Difference Between Absolute and Relative Refractory Period

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Key Difference - Absolute vs Relative Refractory Period

Action potential of a nerve impulse refers to the phenomenon in which a nerve impulse is transmitted across a neuron. It is a resultant of the difference in concentration of Sodium (Na^+) ions and Potassium (K^+) ions across the membrane. There are three main phases of action potential; depolarization, repolarization and hyperpolarization. The Refractory period is the period that immediately follows a nerve impulse transmission or an action potential. This is also regarded as the characteristic recovery time of one action potential before the second. There are two main types of refractory periods in physiology; the absolute refractory period and the relative refractory period. The absolute refractory period refers to the time span in which the Sodium channels remain inactive. The relative refractory period is the phenomenon in which the Sodium gated channels transit from its inactive state to the closed status that prepares the channels to be activated. Then the membrane gains the ability to initiate the second signal for nerve transmission. The **key difference** between the absolute and the relative refractory periods are based upon the sodium ion gated channels. **The absolute refractory period is the period in which the sodium-gated ion channels are completely inactive whereas the relative refractory period is the time span where the inactive sodium channels transit to the active form to accept the second signal.**

What is Absolute Refractory Period?

Absolute refractory period refers to the period in which the Sodium ion channels are completely inactive. This takes place very rapidly and spontaneously after the opening of the Sodium ion channels. When the sodium ion channels undergo inactivation, they cannot get back to the active state immediately. Thus the initial recovery time required to activate the sodium ions channels is described as the absolute refractory period. This process is a voltage-dependent process. The Absolute refractory period can last for 1-2 milliseconds, whereas the total recovery period spans for about 3-4 milliseconds.

During the absolute refractory period, a second action potential is not initiated because the sodium ion channels are fully inactivated. Therefore, any additional depolarization stimuli do not take place during this period. The neurons are not excited during this period. Thus, the neuron excitability is null during the Absolute refractory period.

