

4+



WARNING:
CHOKING HAZARD - Toy contains a small ball
and small parts. Not for Children under 3 years.

DRAGON BALL Z

FULLY
ARTICULATED
ENTIÈREMENT ARTICULÉS
TOTALMENTE ARTICULADO



AVERTISSEMENT:
RISQUE DE SUFFOCATION - Le jouet contient une petite balle
et de petites pièces. Non recommandé pour les enfants de moins de 3 ans.

ADVERTENCIA:
PELIGRO DE ASFIXIA - El juguete contiene una pequeña pelota y
partes pequeñas. No se recomienda para niños menores de 3 años de edad.

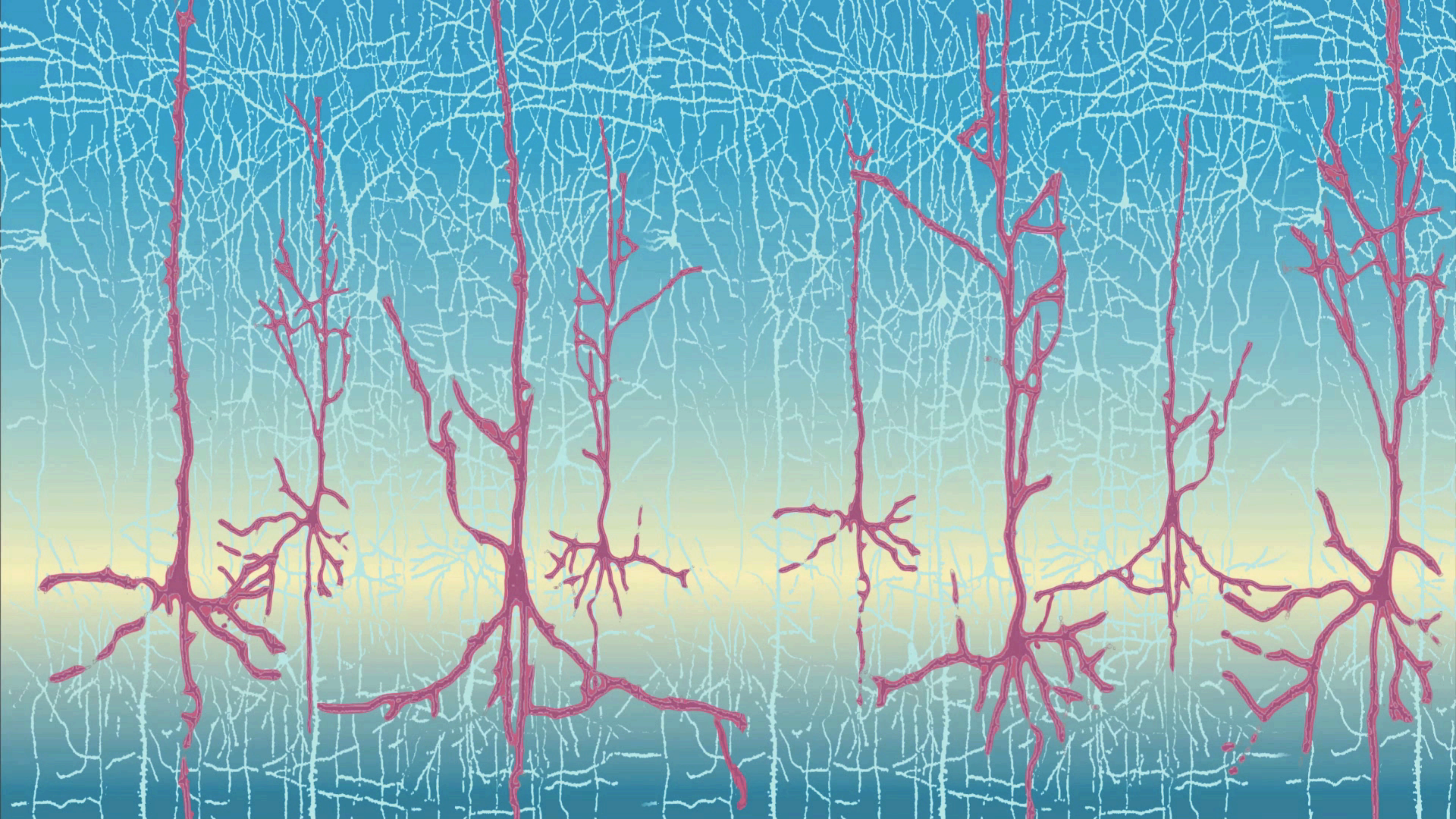


optogenetics

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4 6 8	9	6 3	2	4 3	5	1	7	
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5	9	4	6 8 3	3 6	7	2 3	6 8 9	
2 3 3	7	8	6 9 3	1	2 9 3	3 2 9	5	4 6
1 3 2	1 3 4	6	3 1 9 5	5 4 3	4 9 2 8	3 9 3 9	7	4 8
9	6	5	4	8	1	7	3	2
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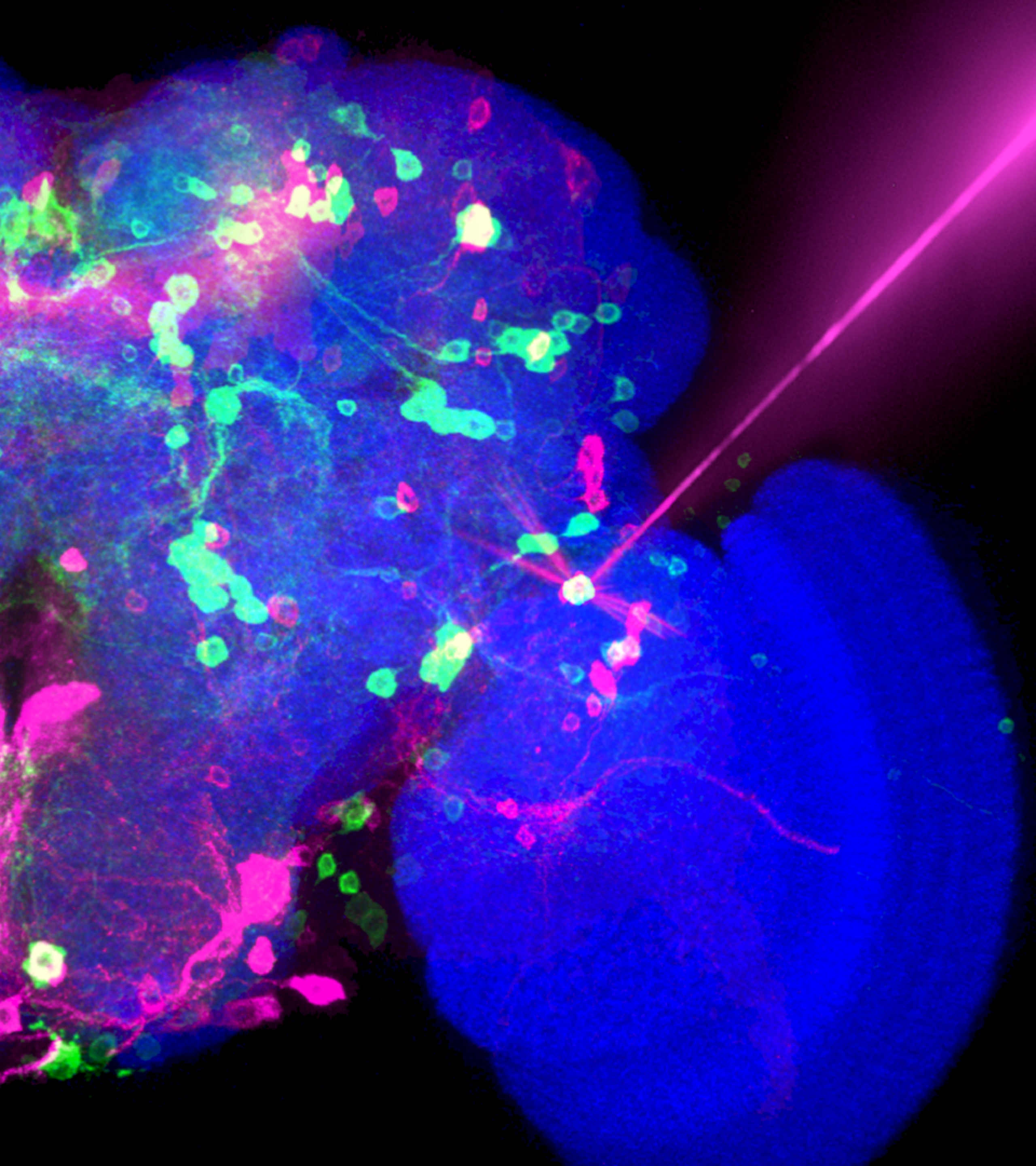




