

# Beeler-Reuter Model of Ventricular Myocardial Action Potential

Ryan Zaczynski  
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Until the 1940's, most biological systems did not have mathematical models. The difficulty of reproducing accurate biological experiments before the computing age was thus a tedious endeavor requiring great numbers of experiments to extract useful data. Along with the great commitment of time, economic and moral issues frequently added to the already difficult process of biological experimentation.

G.W. Beeler and H. Reuter recognized this need and in 1974 attempted to model arguably the most important organ in the human body, the heart. Their inspiration and methods for their model was drawn from their own prior experiments as well as work done by Hodgkin and Huxley in 1952 to model the action potential of an axon. The HH model provided one of the first mathematical models of a biological system explained in terms of 3 mathematical variables defining ion currents. The Beeler Reuter Model was significantly more complex, and resulted in an 8 variable model.

The methods used by Beeler and Reuter to complete their experiments before modern computing applications such as MATLAB are an accomplishment in their own right, and thus their work served a double purpose. They developed a model to reproduce the characteristics of the mammalian myocardium by means of measuring ion currents using voltage clamping methods. In addition to the model they created an extensive method of mathematical modeling of

a biological system that is very accurate to modern computer simulations, and also serves as a basis for countless other experiments involving the model of biological systems and how to go about them.

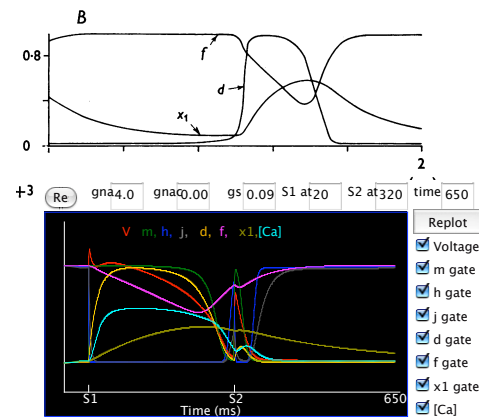


Figure 1) Top: Original experiment, sodium current modeled with analog devices. Bottom: Computer applet simulation of all ion currents and gates, completed with click of a mouse.

The preceding figure consisted of months of work to attain one result (top) while the bottom simulation is an internet accessible applet that does the same calculations in seconds.

## References:

- Beeler and H. Reuter. Reconstruction of the action potential of ventricular myocardial fibres. *J Physiol* 268(1):177–210, Jun 1977.
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