Step current response of the HH Model

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A constant current applied to the HH model produces a train of action potentials.

HH Model Step Current Response

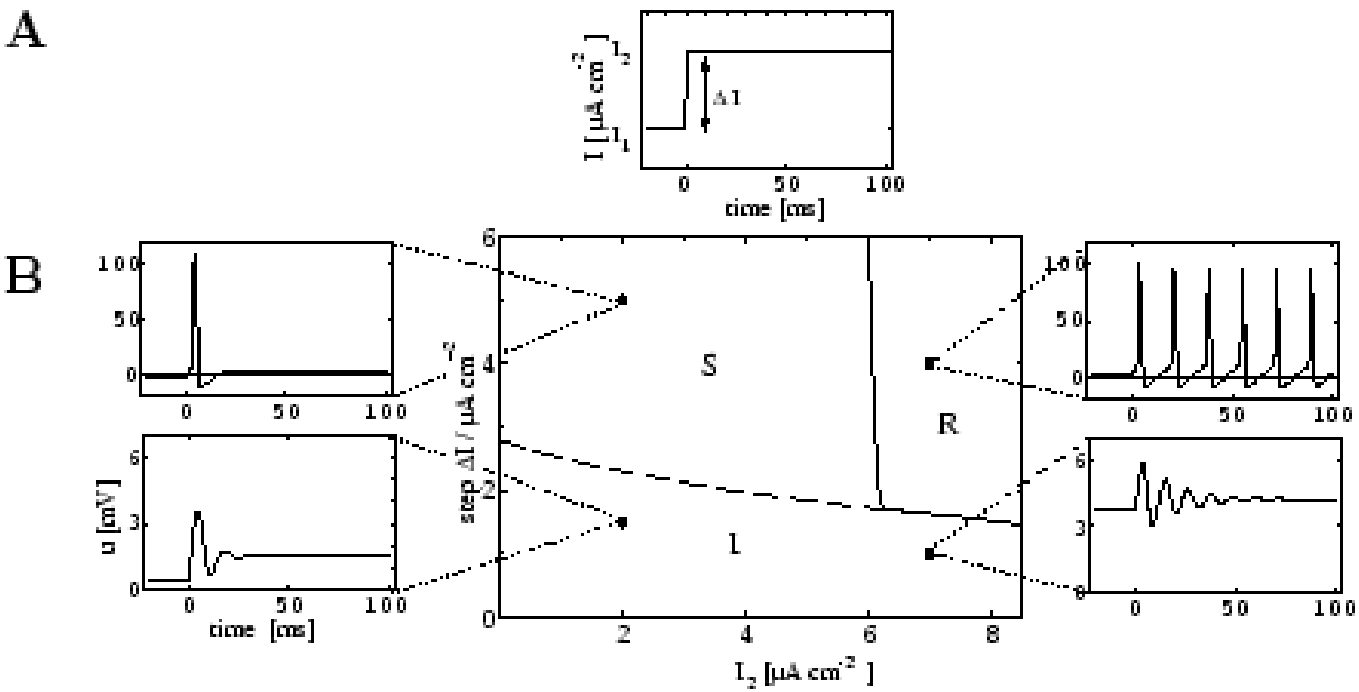

Figure: Step Current Stimulation Phase diagram

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Applications: Refractory Period

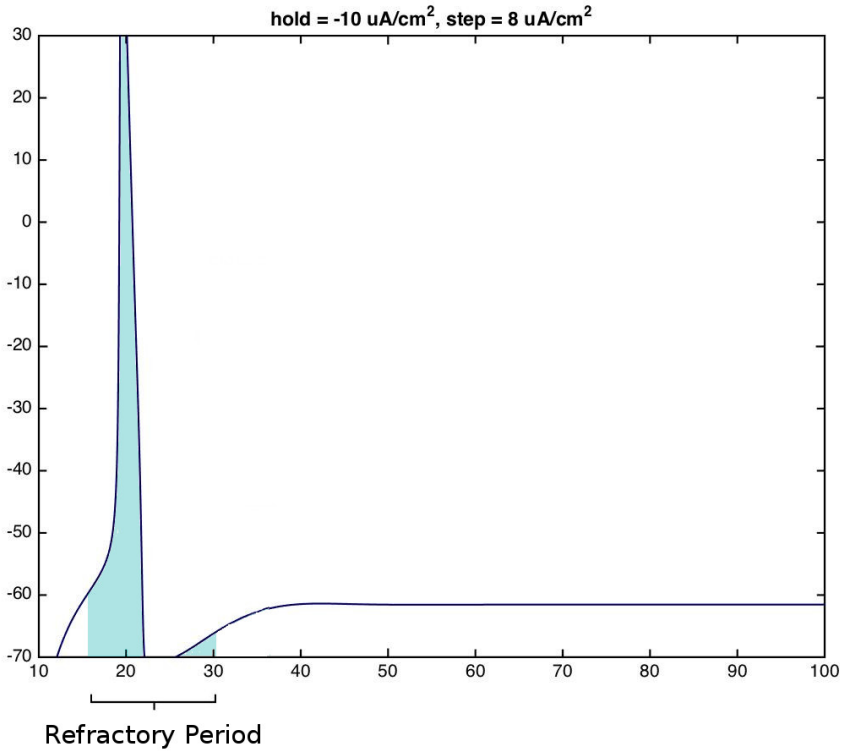


Figure: Reducing the Refractory Period can lead to faster reflexes.

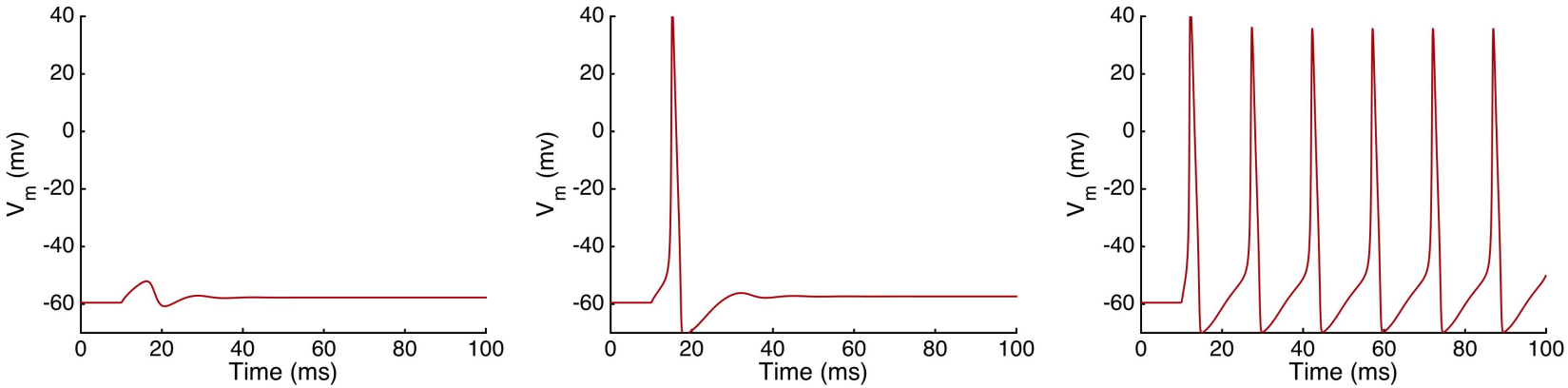


Figure: Response in the *Ringing*, *Single AP* and *AP Train* regions

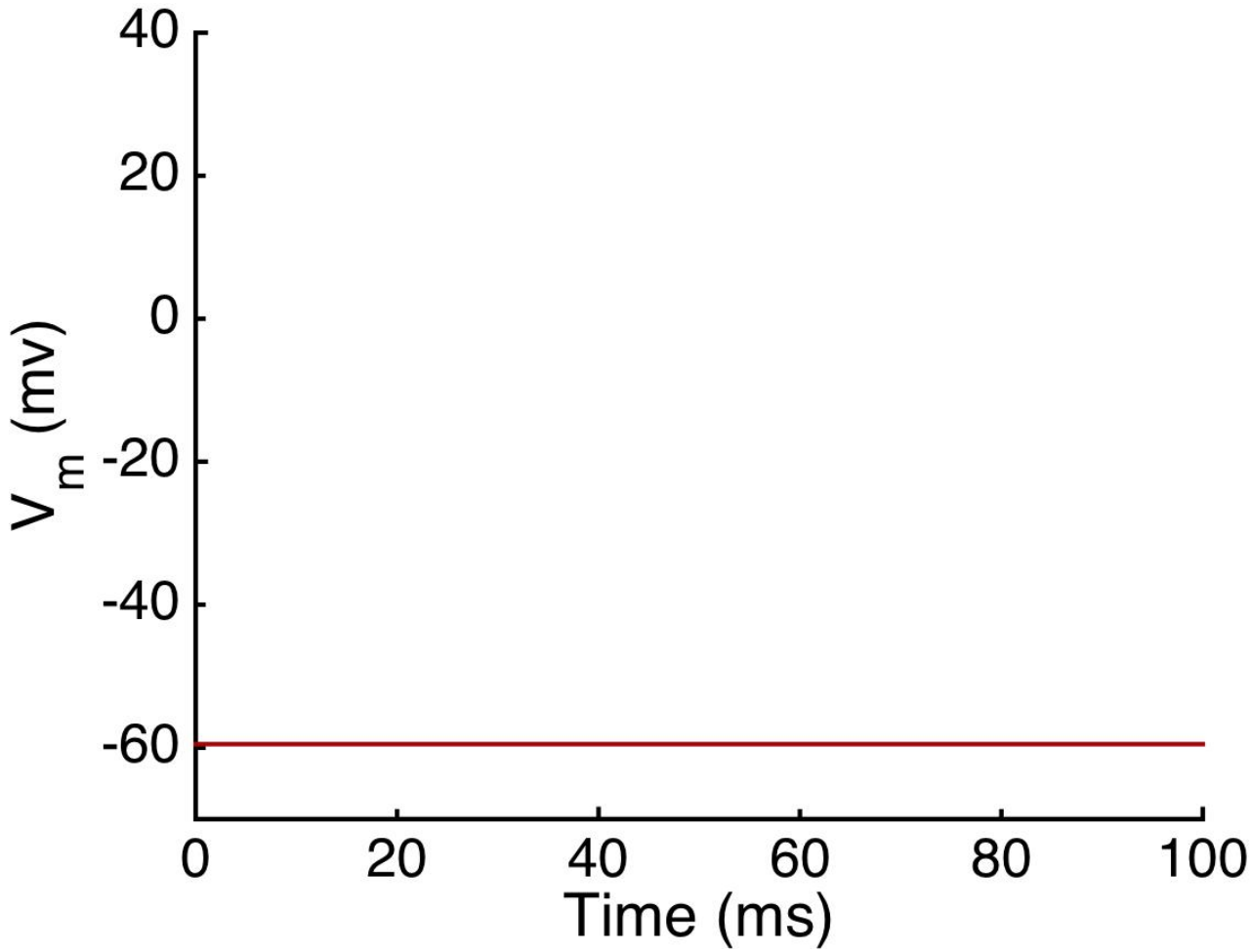
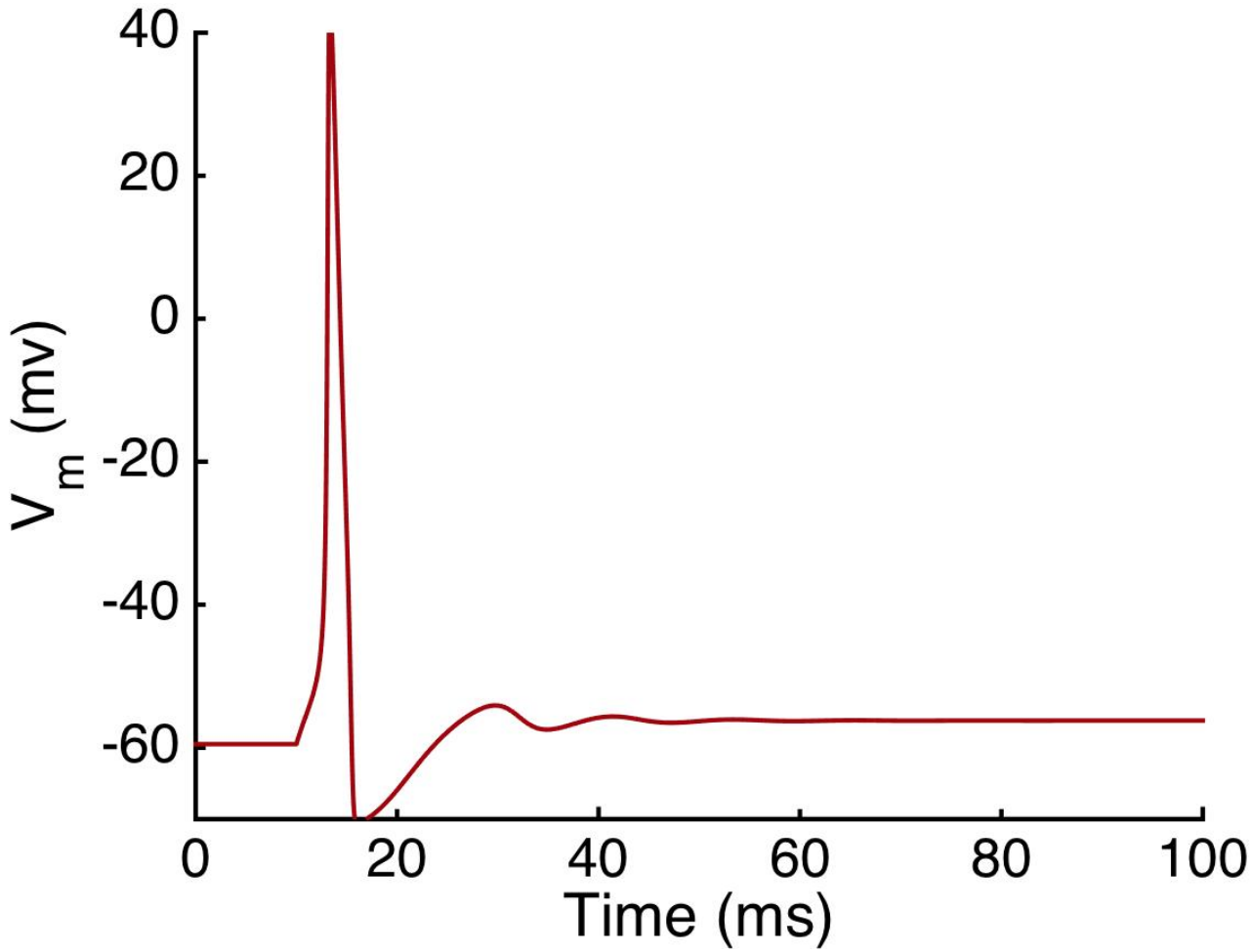