Causes

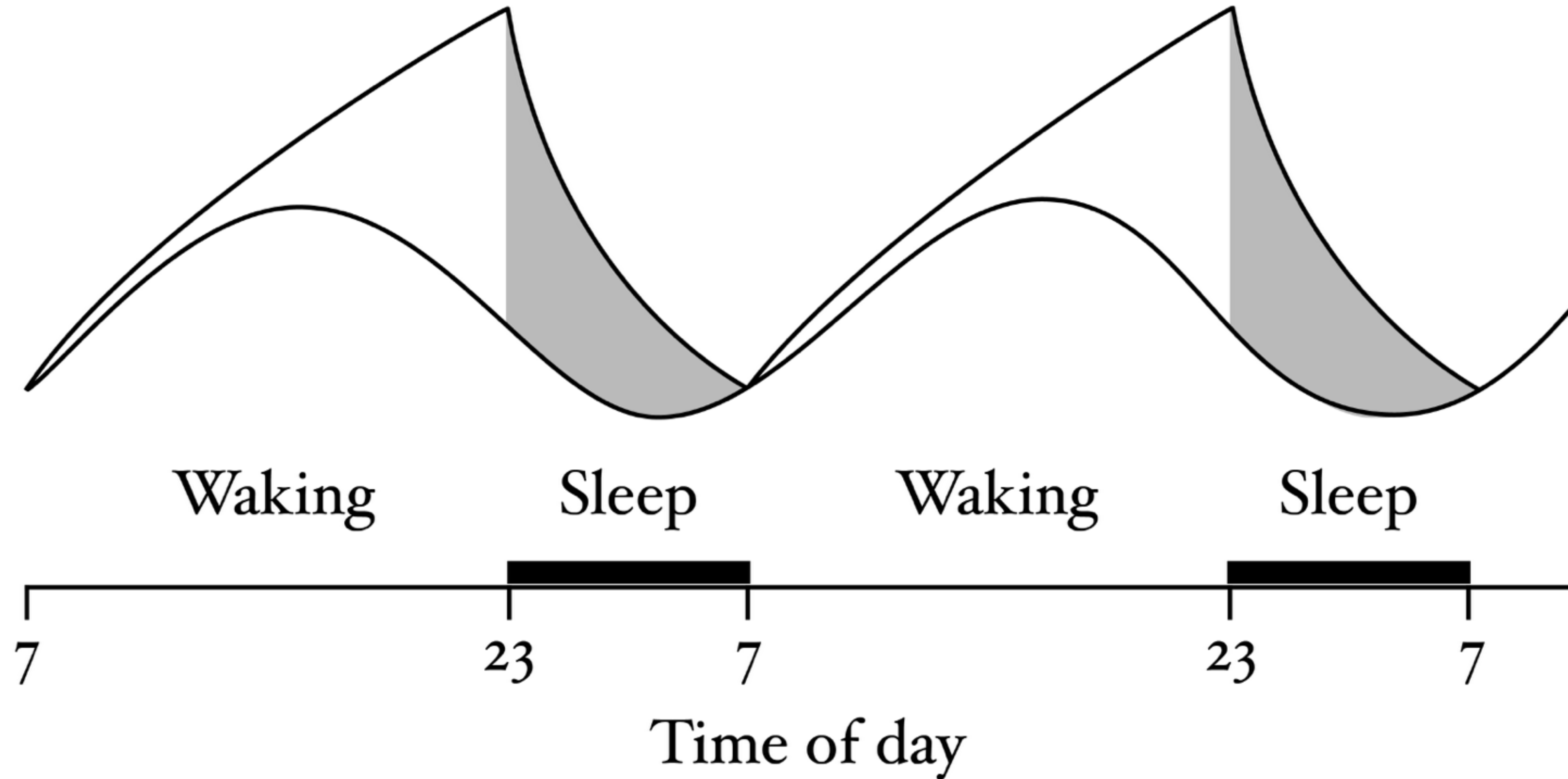
Causes, Connections

Causes, Connections, Mechanisms



Light Sleep

Circadian and Homeostatic Sleep Regulation



Proc. Nat. Acad. Sci. USA

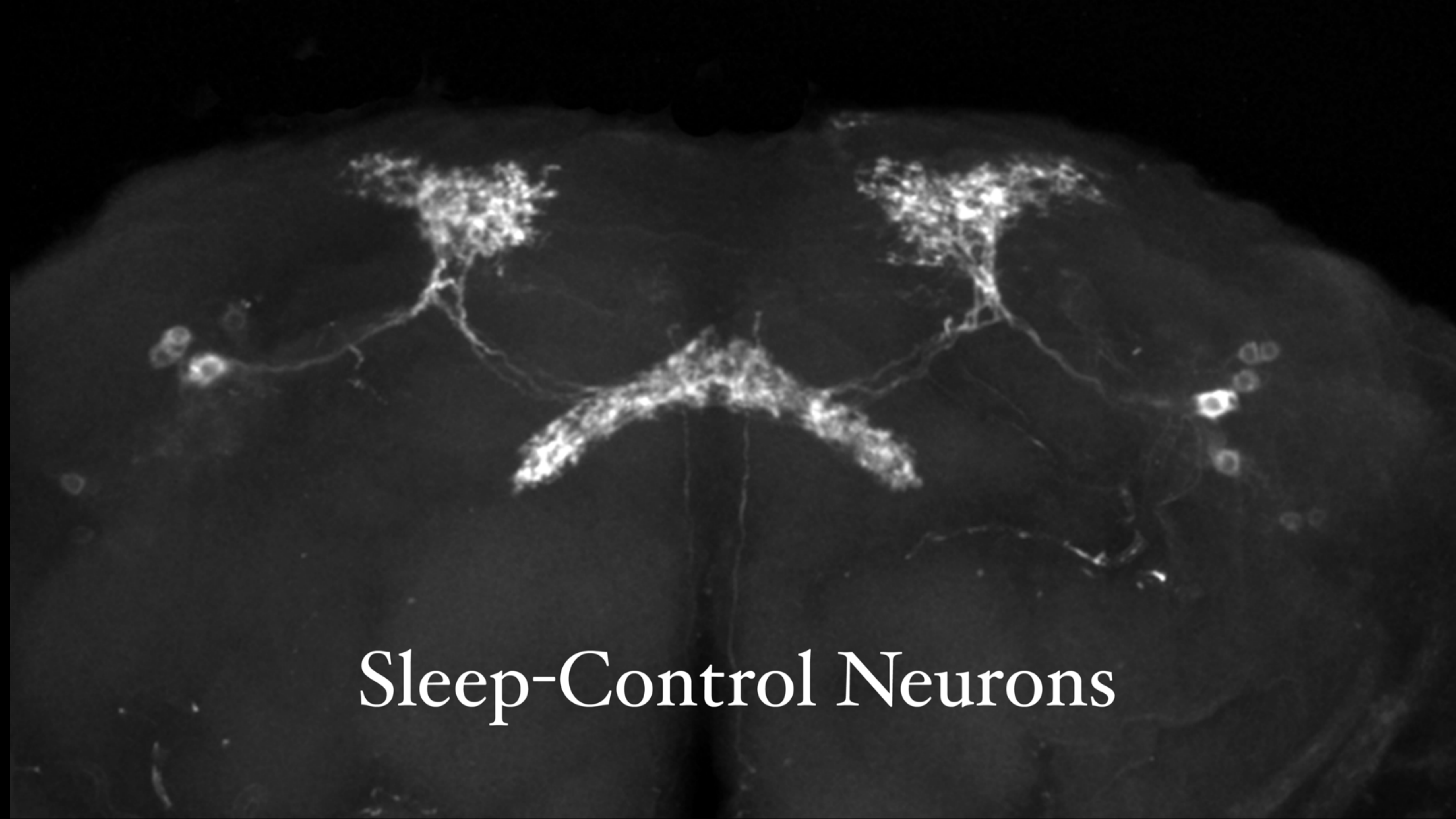
Vol. 68, No. 9, pp. 2112-2116, September 1971

Clock Mutants of *Drosophila melanogaster*

RONALD J. KONOPKA AND SEYMOUR BENZER

Division of Biology, California Institute of Technology, Pasadena, Calif. 91109

ABSTRACT Three mutants have been isolated in which the normal 24-hour rhythm is drastically changed. One mutant is arrhythmic; another has a period of 19 hr; a third has a period of 28 hr.

