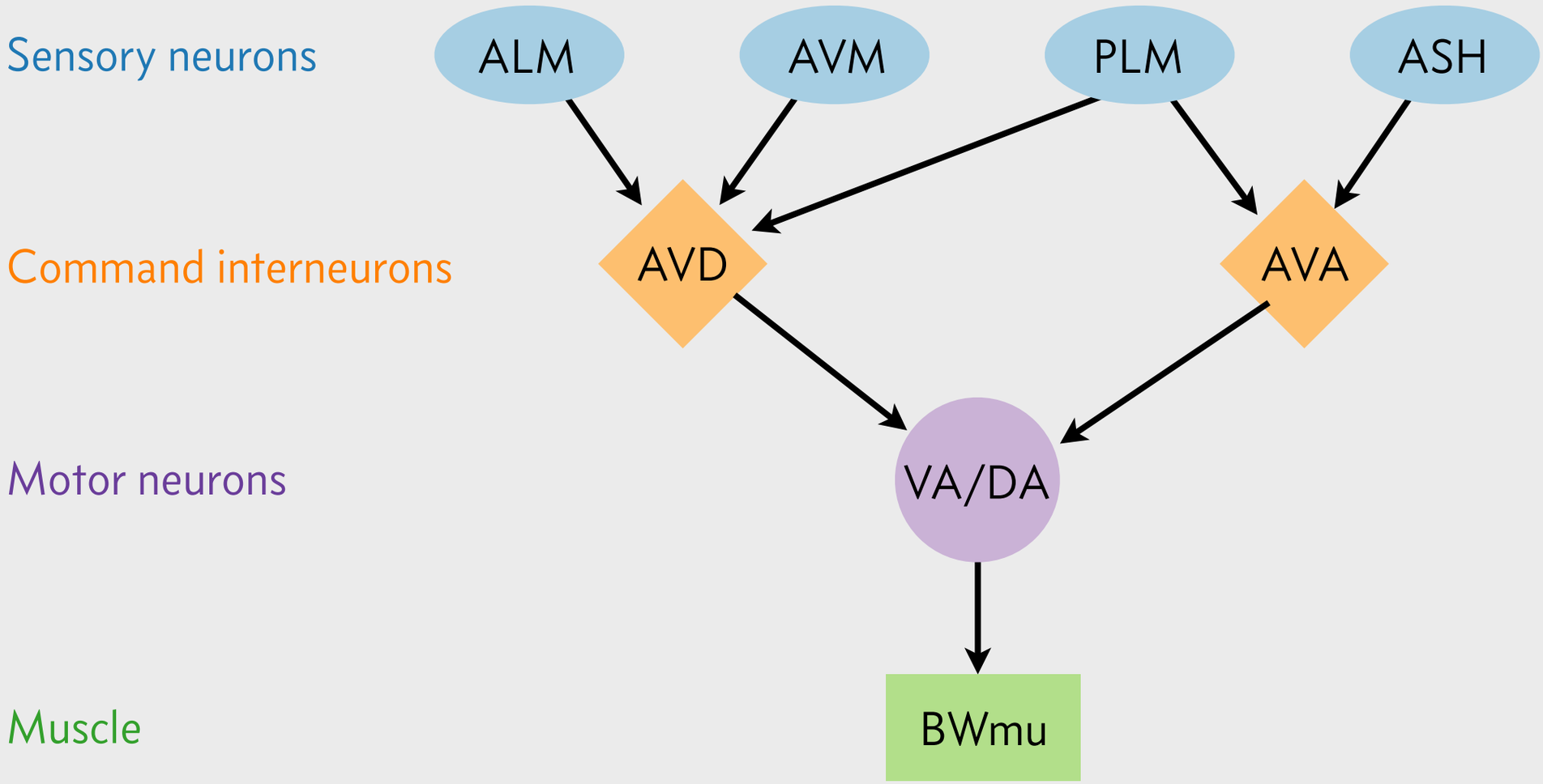
axismaps

The *C. elegans* reversal circuit is well-mapped and simple



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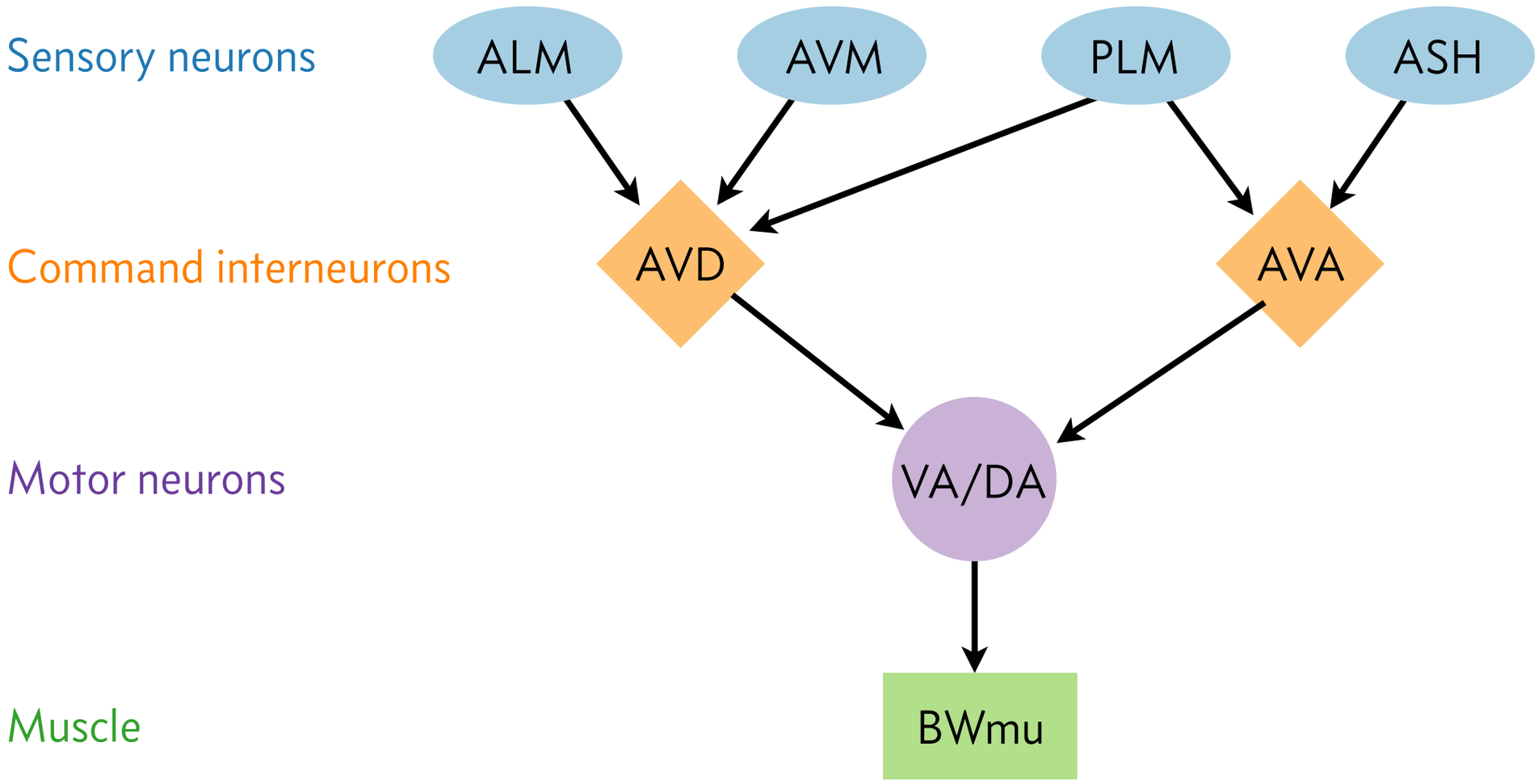


Adapted from WormAtlas

This equation is ok, but can be confusing and a little hard to read

$$P(p_{\text{rev}} \mid n, r) = \frac{P(n, r \mid p_{\text{rev}})\, P(p_{\text{rev}})}{P(n, r)}$$
$$= \frac{(n+1)!}{(n-r)!r!}\, p_{\text{rev}}^{r} (1 - p_{\text{rev}})^{n-r}$$

We use Bayes's theorem to quantify reversal probability

$$P(p_{\text{rev}} \mid n, r) = \frac{P(n, r \mid p_{\text{rev}})\, P(p_{\text{rev}})}{P(n, r)}$$