Figure: HH Model's step current response starting at 0 $\mu A/cm^2$



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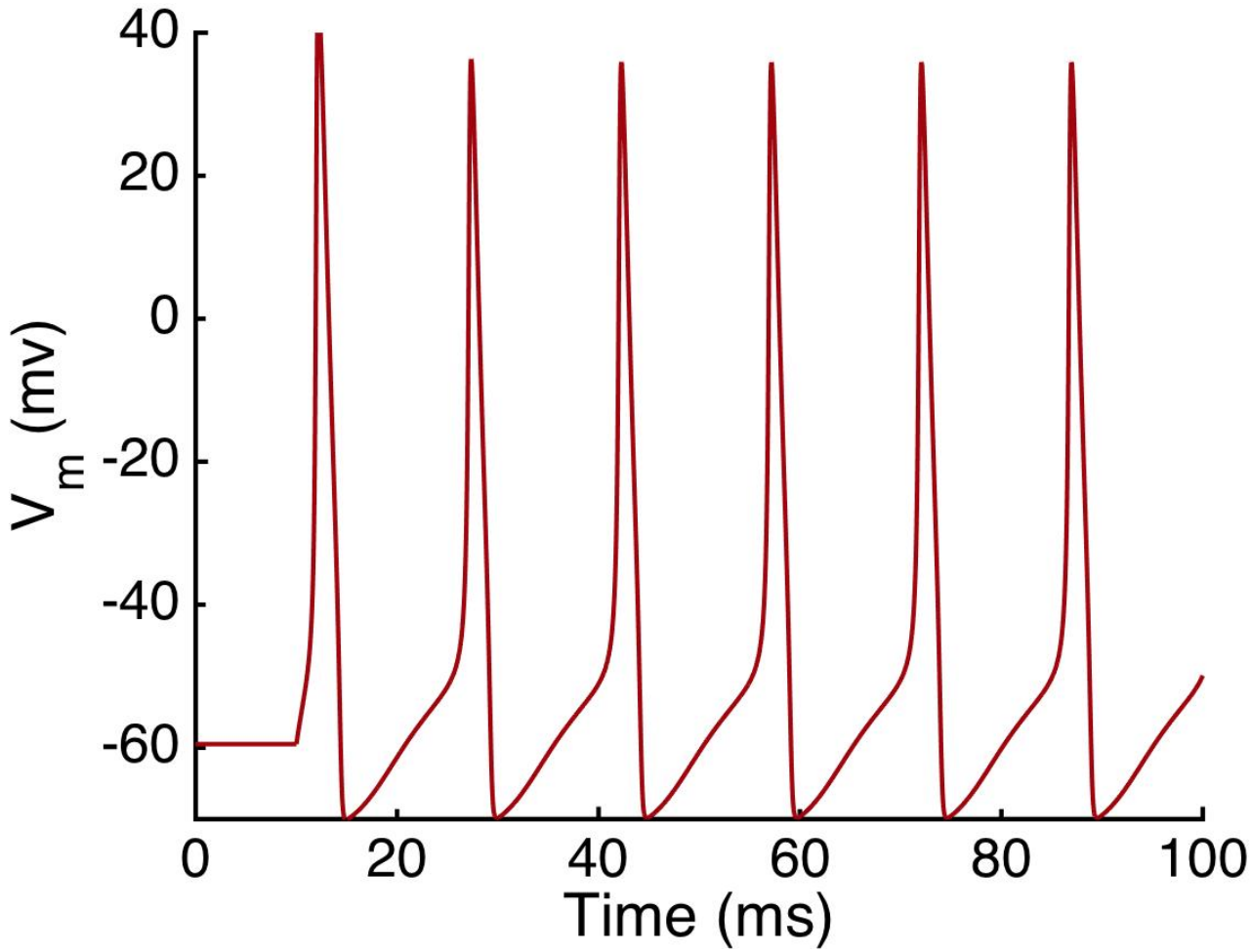

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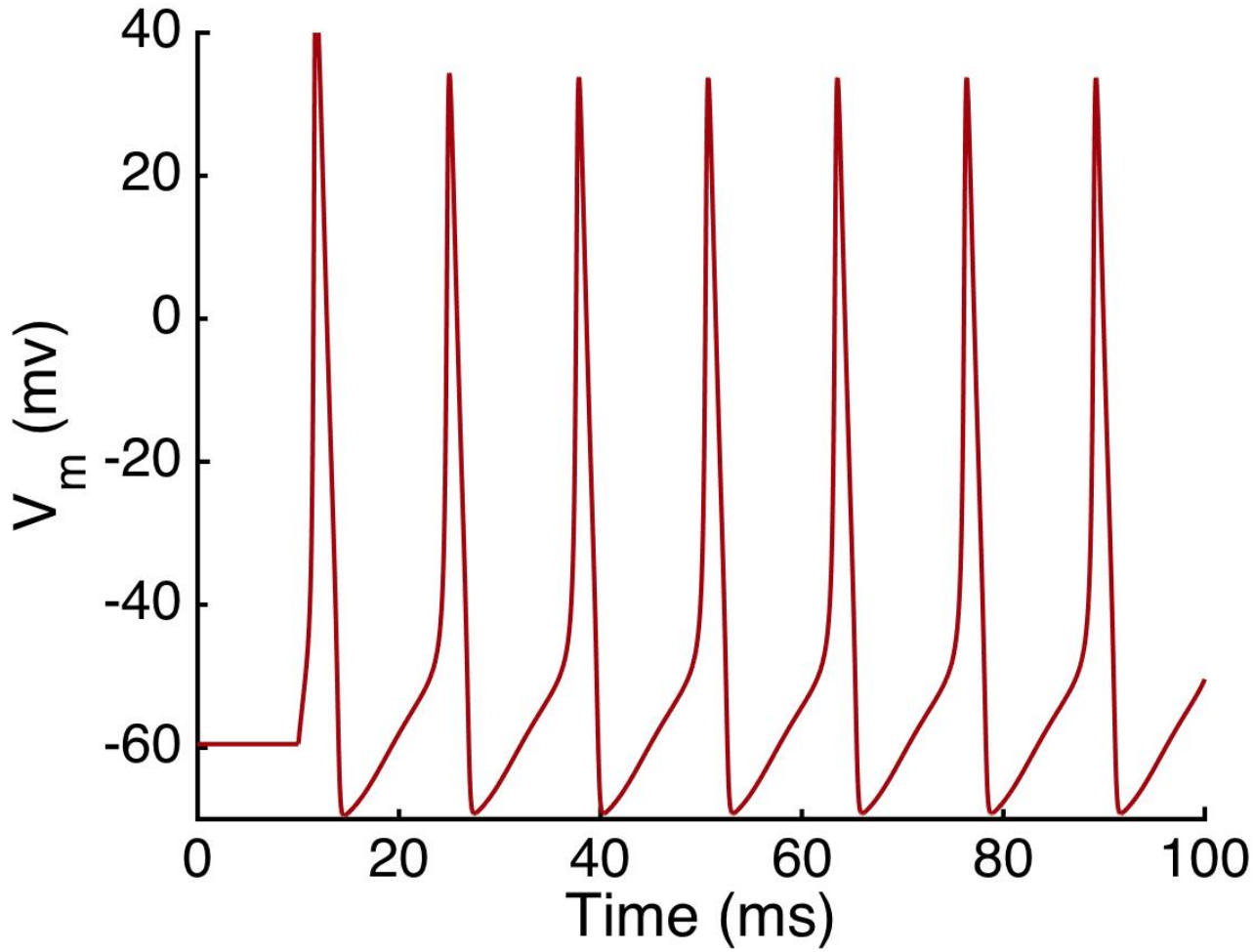