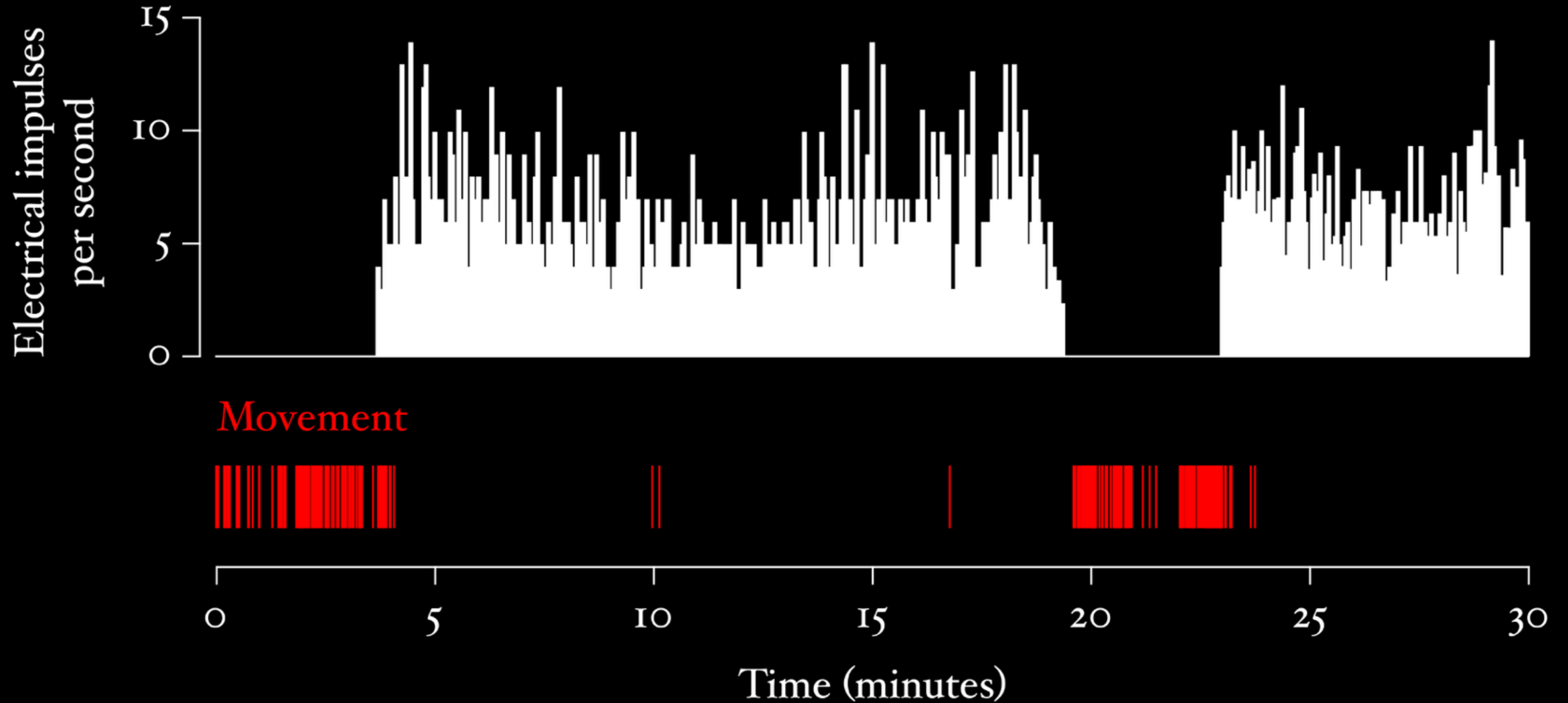


Sleep-Control Neurons

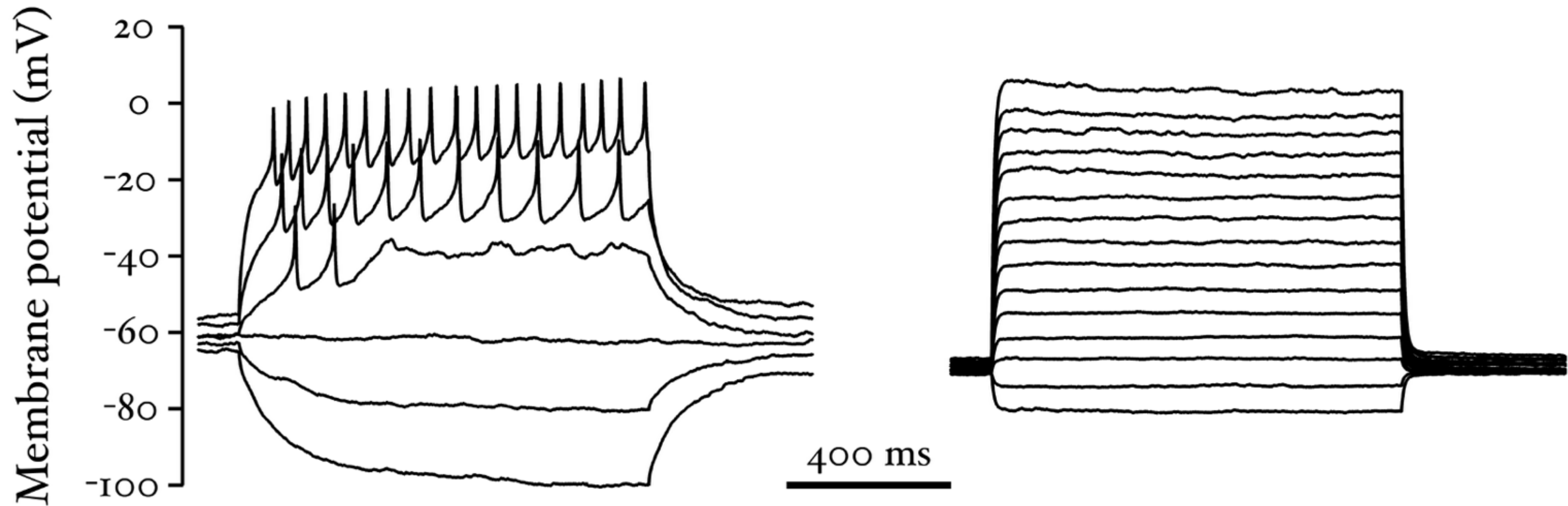
Causes, *Connections, Mechanisms*



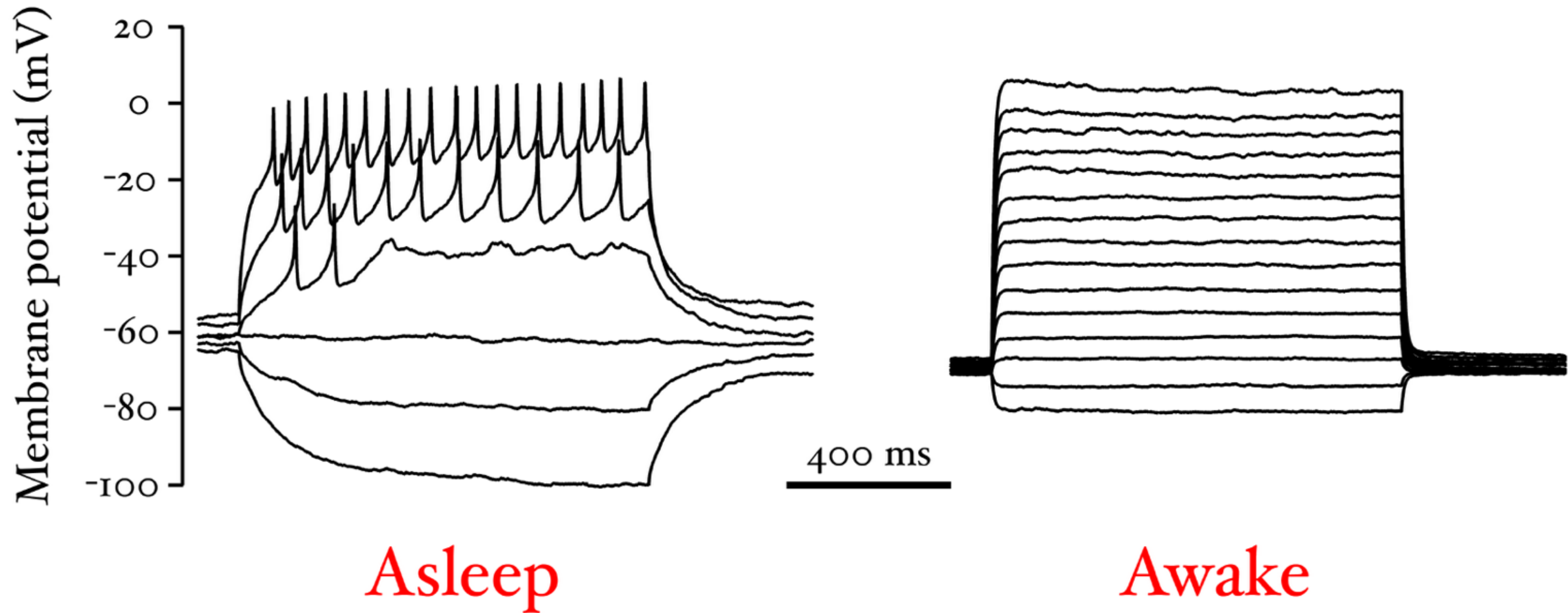