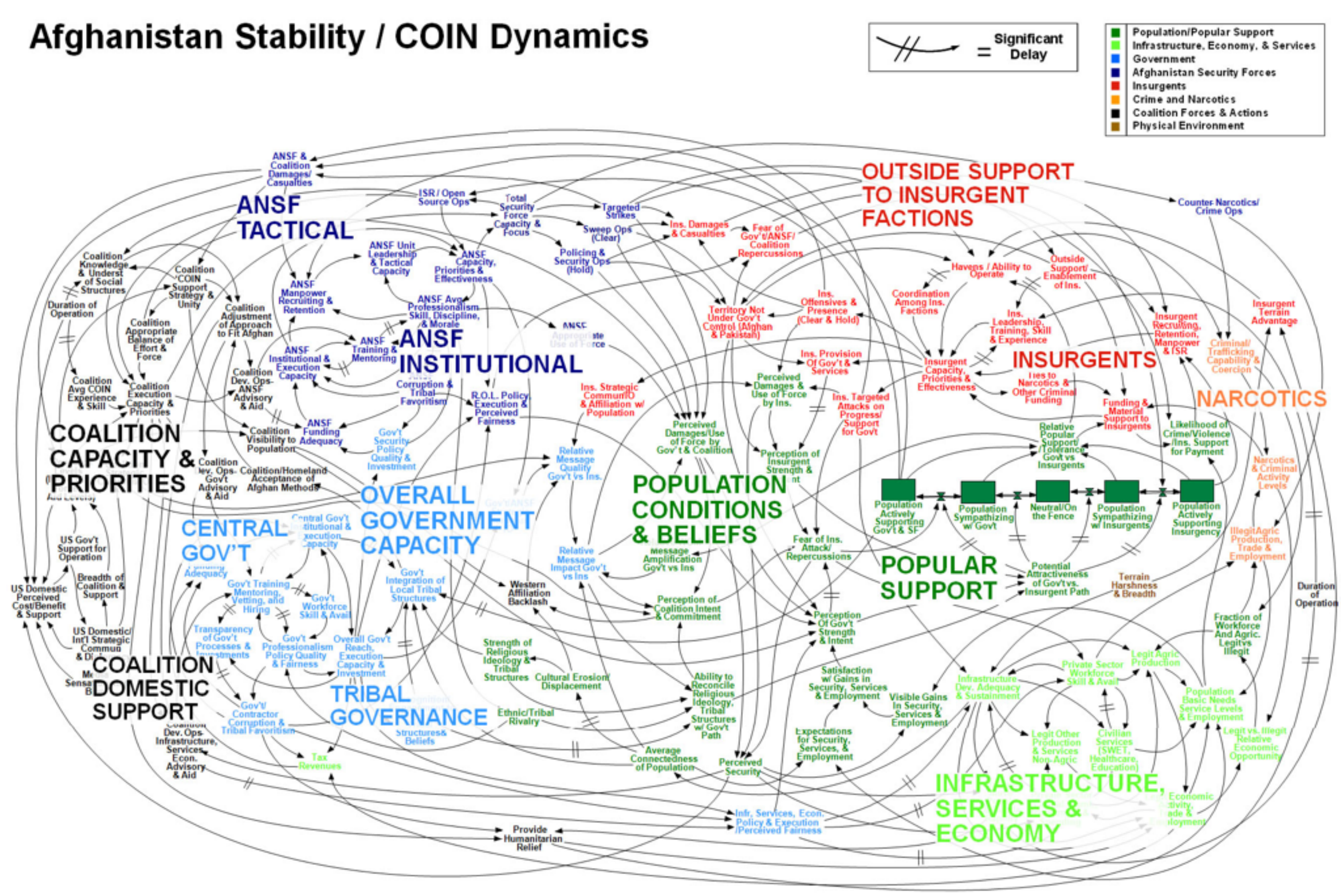
$$= \frac{\text{Binomial}(r \mid n, p_{\text{rev}}) \times \text{Uniform}(0, 1)}{\text{Uniform}(0, n{+}1)}$$

p_{rev} = probability of reversal

n, r = r reversals in n trials

Why is General McChrystal so angry?

Afghanistan Stability / COIN Dynamics



WORKING DRAFT – V3

Why is General McChrystal so angry?