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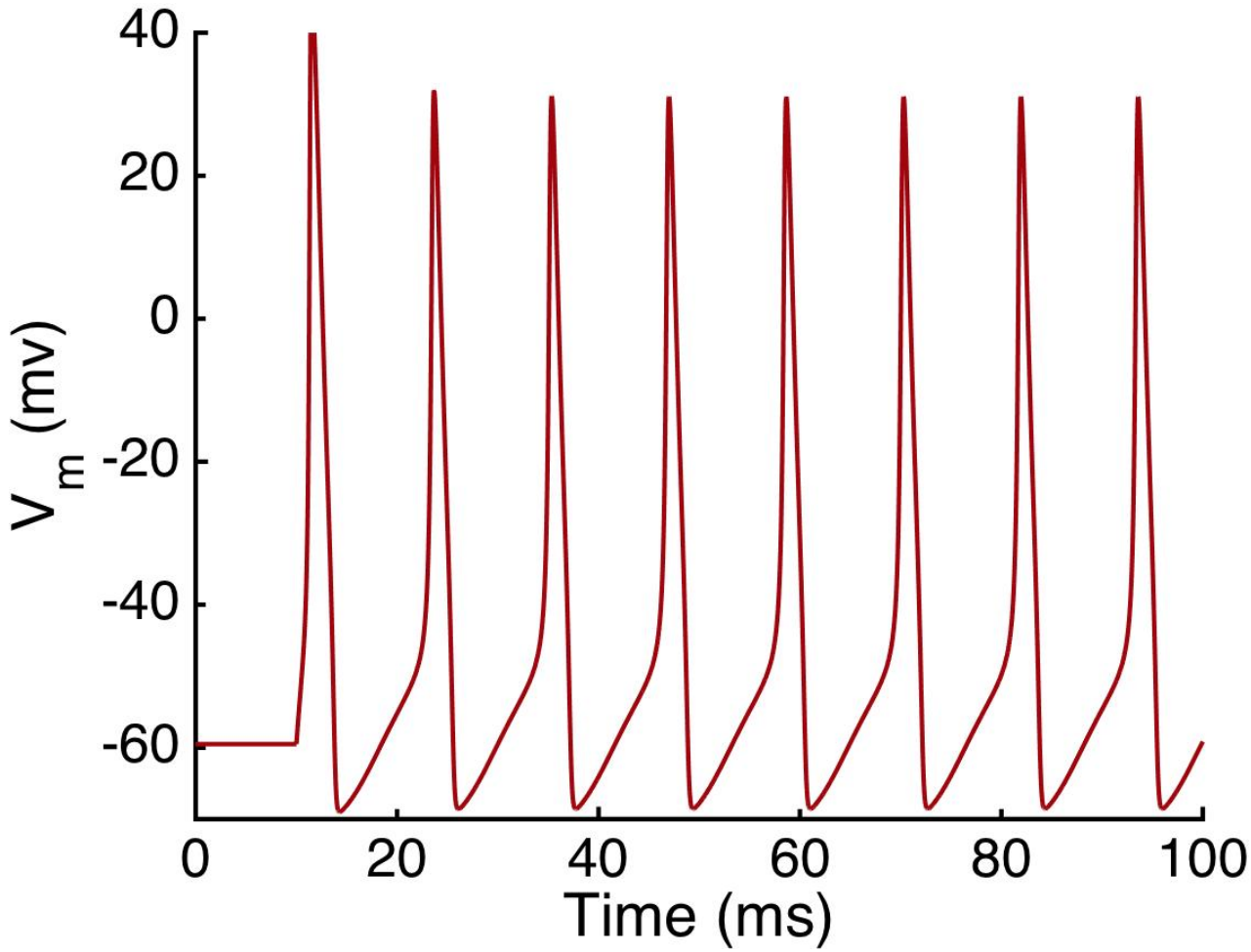

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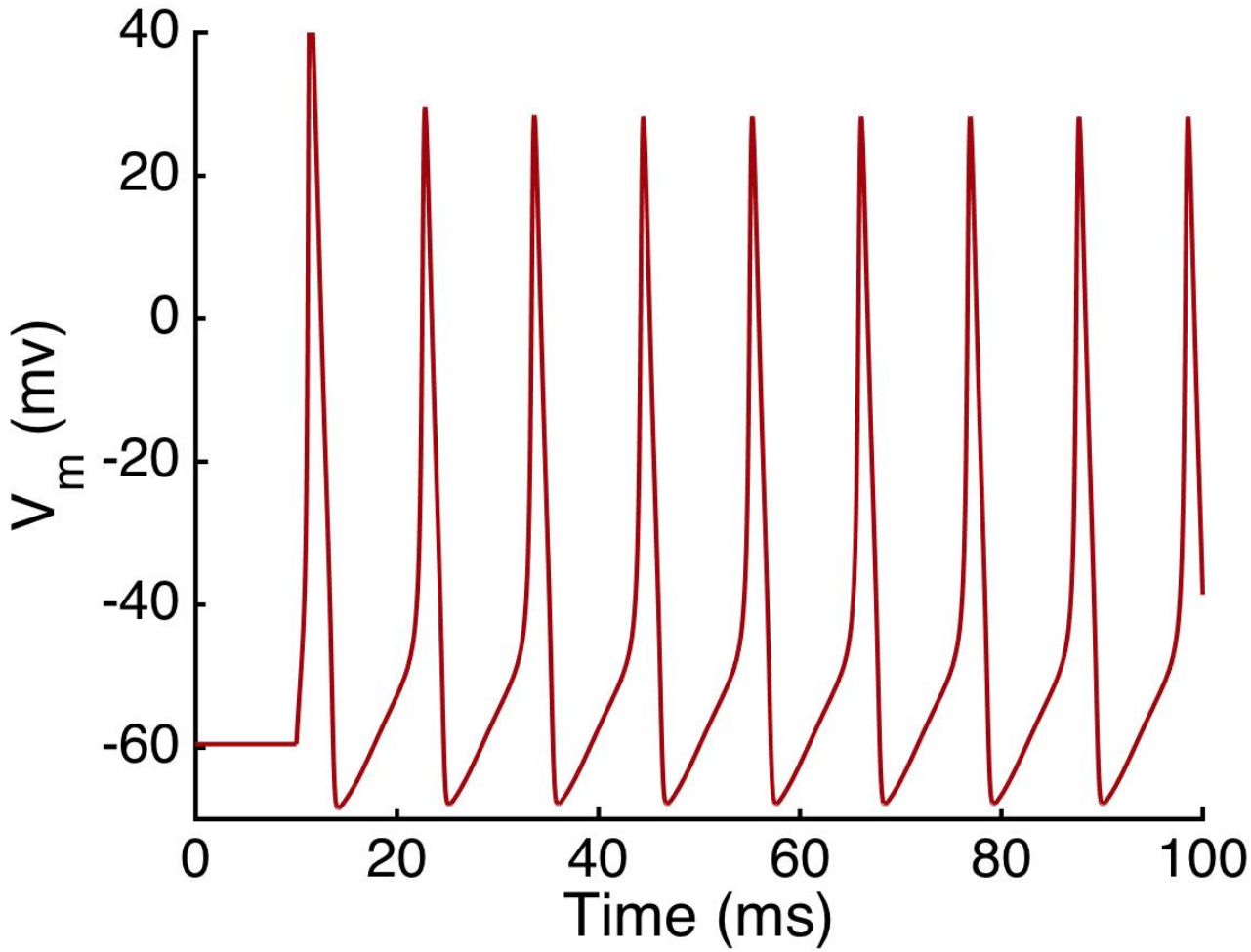

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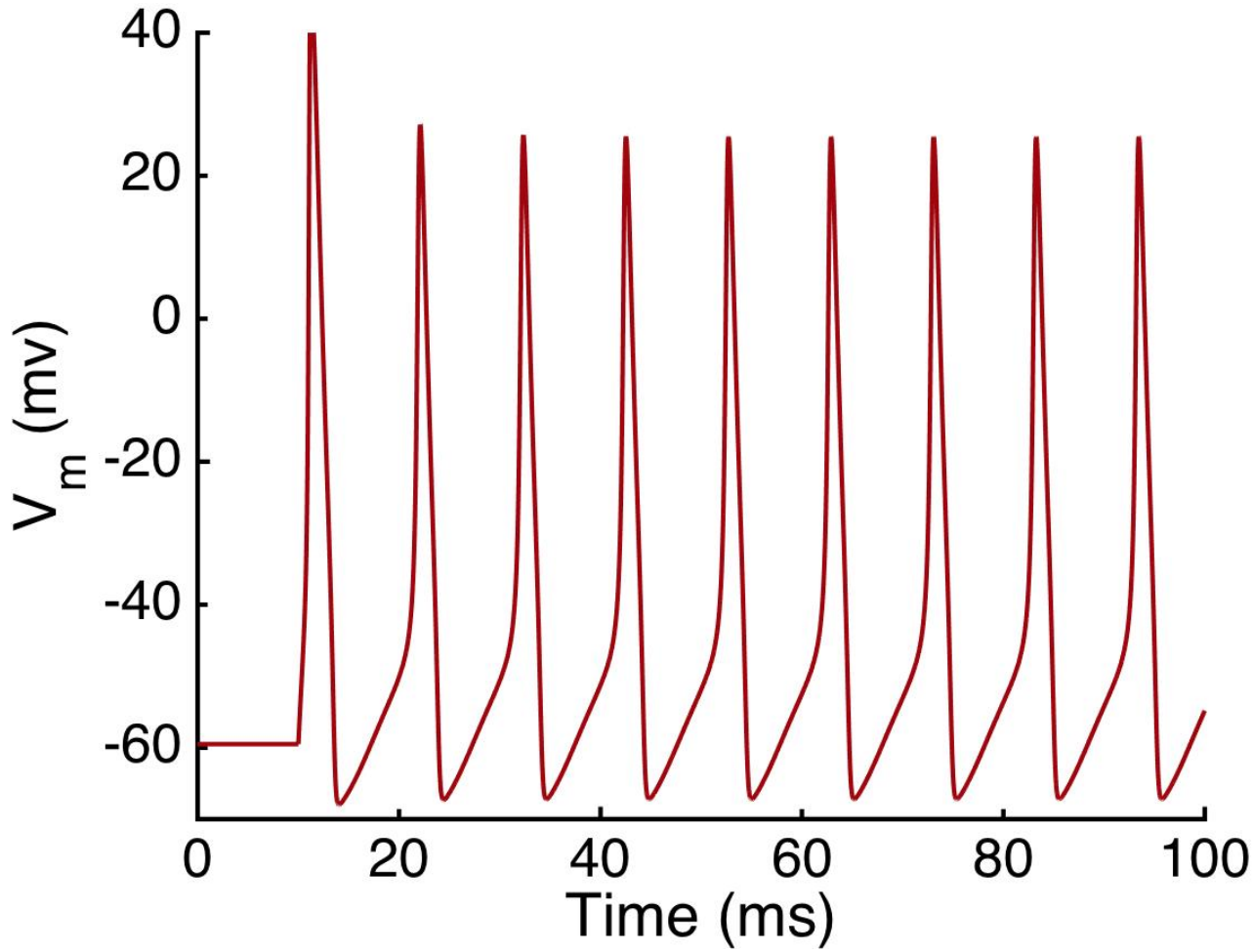