Controlling Sleep-Control Neurons



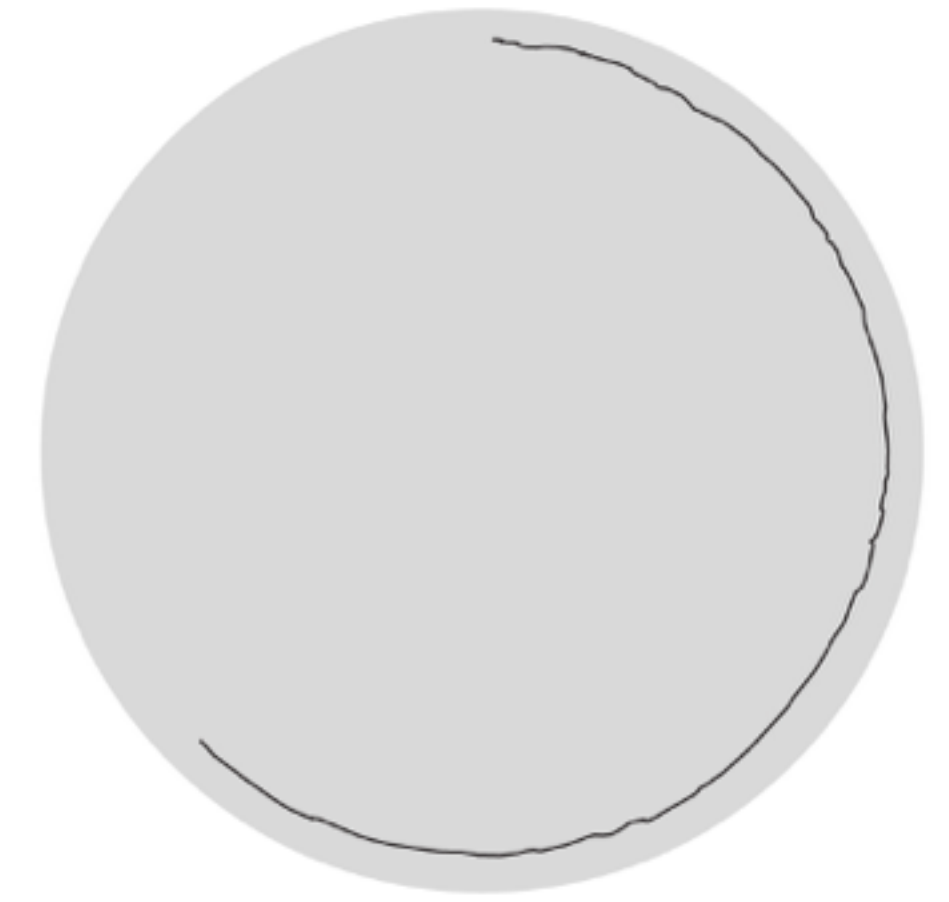
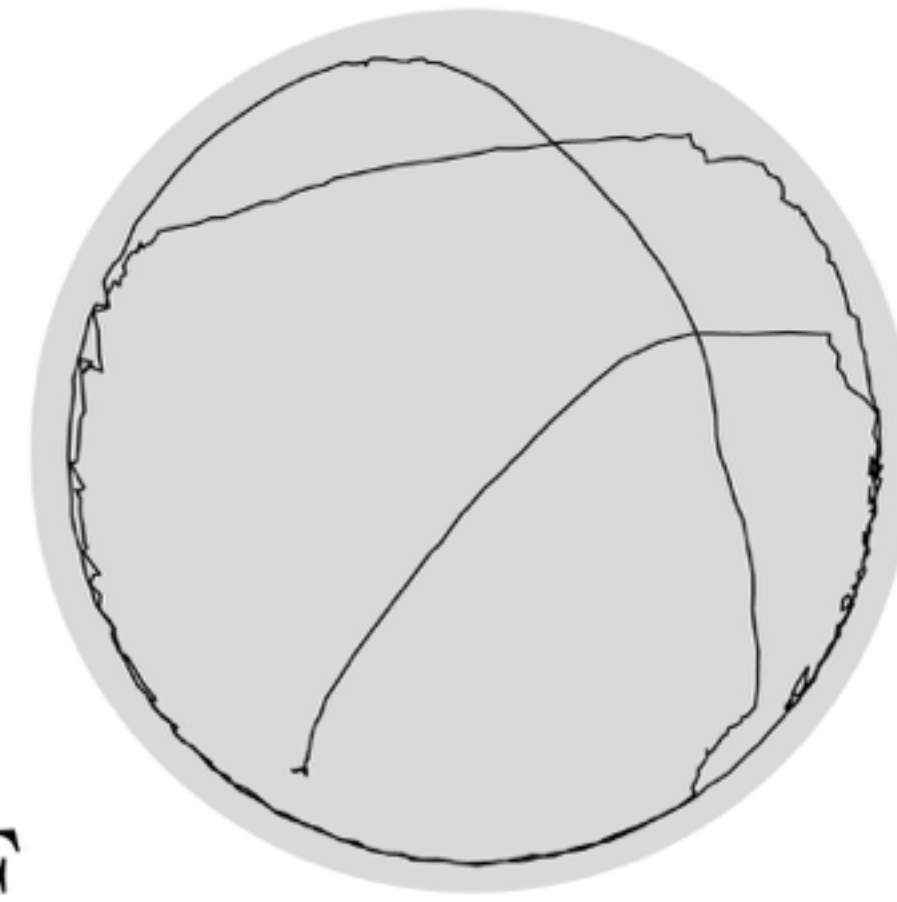
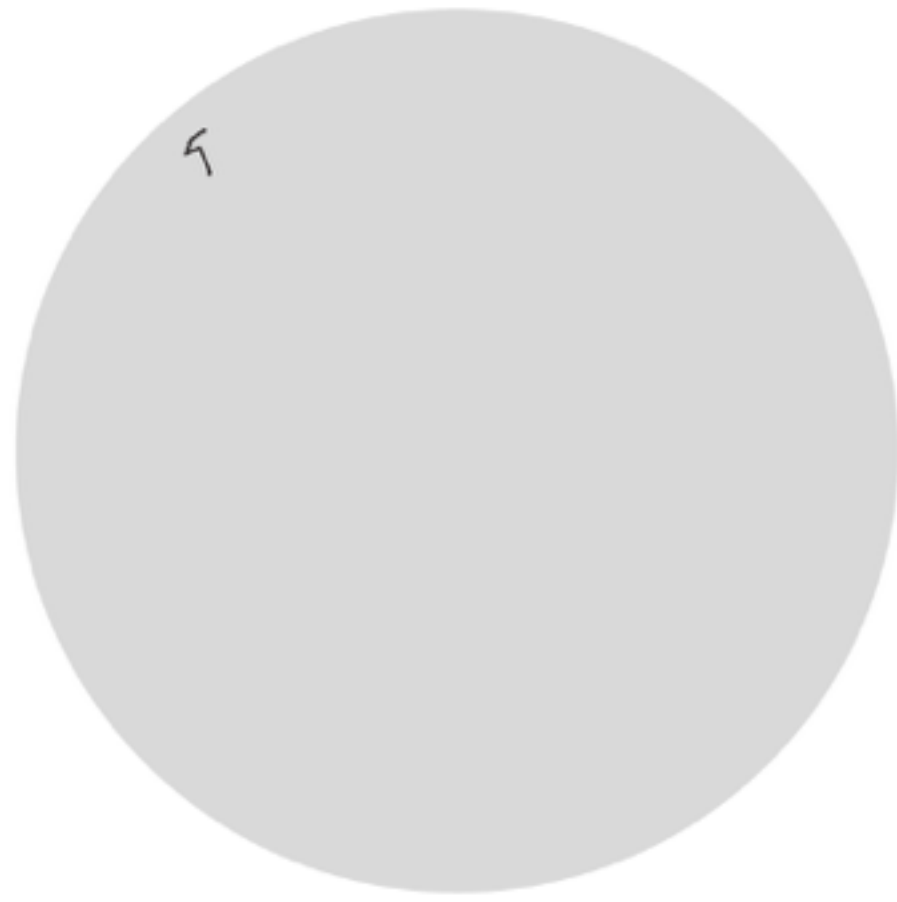
Sleep-Control Neurons Can Be Electrically Active or Silent