When we understand that slide,
we'll have won the war.

—Gen. Stanley McChrystal

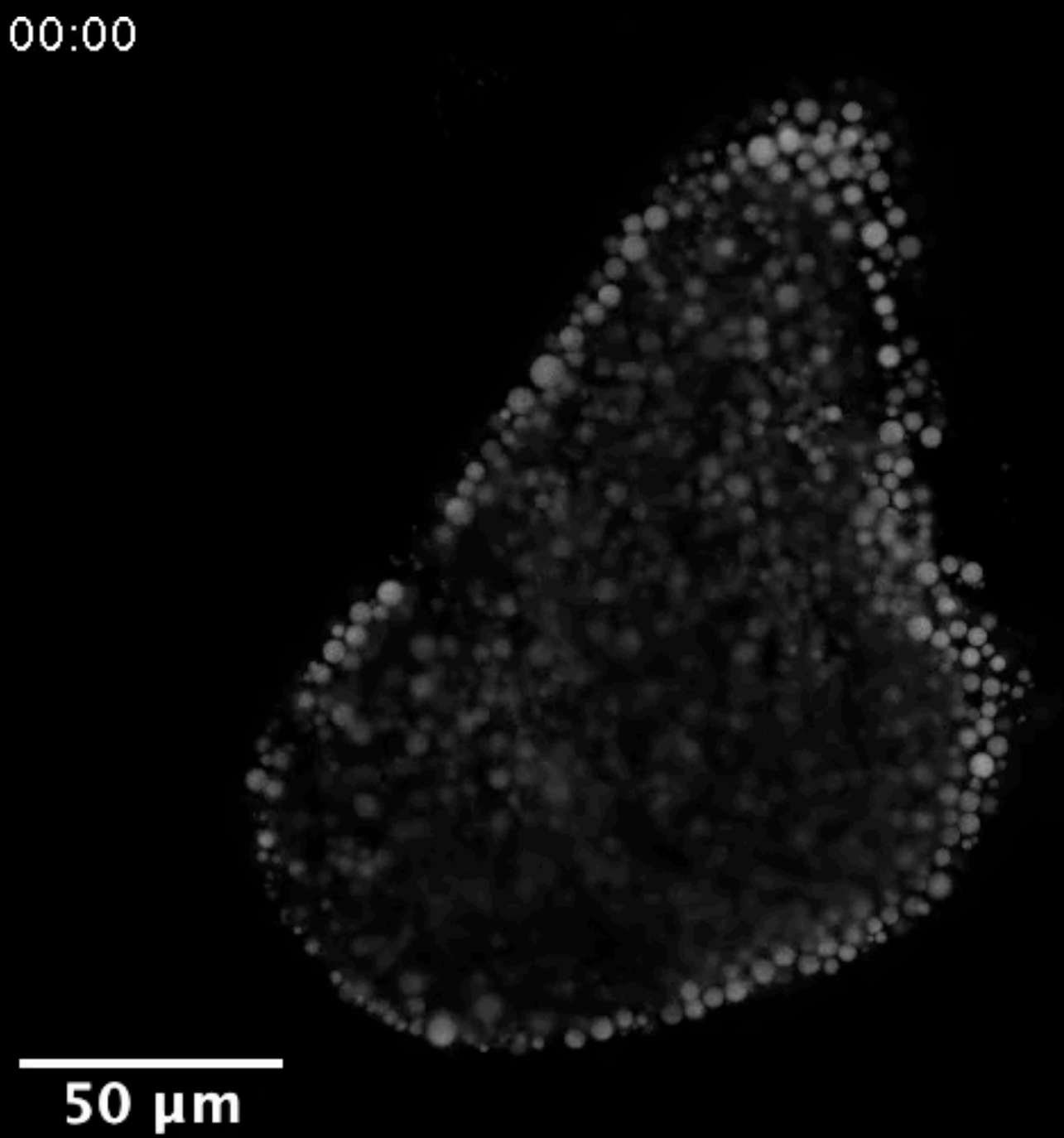
General Mattis is more blunt

PowerPoint makes us stupid.

—Gen. James Mattis

(paraphrased from Edward Tufte)

Stage 11 oocytes exhibit fast streaming



Stage 11 oocytes exhibit fast streaming