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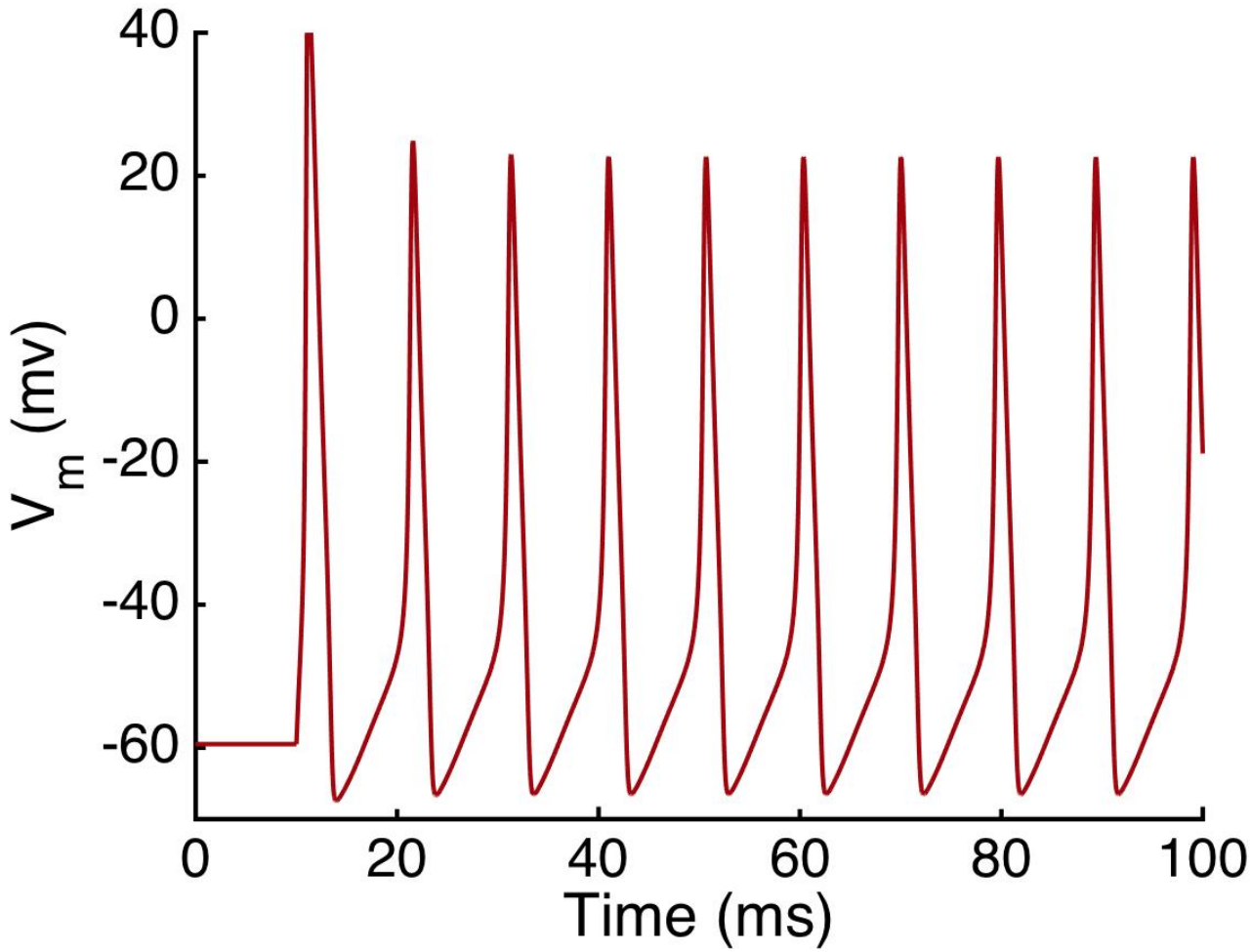

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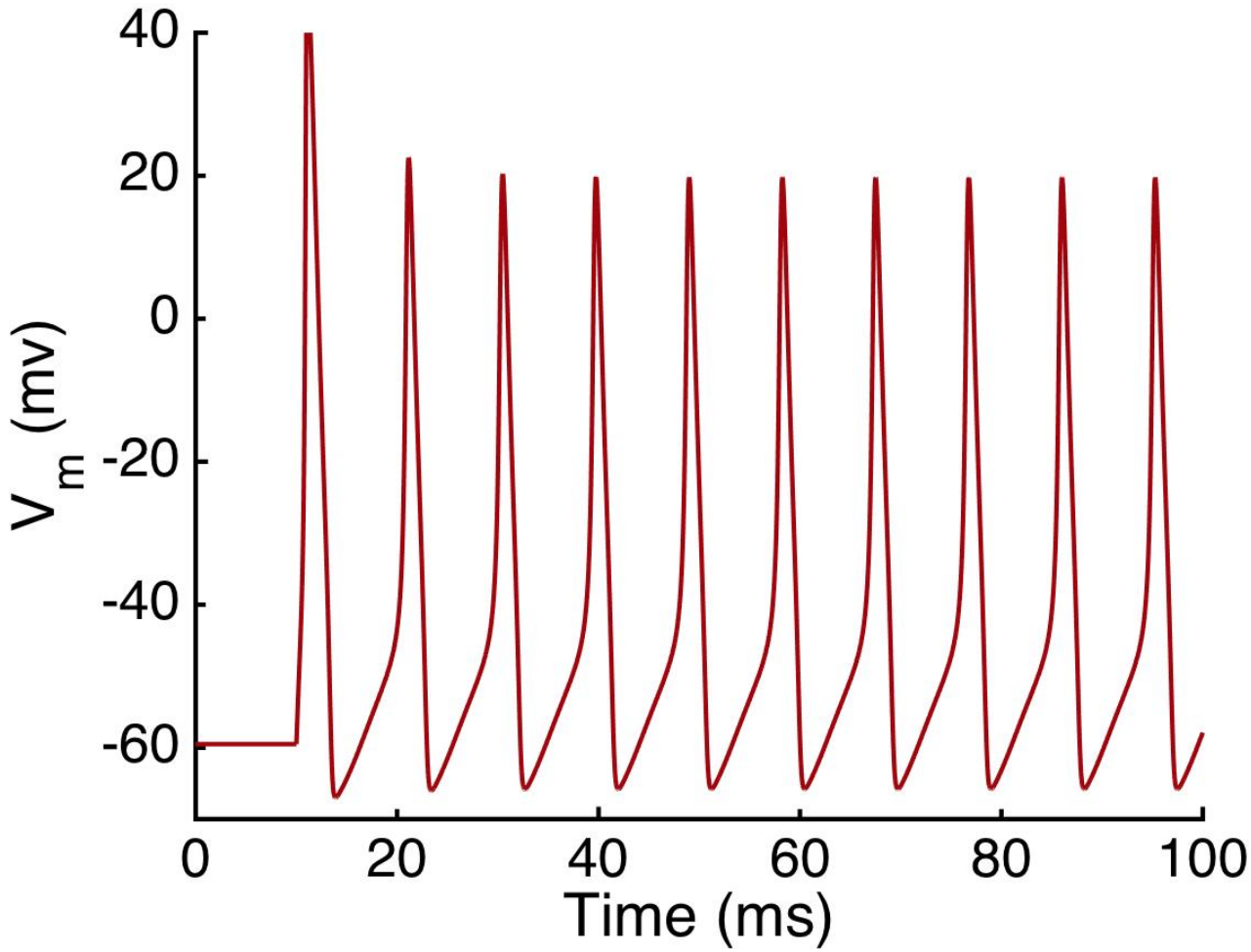

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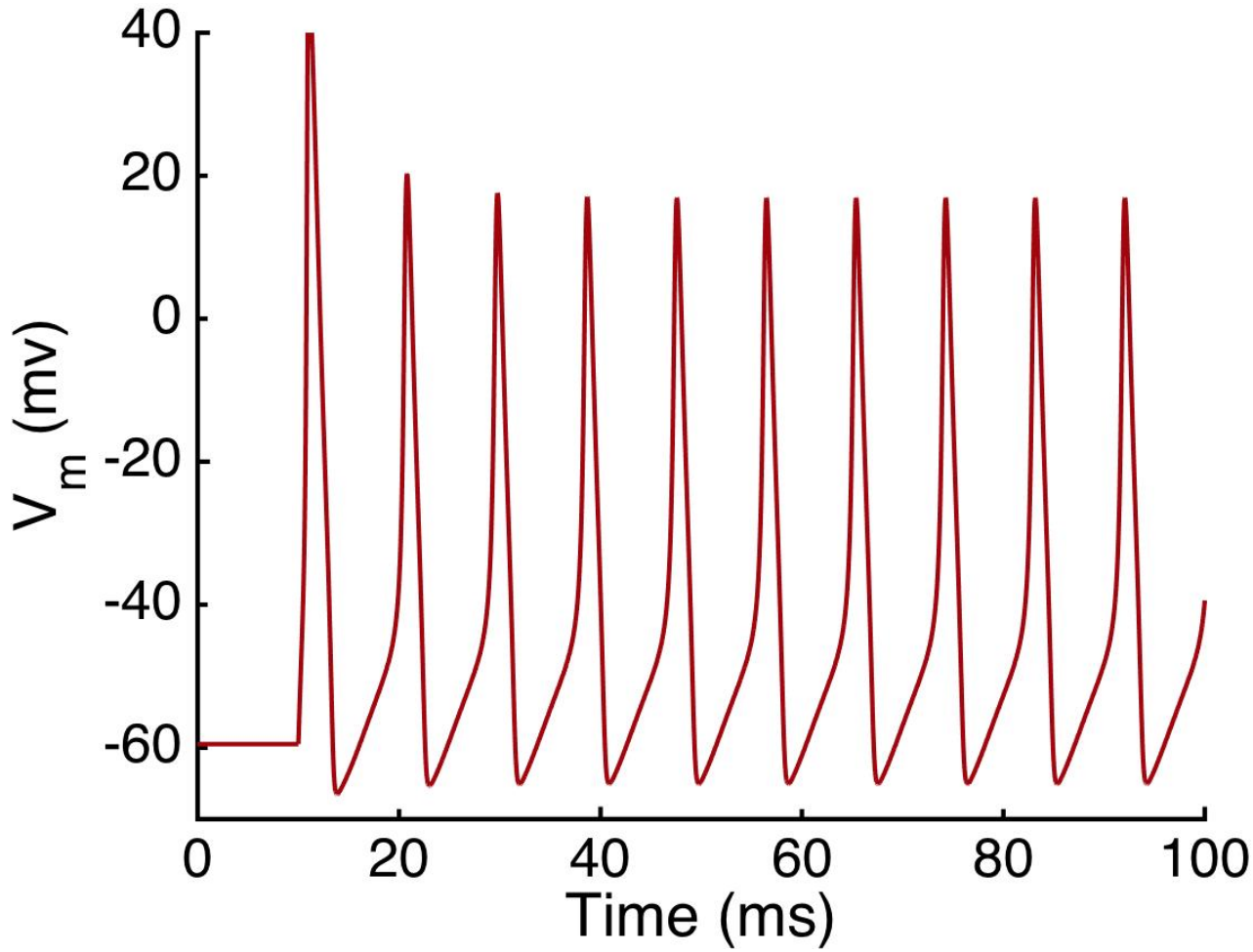