Sleep-Control Neurons Can Be Electrically Active or Silent



Dopamine: An 'Upper' Also for Flies



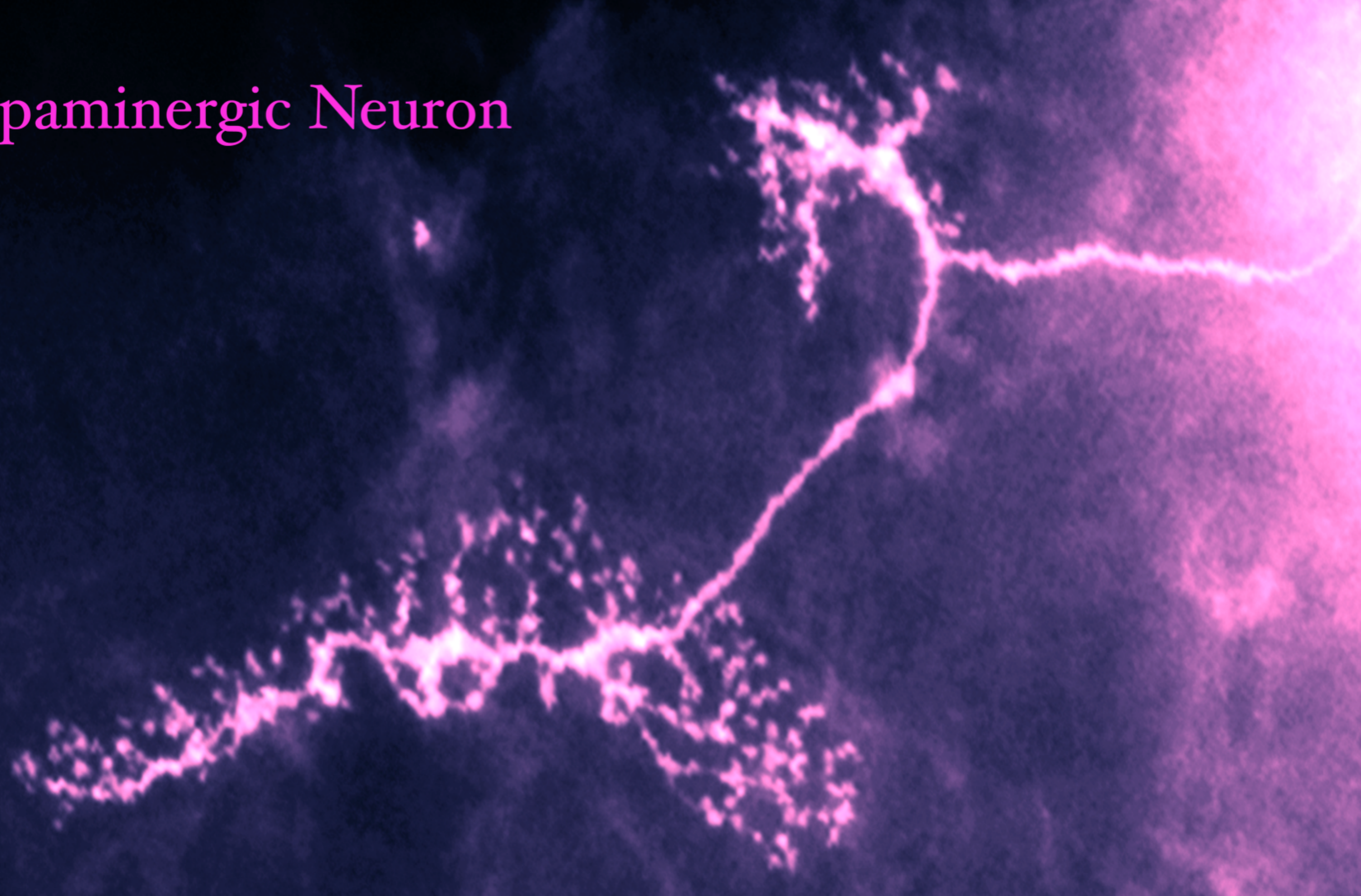
OFF

dopaminergic system