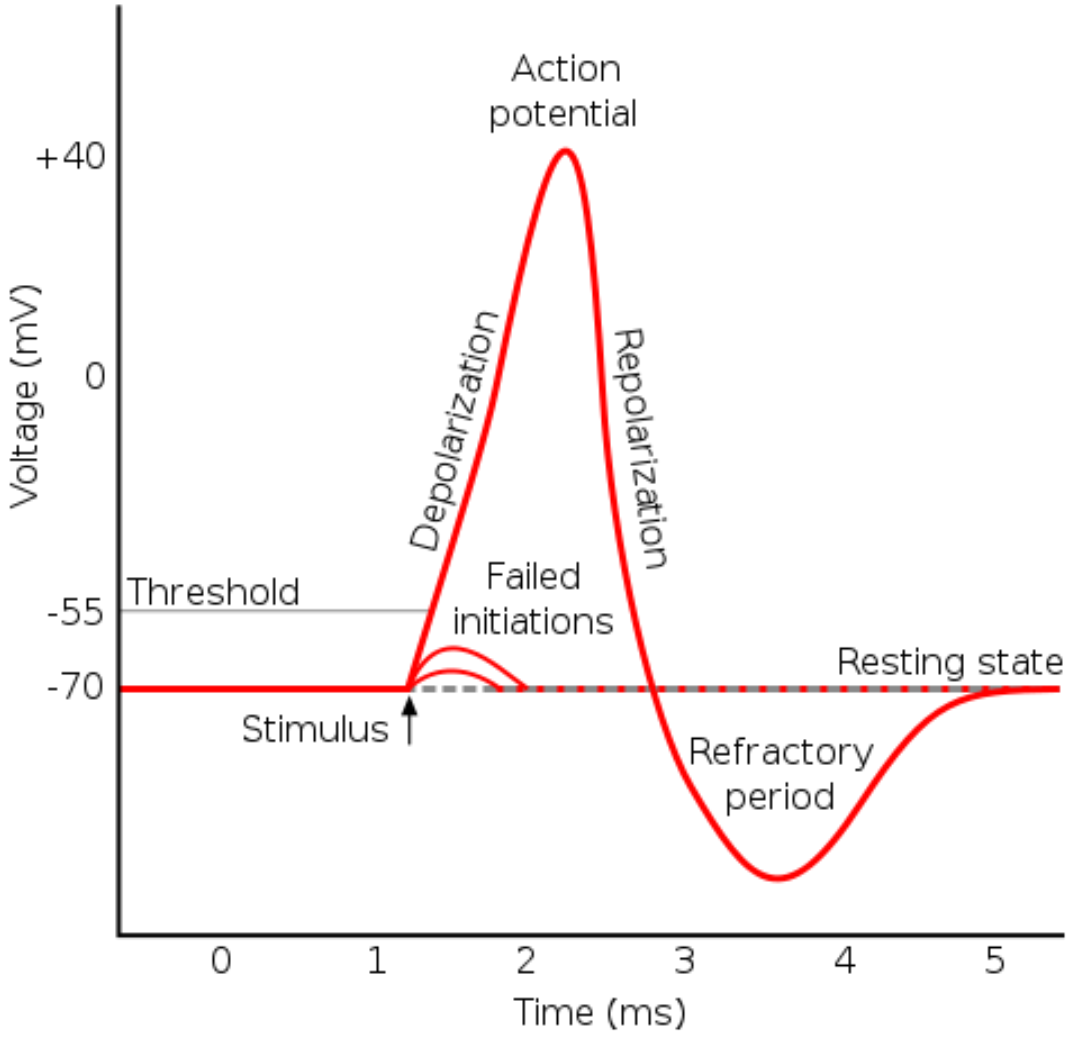

Figure 01: Refractory Period

In terms of the frequency of the action potential during nerve impulse transmission, the absolute refractory period determines the maximum frequency of the action potential along the plasma membrane of the axon. Therefore, this is responsible for setting the upper limit of the action potential at any given time. This phenomenon has a physiological significance. The absolute refractory period can be used to predict the manner in which the nervous system responds to different high-frequency stimuli and to determine its effects on different effector organs or muscles.

What is Relative Refractory Period?

Upon the completion of the absolute refractory period, the sodium ion channels begin to activate, which is the final phase of the recovery period. A much stronger signal is required by the sodium ion channels to recover back to the active form from its complete inactive state.

The period in which a stronger signal is received for the activation of the sodium ion channels is referred to as the relative refractory period. This constitutes to the later part of the complete refractory period. The ionic permeability of Potassium remains above the resting membrane potential value during the relative refractory period. This will result in the continuous flow of Potassium ions out of the cell. This will activate the process, and the second signal will enter.

What are the Similarities Between Absolute and Relative Refractory Period?

- Both are components of the refractory period that takes place during nerve impulse transmission.
- Both are dependent on the sodium and potassium ion channels.

What is the Difference Between Absolute and Relative Refractory Period?

Absolute vs Relative Refractory Period	
The absolute refractory period refers to the time span in which the Sodium channels remain inactive.	The relative refractory period is the phenomenon in which the Sodium gated channels transit from its inactive status to the closed status that prepares the channels to be activated.
Stimulus	
During the absolute refractory period, the stimulus will not produce a second action potential.	During the relative refractory period, the stimulus must be stronger than the usual to produce the action potential.
Involvement of Ion Channels	
The sodium ion channels are completely inactive during the absolute refractory period.	The potassium ion channels are active, and flow of potassium out of the cell takes place during the relative refractory period.

Summary - Absolute vs Relative Refractory Period

The refractory period during a nerve impulse transmission is characterized as absolute refractory period and the relative refractory period. During the absolute refractory period, the Na^+ channels are completely inactive and therefore cannot initiate any action potential. During the relative refractory period, the Na^+ channels undergo a recovery period in which they transit to the active state. A much stronger second stimulus is required for this process. This is the difference between absolute and relative refractory period.

Reference:

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