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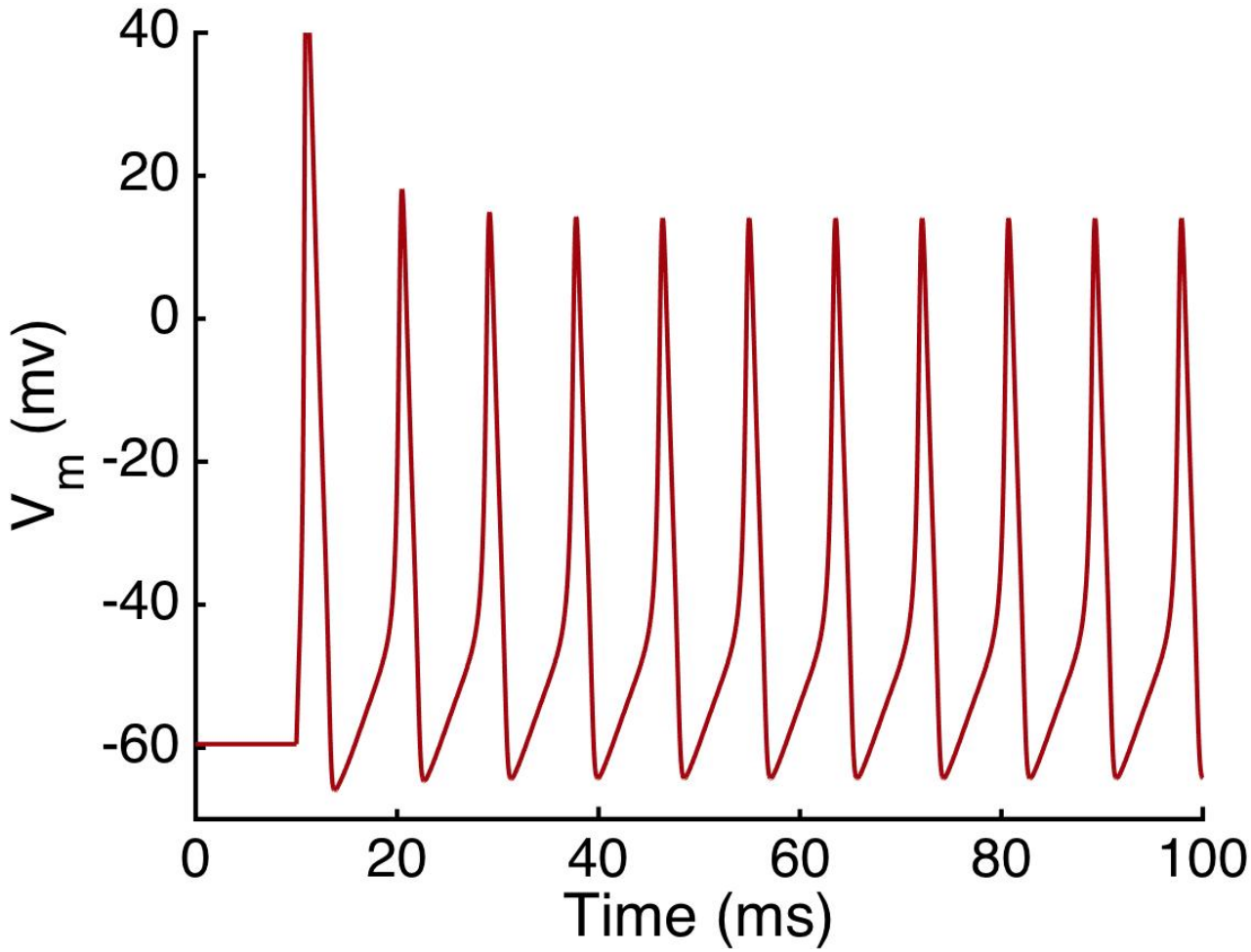

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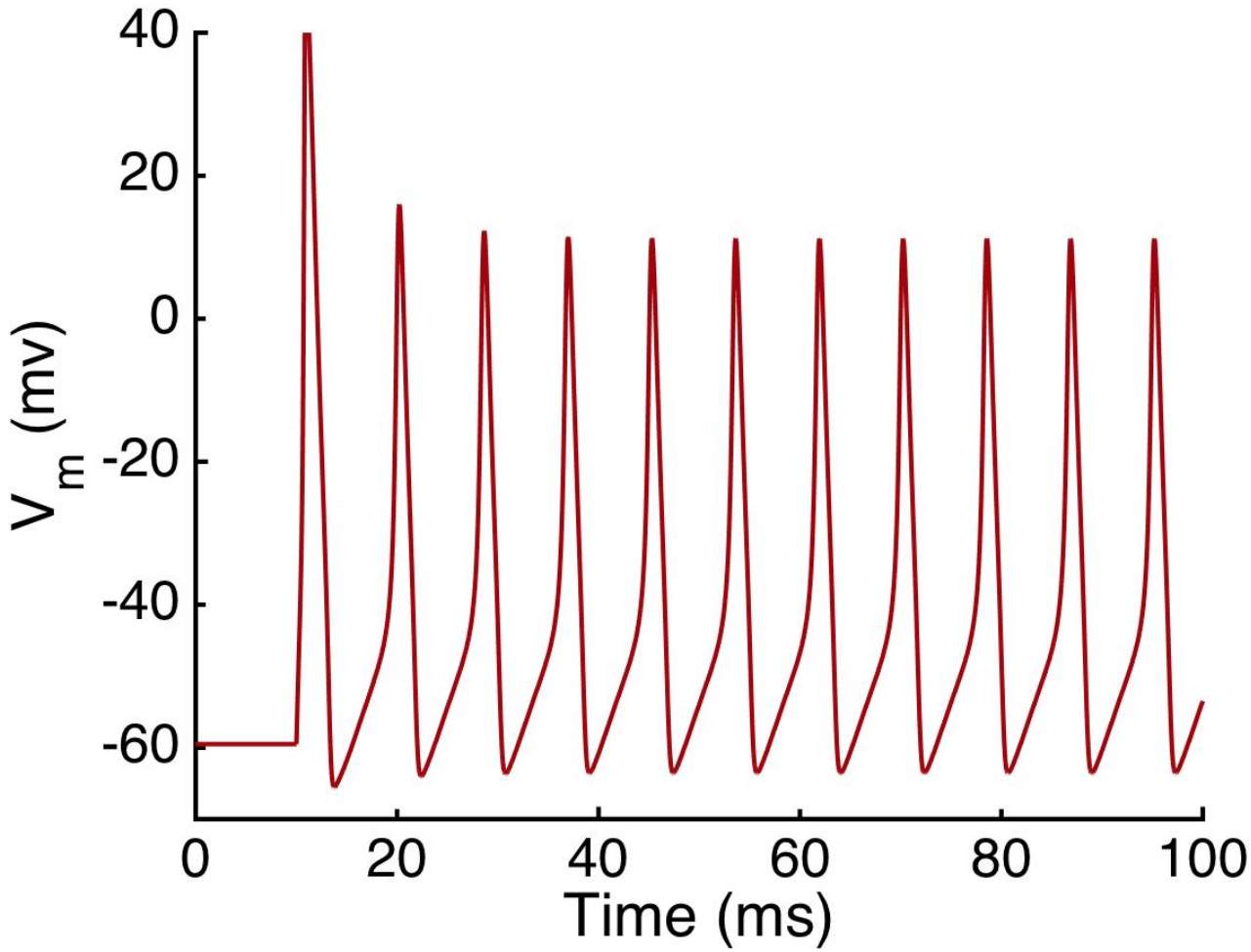

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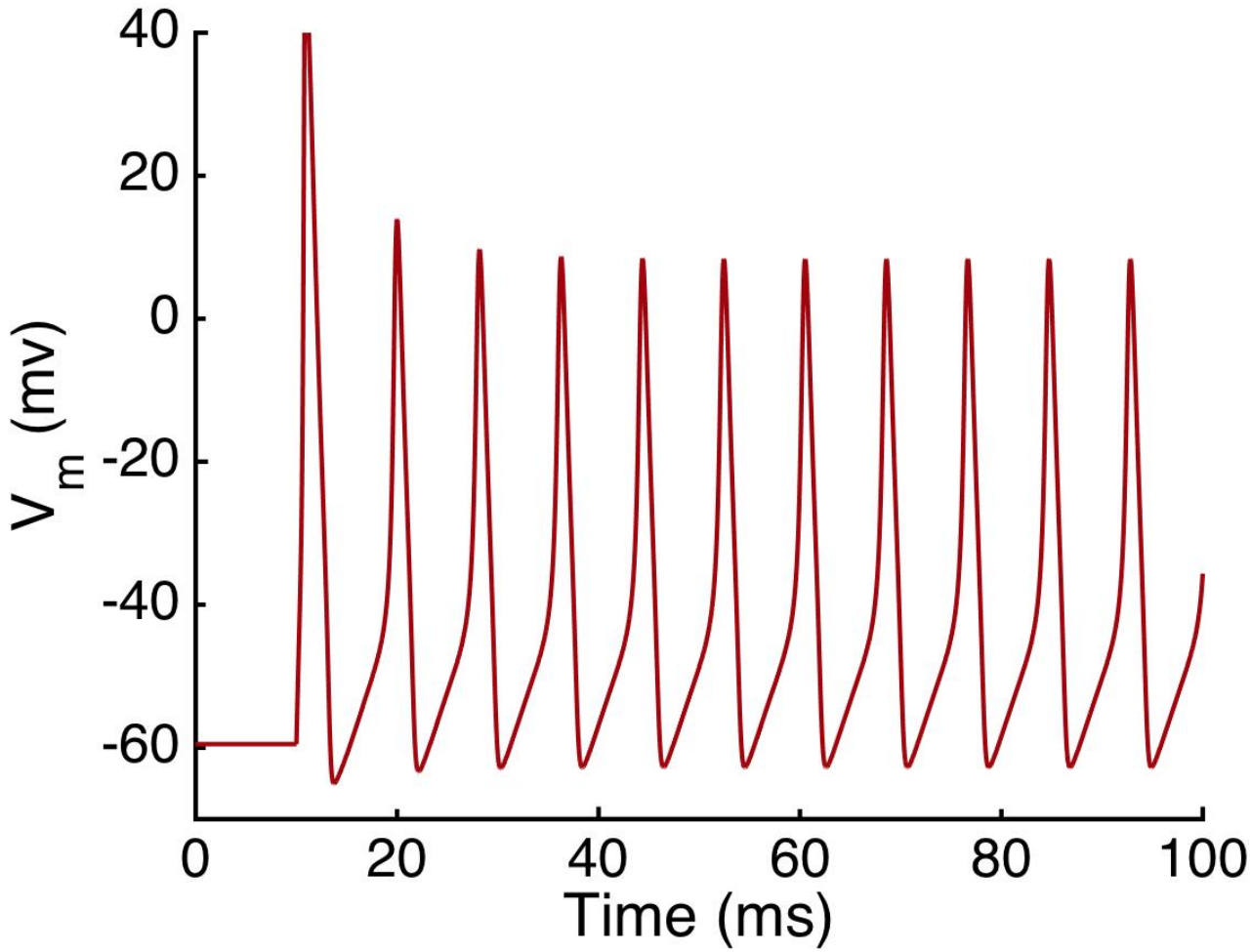