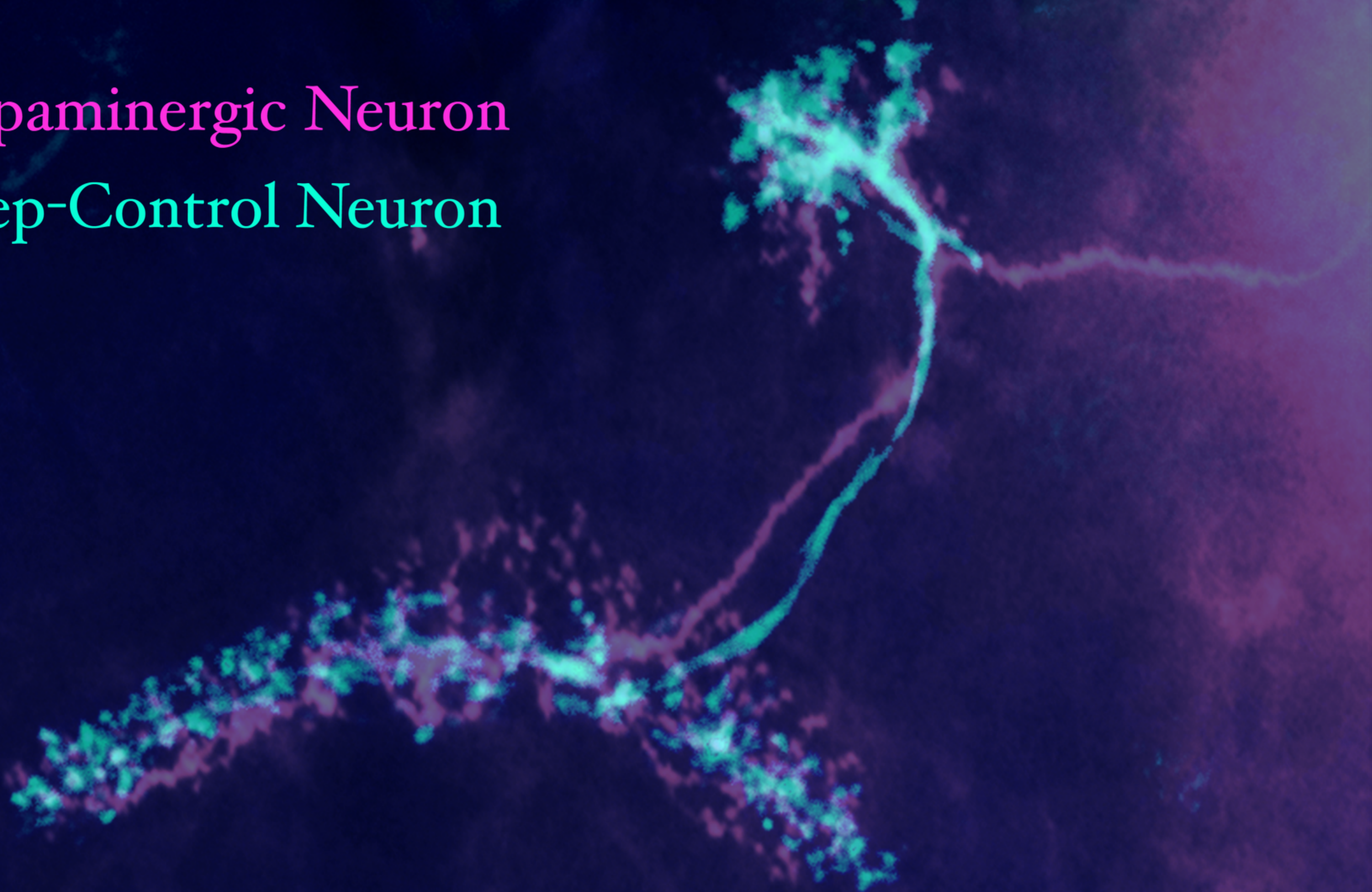
ON



A Dopaminergic Neuron



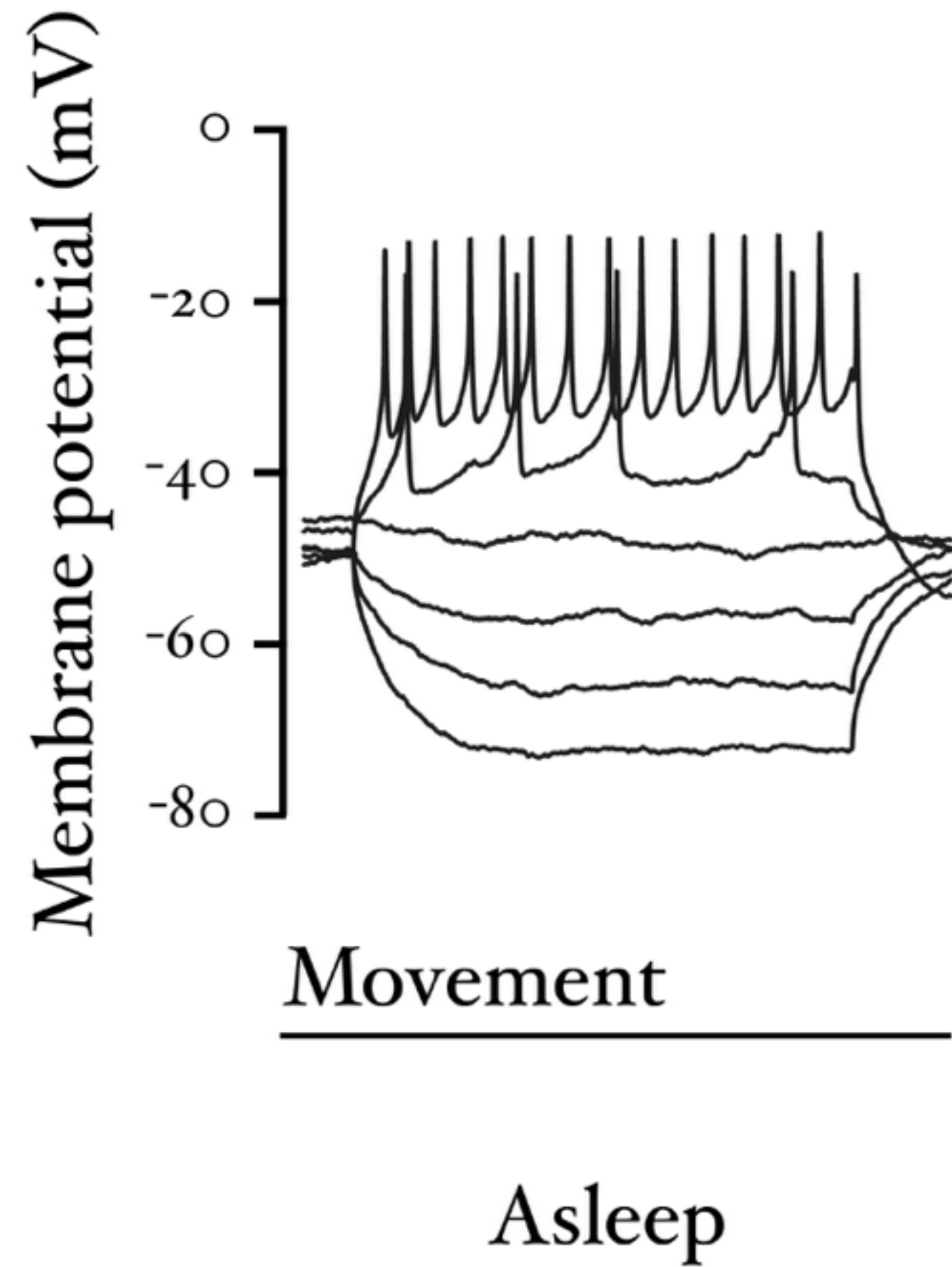
A Dopaminergic Neuron
A Sleep-Control Neuron



