Does not fire APs (action potentials) at arbitrarily low frequency for steady applied current, $I_{app}$. Hodgkin (1948) called this Class/Type II excitability.

For large $I_{app}$, responses shrink in size...not really APs. Only steady depolarization for very large $I_{app}$ – “nerve block”.

Firing frequencies are higher at higher temperature. Threshold value of $I_{app}$ for repetitive firing increases with temperature.

HH model (and a class of other AP models) show bistability just above threshold value for step of $I_{app}$.


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Fig. 5. Repetitive firing through Hopf bifurcation in Hodgkin-Huxley model. *A:* Voltage time courses in response to a step of constant depolarizing current (several levels of current: from bottom to top: $I_{app}$= 5, 15, 50, 100, 200 in μamp/cm²). Scale bar is 10 msec. *B:* f-I curves for temperatures of 6.3, 18.5, 26°C, as marked. Dotted curves show frequency of the unstable periodic orbits.

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Fig. 7. *A:* Bifurcation diagram showing the possible behaviors for the Hodgkin-Huxley equations for different values of $I_{app}$ at temperature 18.5°C. $I_1$ and $I_2$ denote Hopf bifurcations of the steady states, $I_c$ bifurcation of the periodic solutions. *Thin solid curves:* stable steady state, *thin dashed curves:* unstable steady state, *thick solid curves:* maximum and minimum $V$ of the stable limit cycle, *thick dashed curves:* maximum and minimum $V$ of the unstable limit cycle. *B:* Range of $I_{app}$ where the steady state is unstable plotted as a function of temperature. In both panels $I_{app}$ is in μA/cm².