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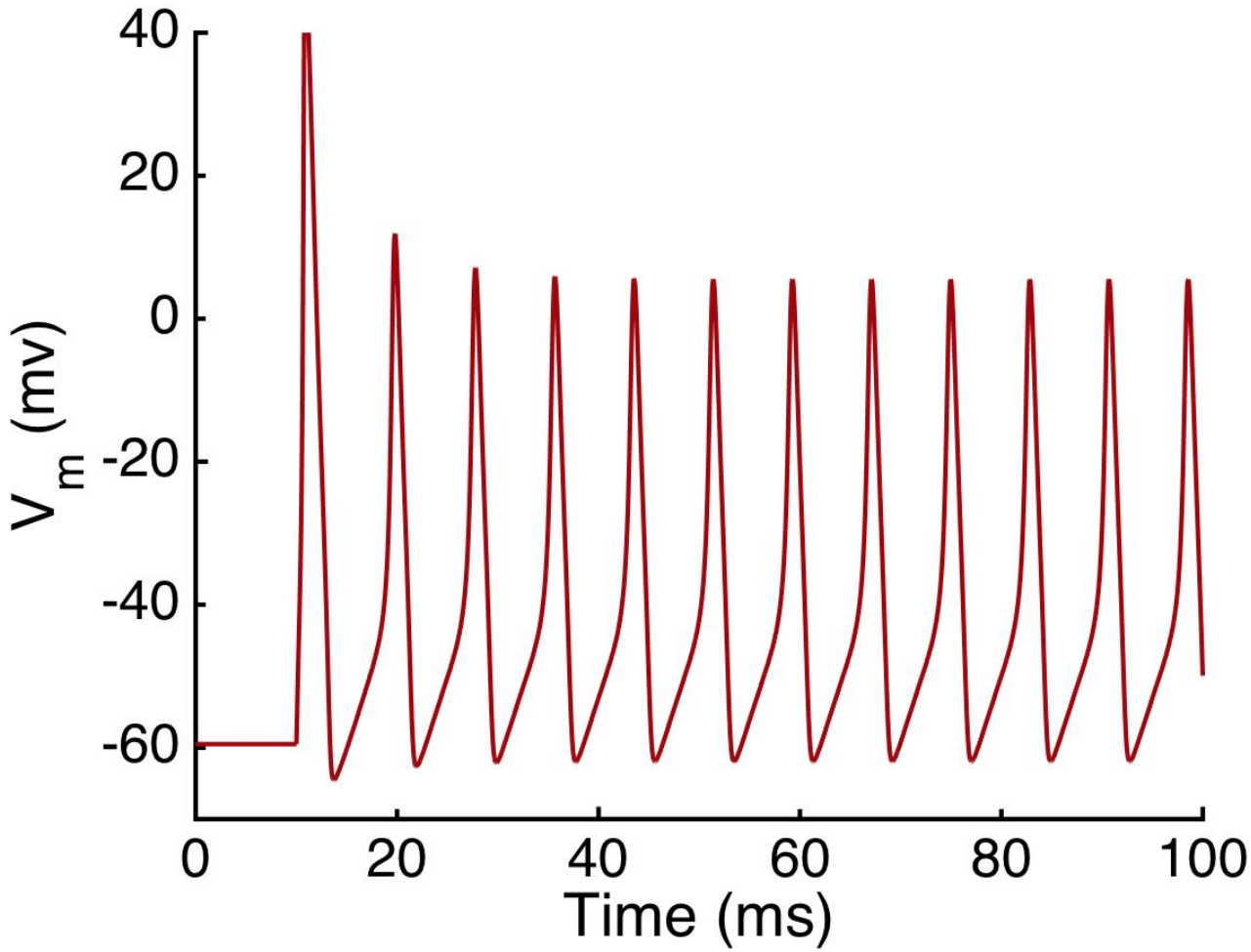

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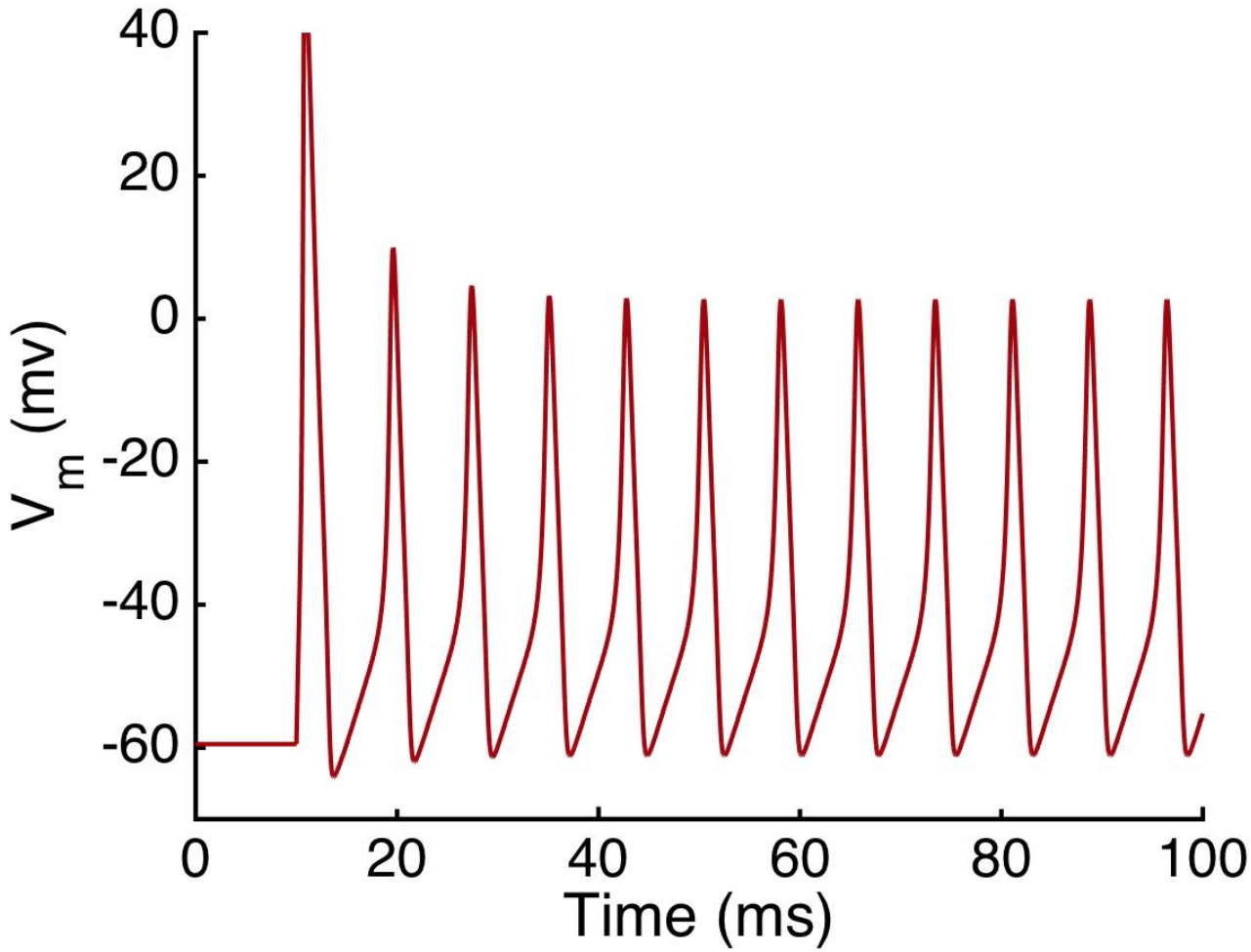

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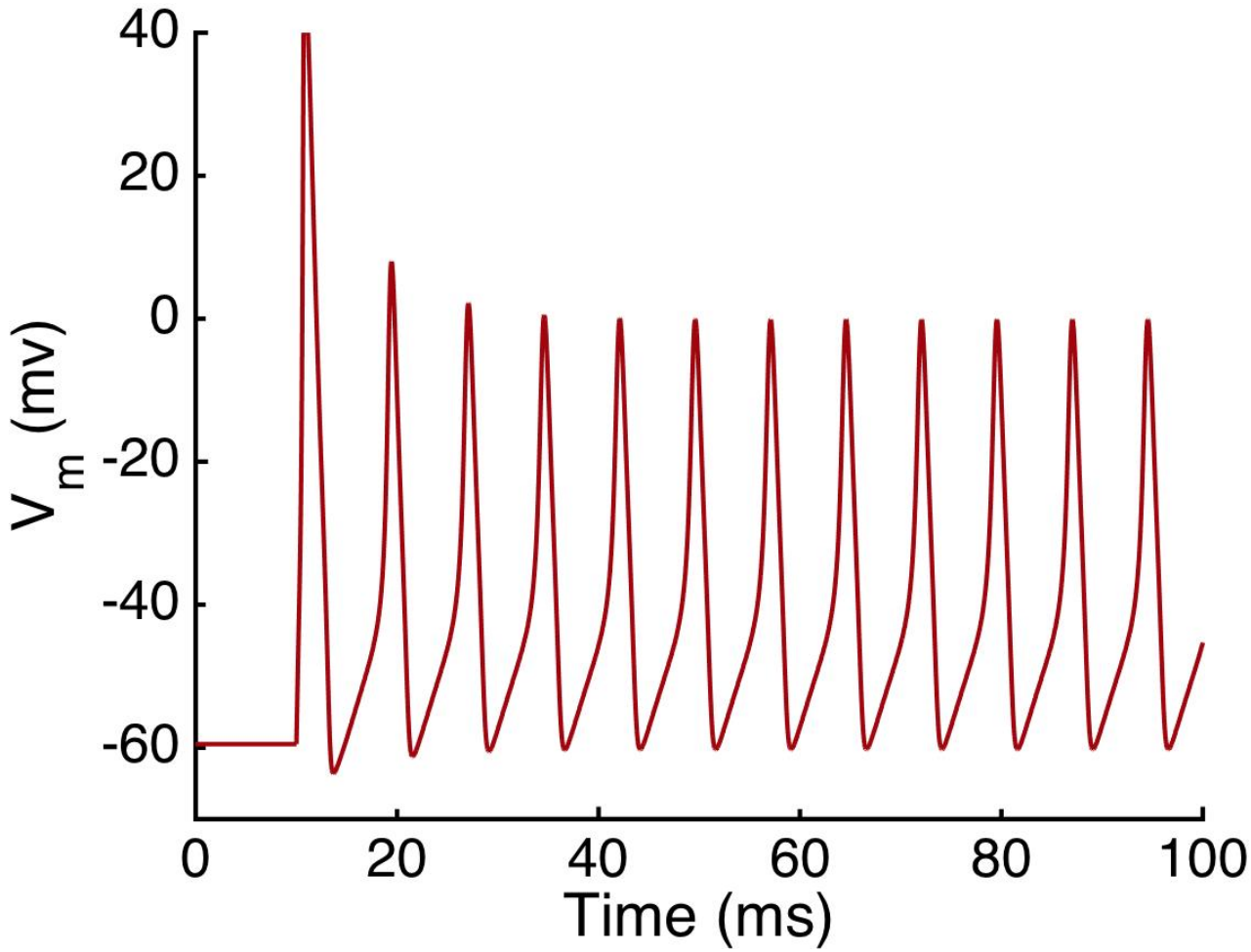