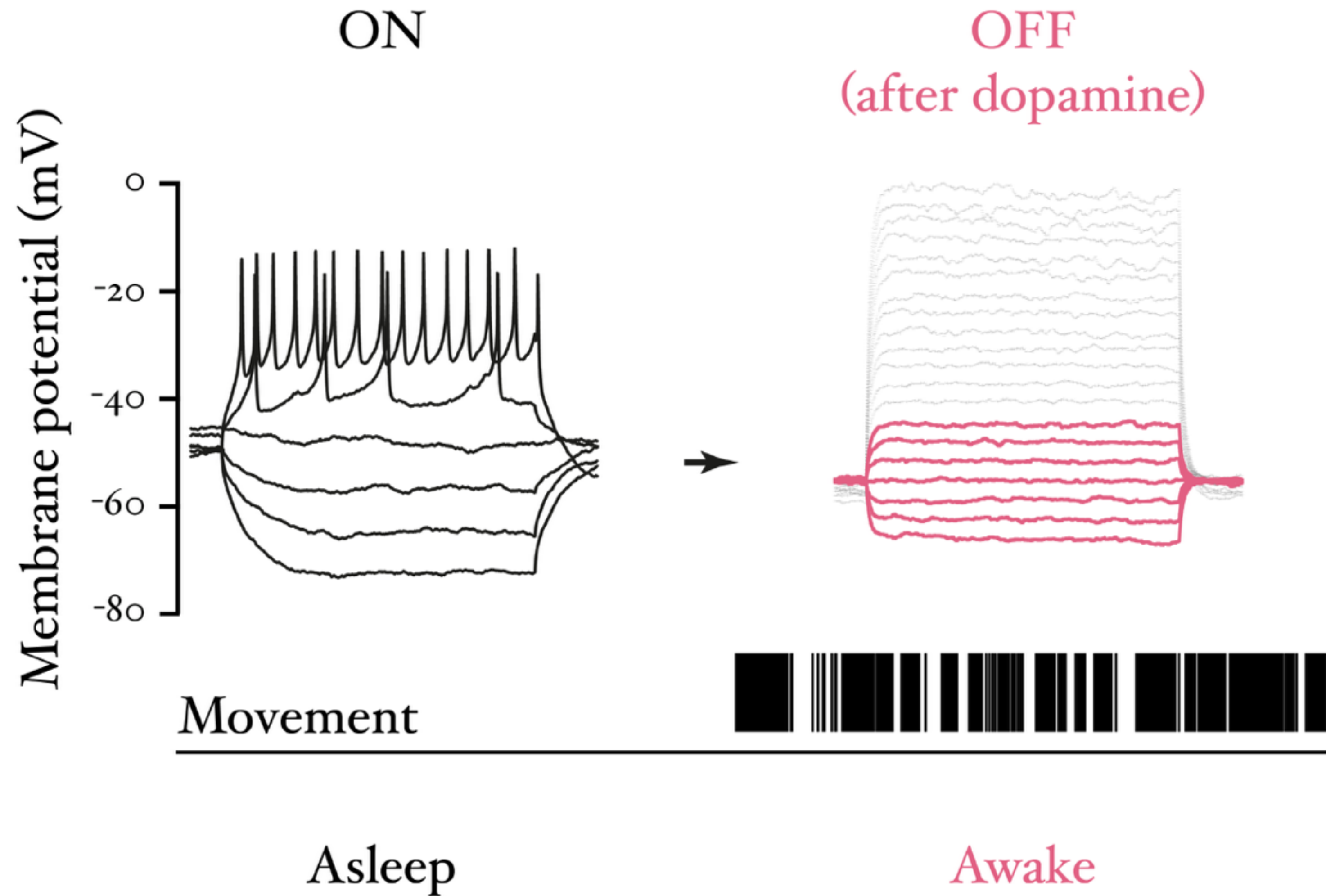
Causes, **Connections**, Mechanisms

Dopamine Flips the Sleep Switch

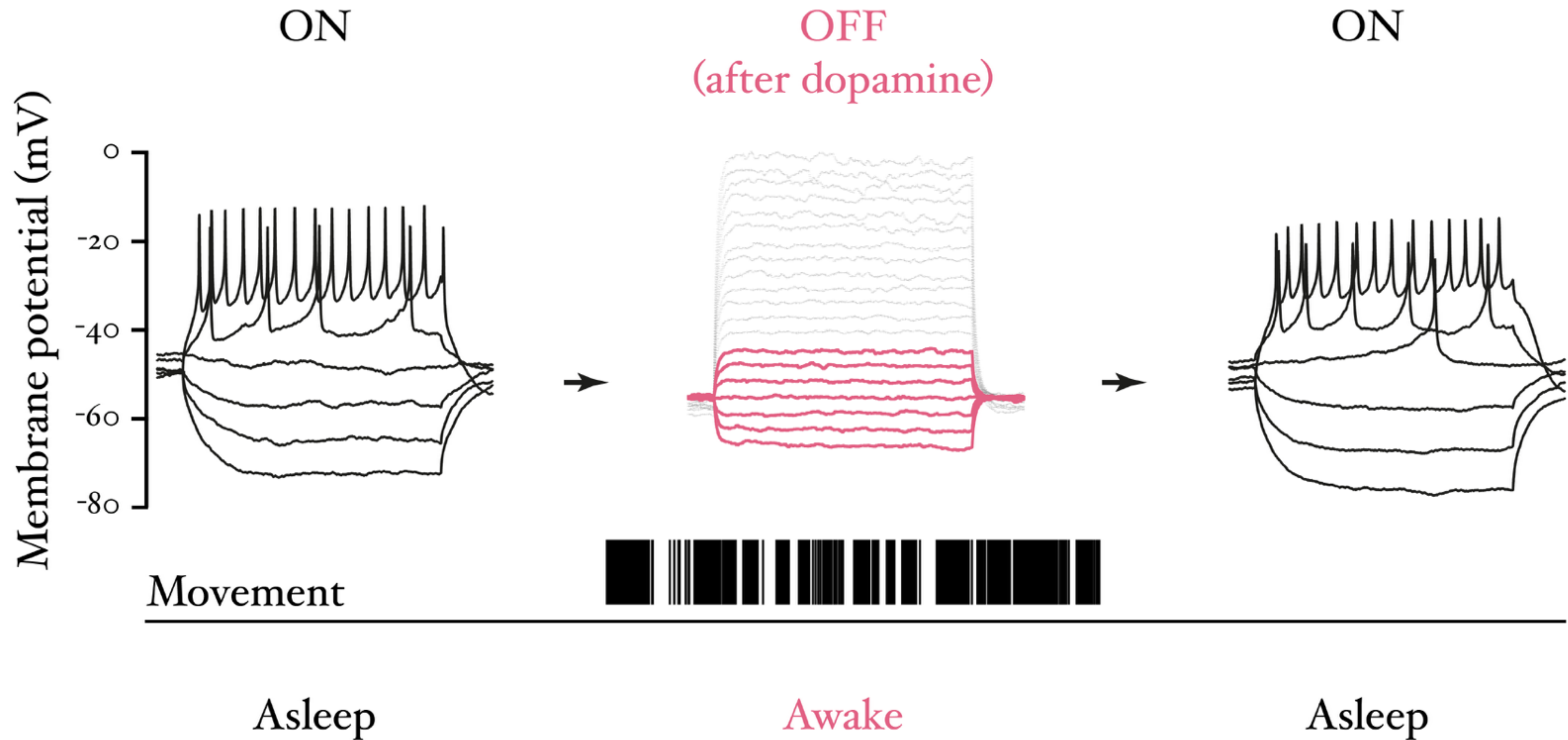
ON



Dopamine Flips the Sleep Switch



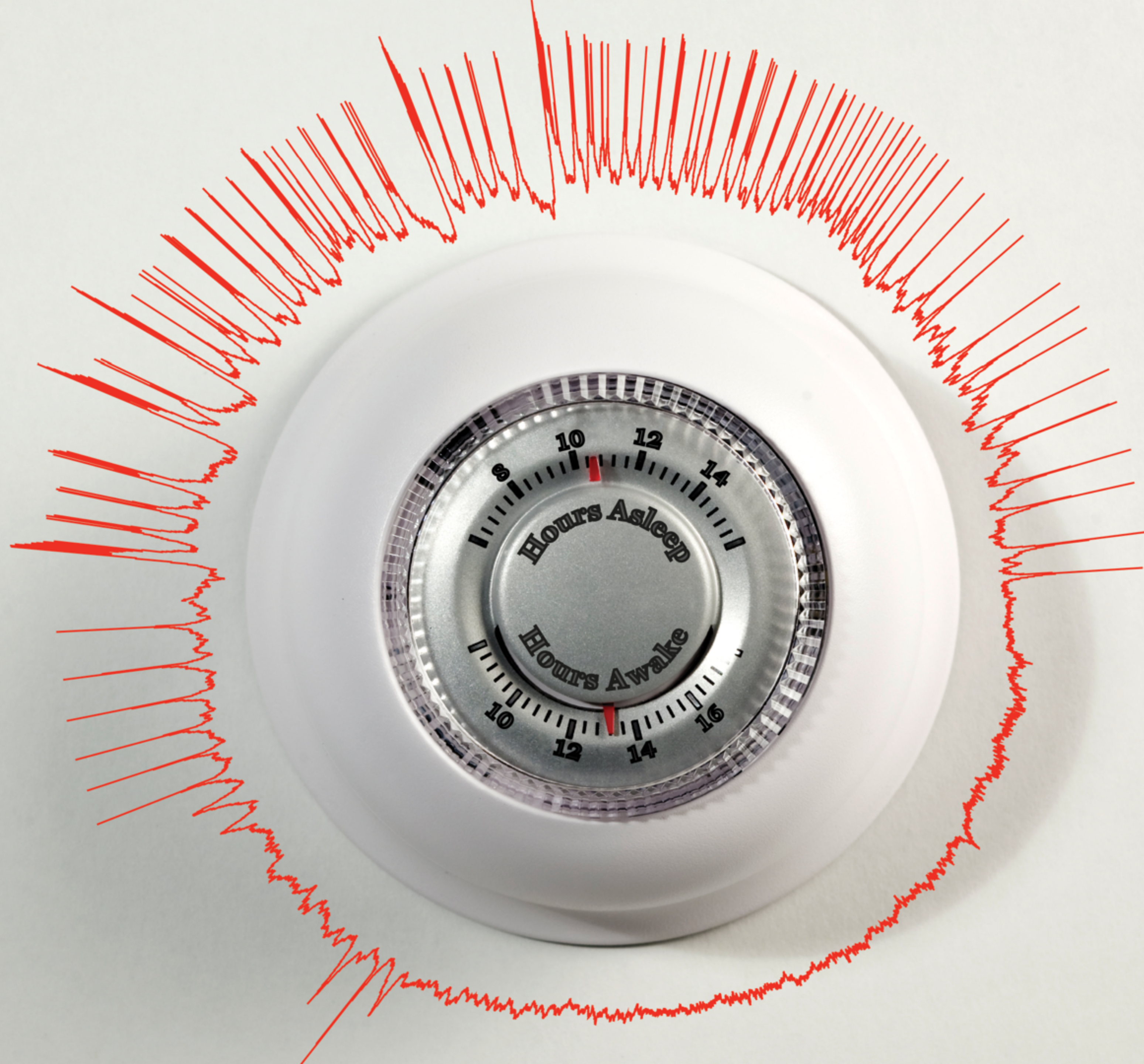
Dopamine Flips the Sleep Switch



Causes, Connections, Mechanisms



ON



Francis Crick (1999)

The impact of molecular biology on neuroscience.

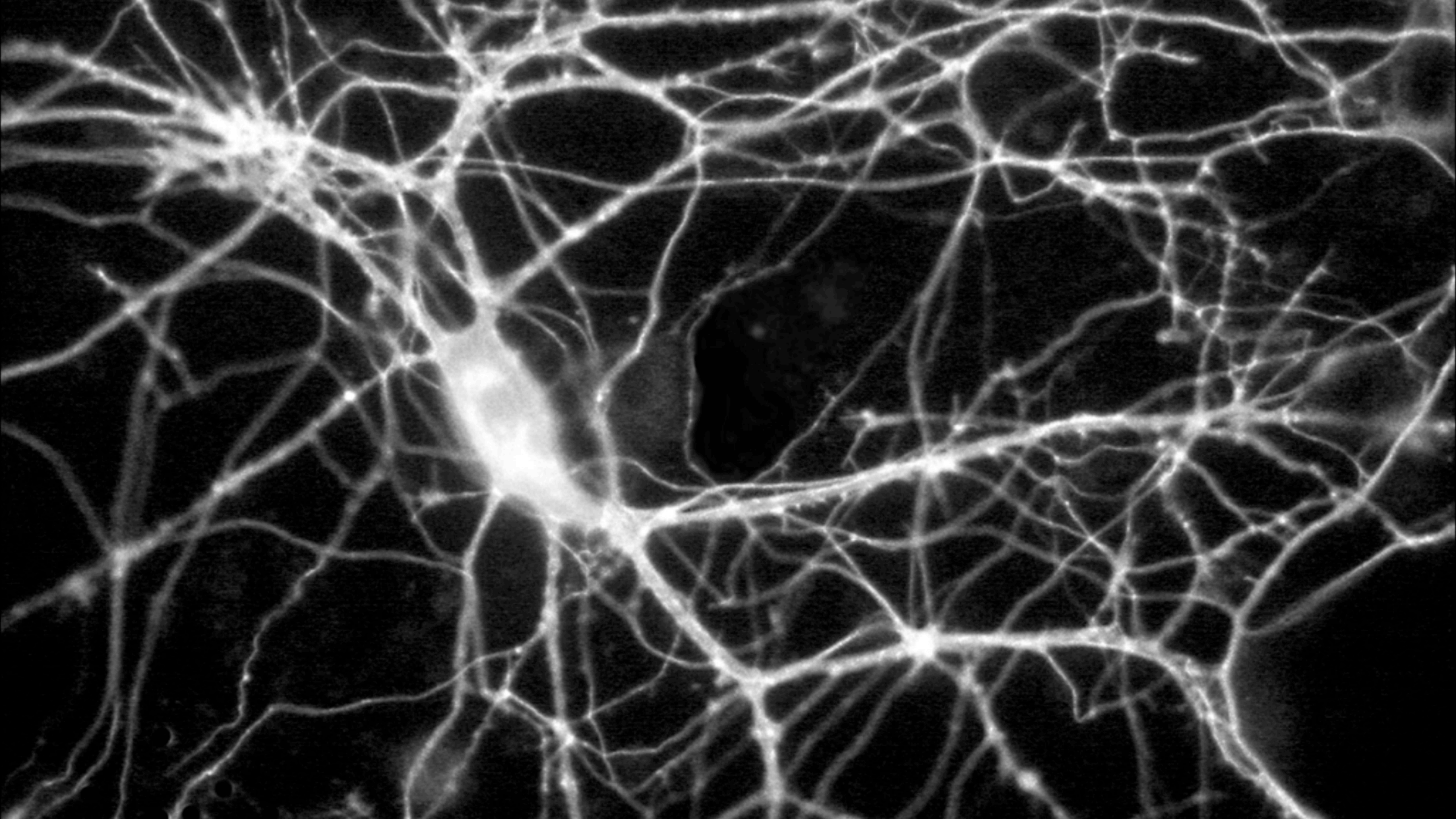
Phil Trans R Soc Lond B 354: 2021

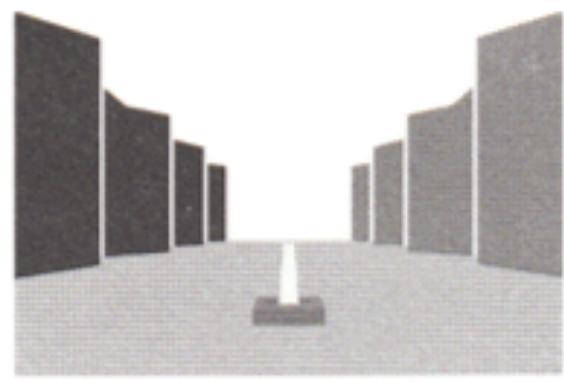
The next requirement [for understanding the brain] is to be able to turn the firing of one or more types of neuron on or off in a rapid manner in the behaving animal. The ideal signal would be light. This seems rather far-fetched but it is conceivable that molecular biologists could engineer a particular cell type to be sensitive to light in this way.

Francis Crick (1999)

The impact of molecular biology on neuroscience.

Phil Trans R Soc Lond B 354: 2021





THE SALK INSTITUTE

Francis Crick, Ph.D.
Kieckhefer Distinguished Research Professor

December 14, 2001

Dear Dr. Miesenböck,

I read the paper you sent me with great interest. I am excited to see that the system already works, at least to some extent.

However I realize, as you do, that it still needs improvement, and that this will take further work. So this is just to encourage you to keep on with your efforts.

I look forward to hearing how your experiments progress.

Yours sincerely,

Francis Crick