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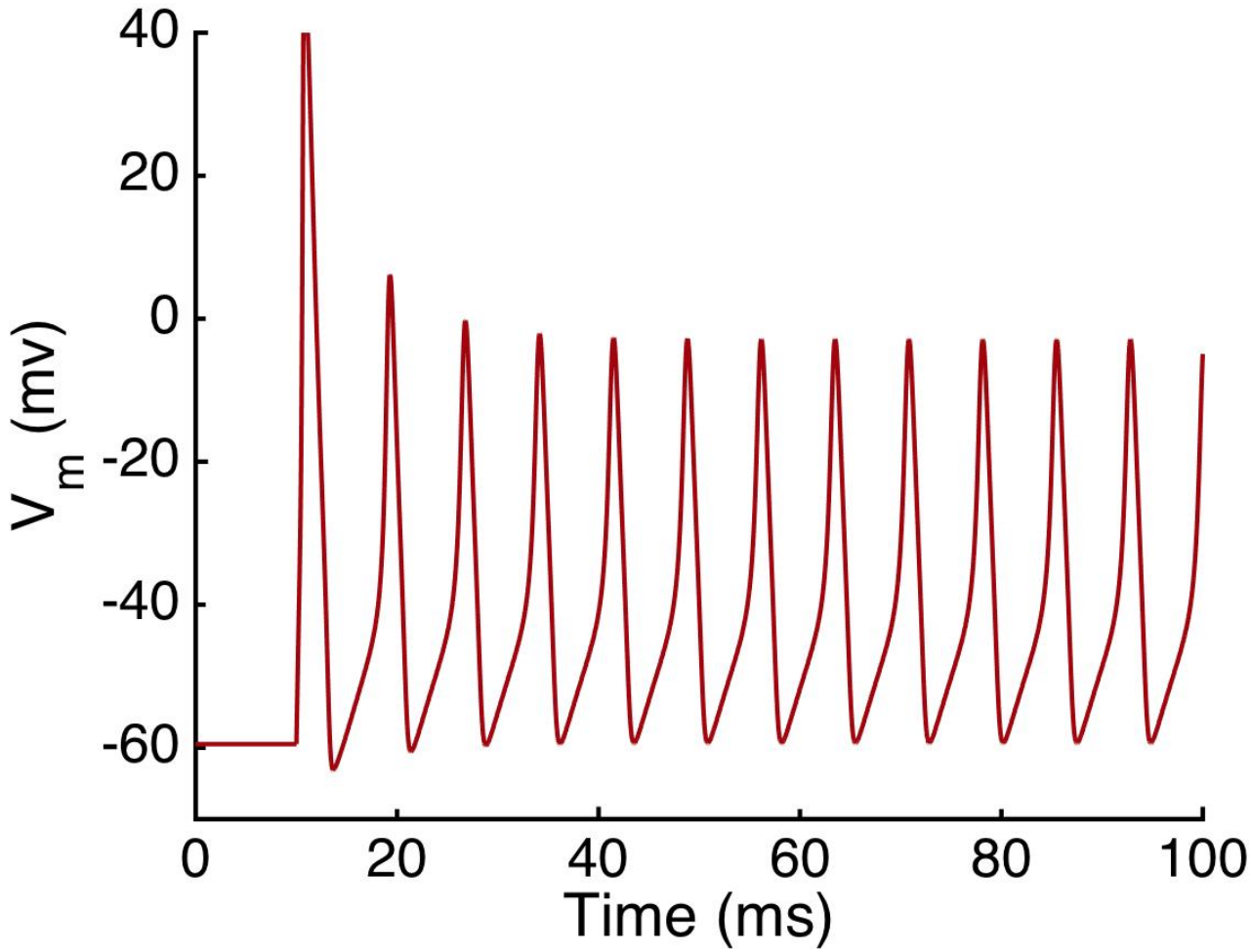

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Naive Mechanism

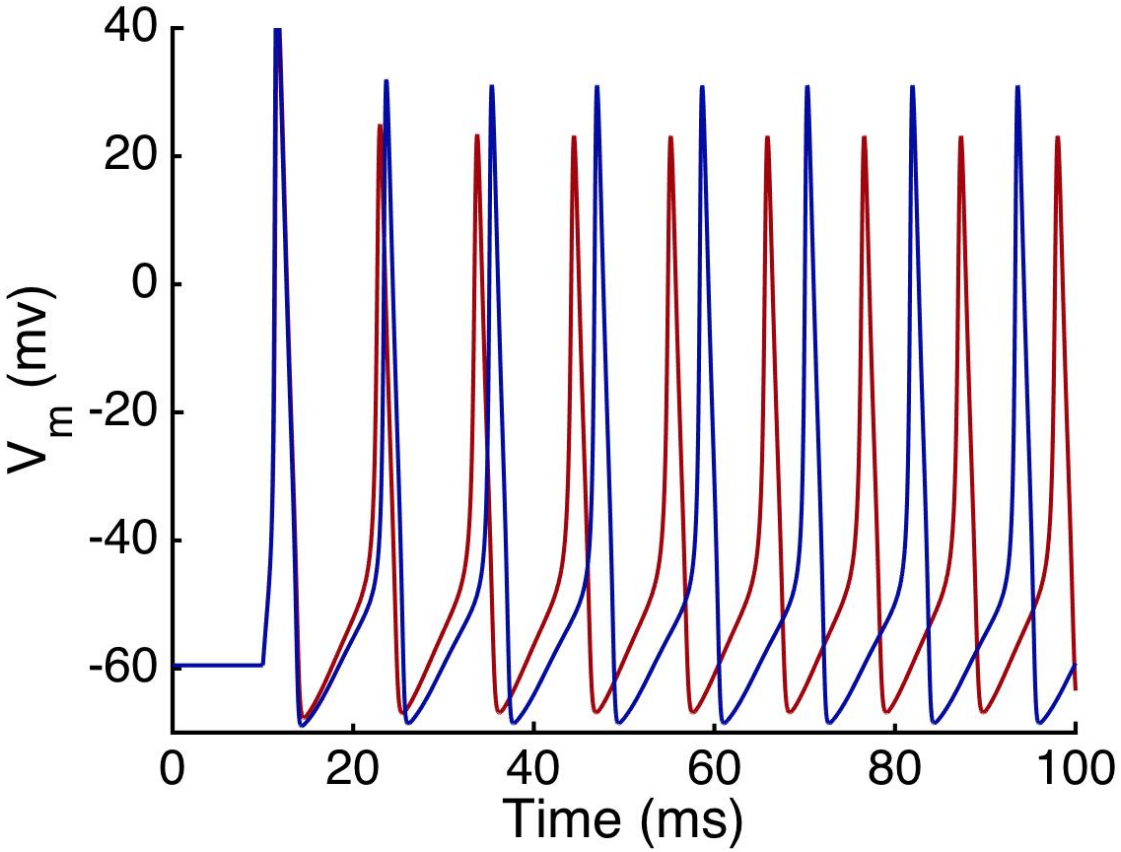

Figure: Equal ratio of current to capacitance

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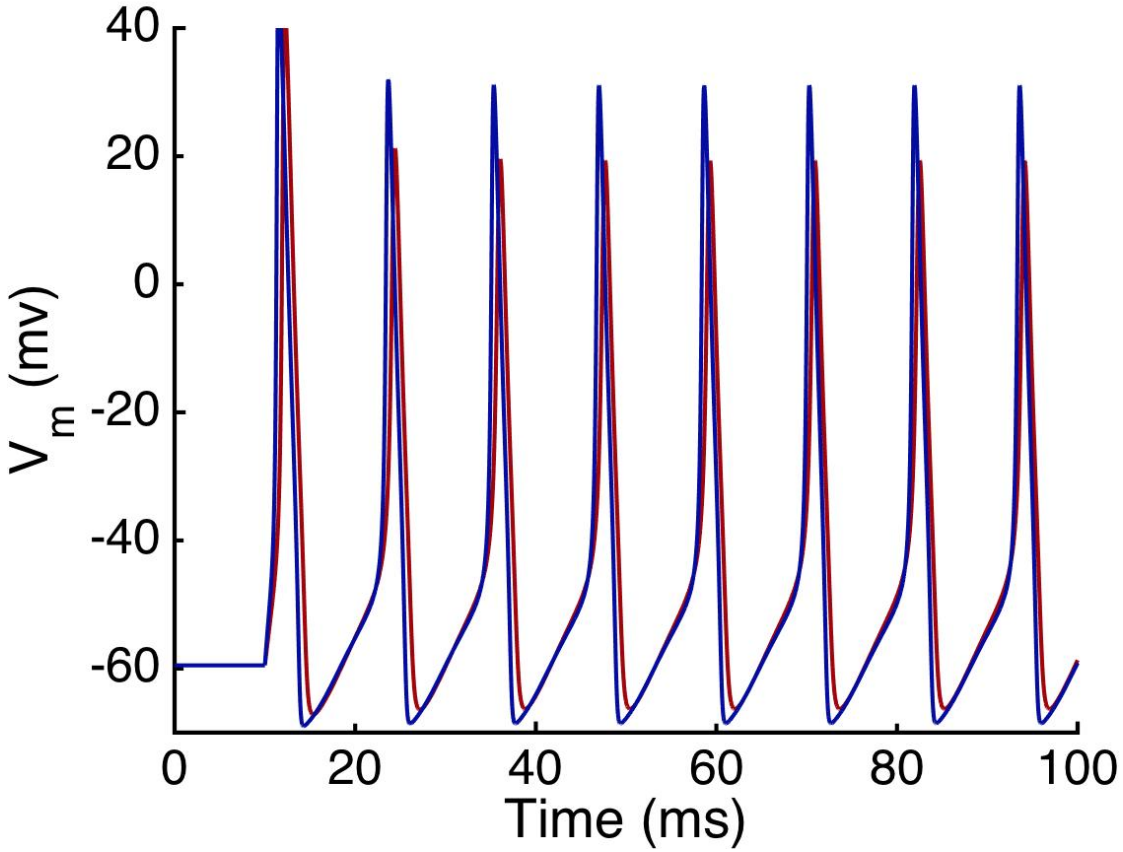
Mechanism



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DFT insufficient

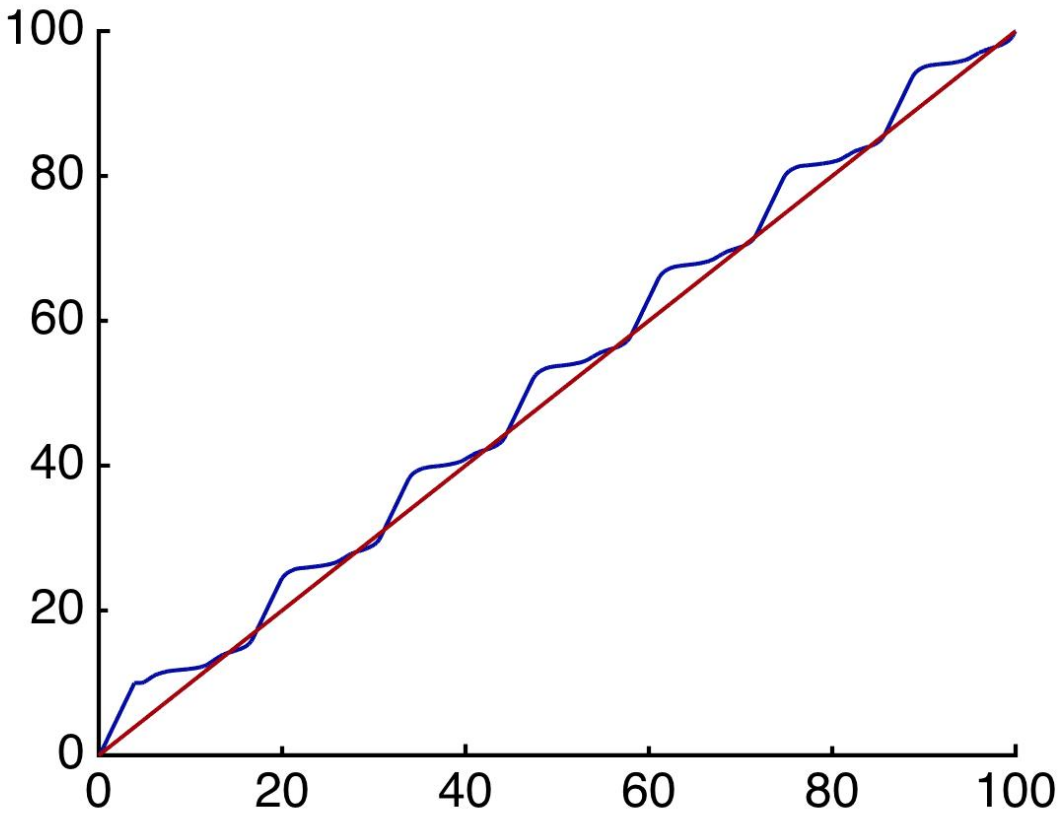


Figure: Discrete Fourier Transform insufficient due to variable time intervals.

Least-squares spectral analysis

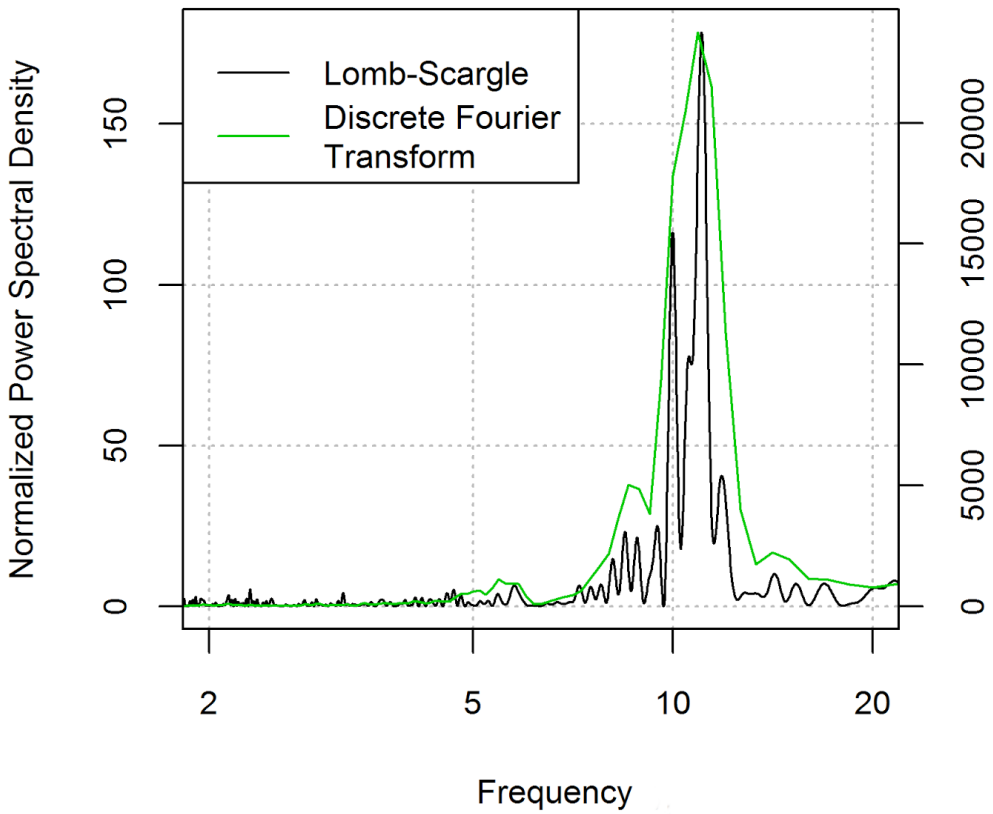
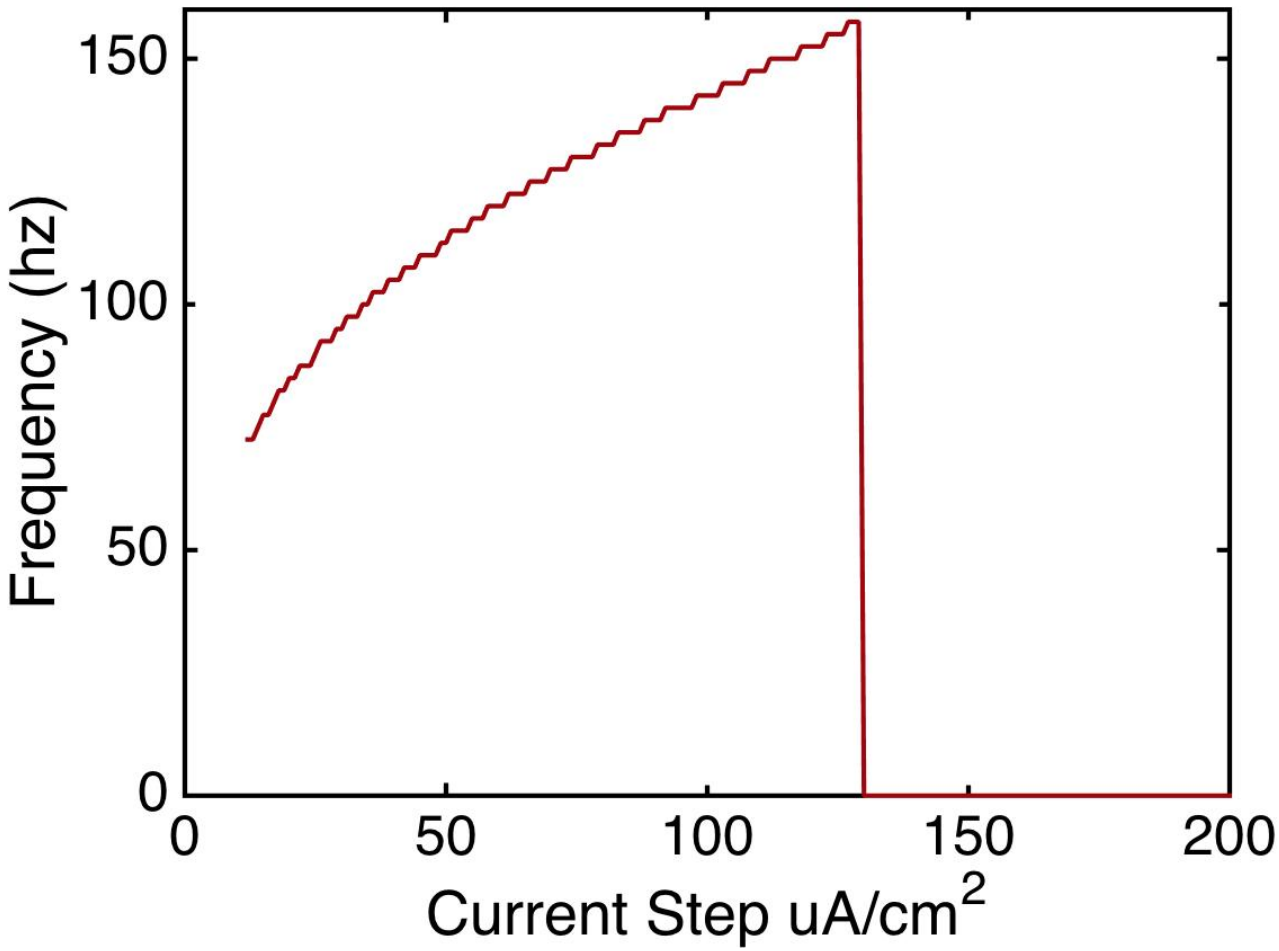


Figure: The Lomb-Scargle Periodogram works with variable intervals.

Train frequency over increasing input step



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Issues with precision approximation

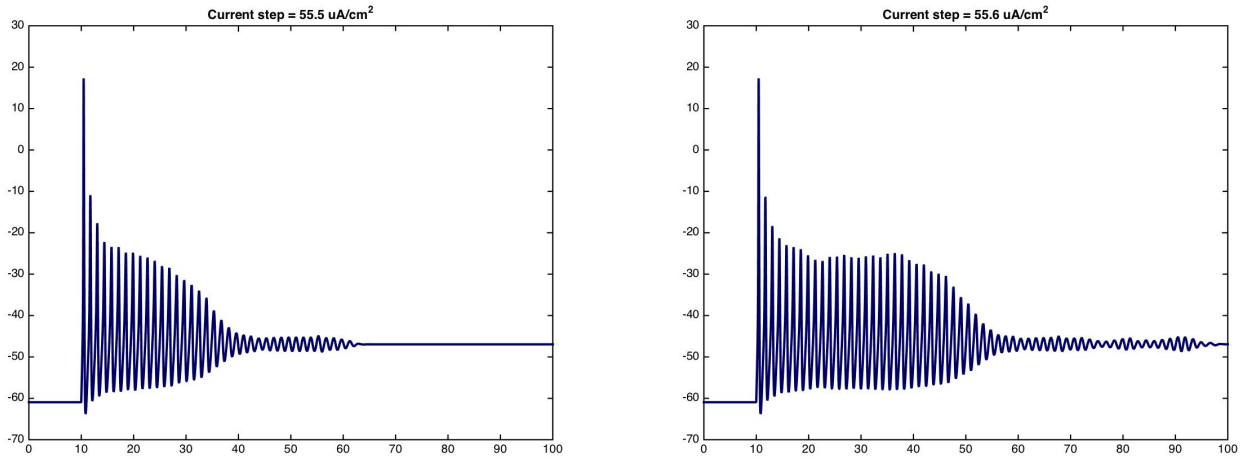

Figure: Incorrect behavior due to low precision

References

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2. Weiss, T. F. (1995).Cellular Biophysics. Volume 2: Electrical Properties, MIT Press.
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