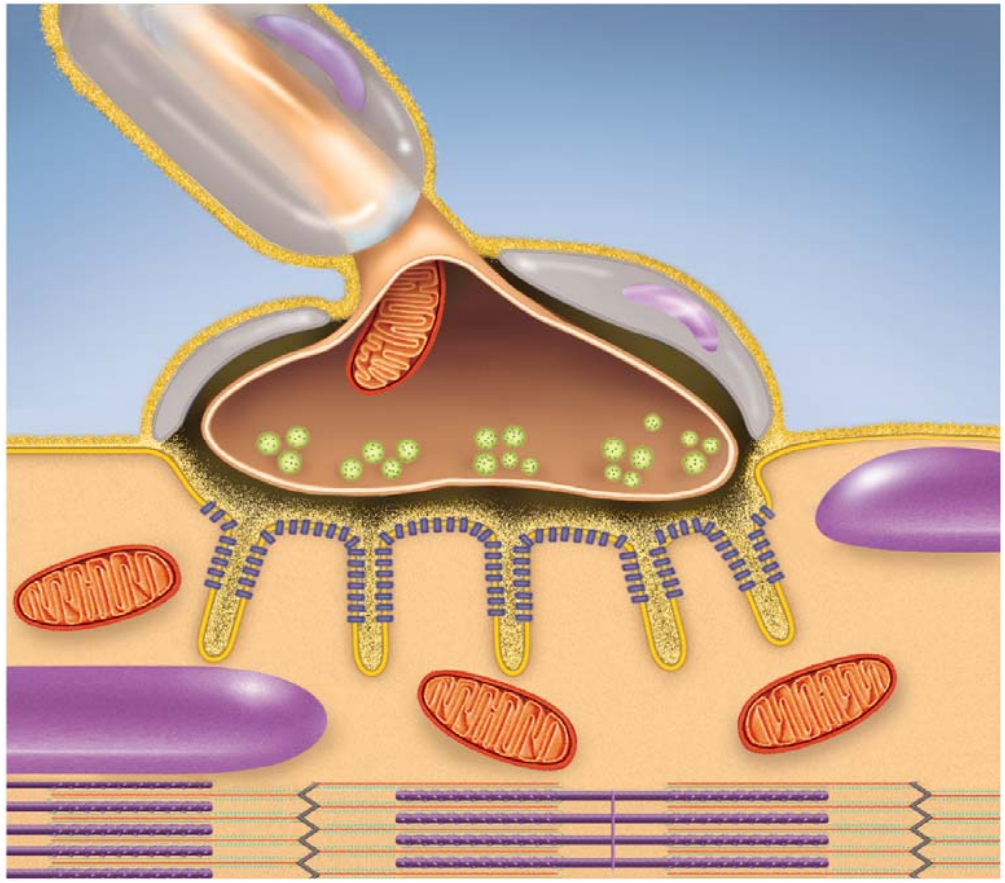
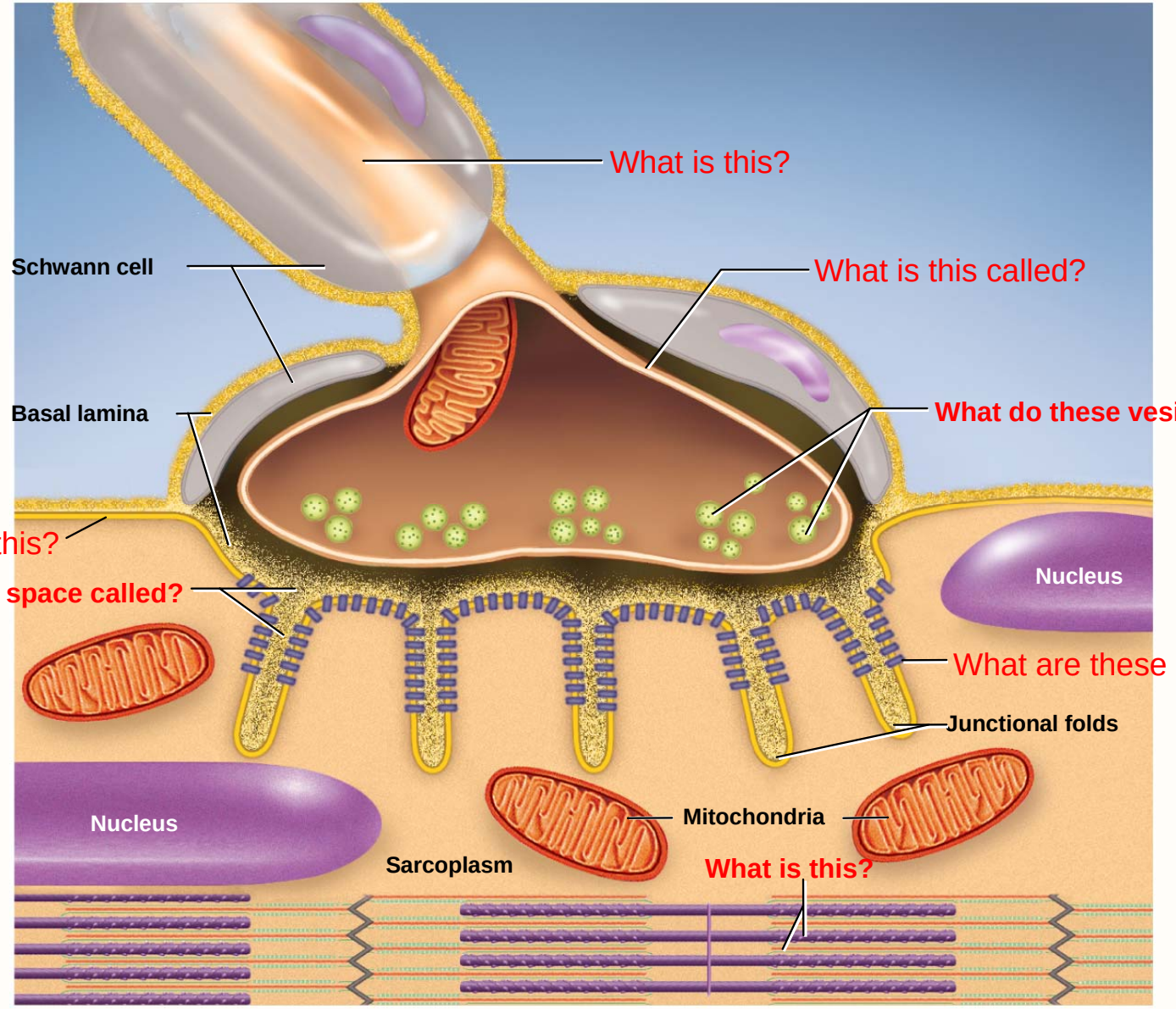
Nerve Muscle Relationship and Neural Muscular Junction Quiz

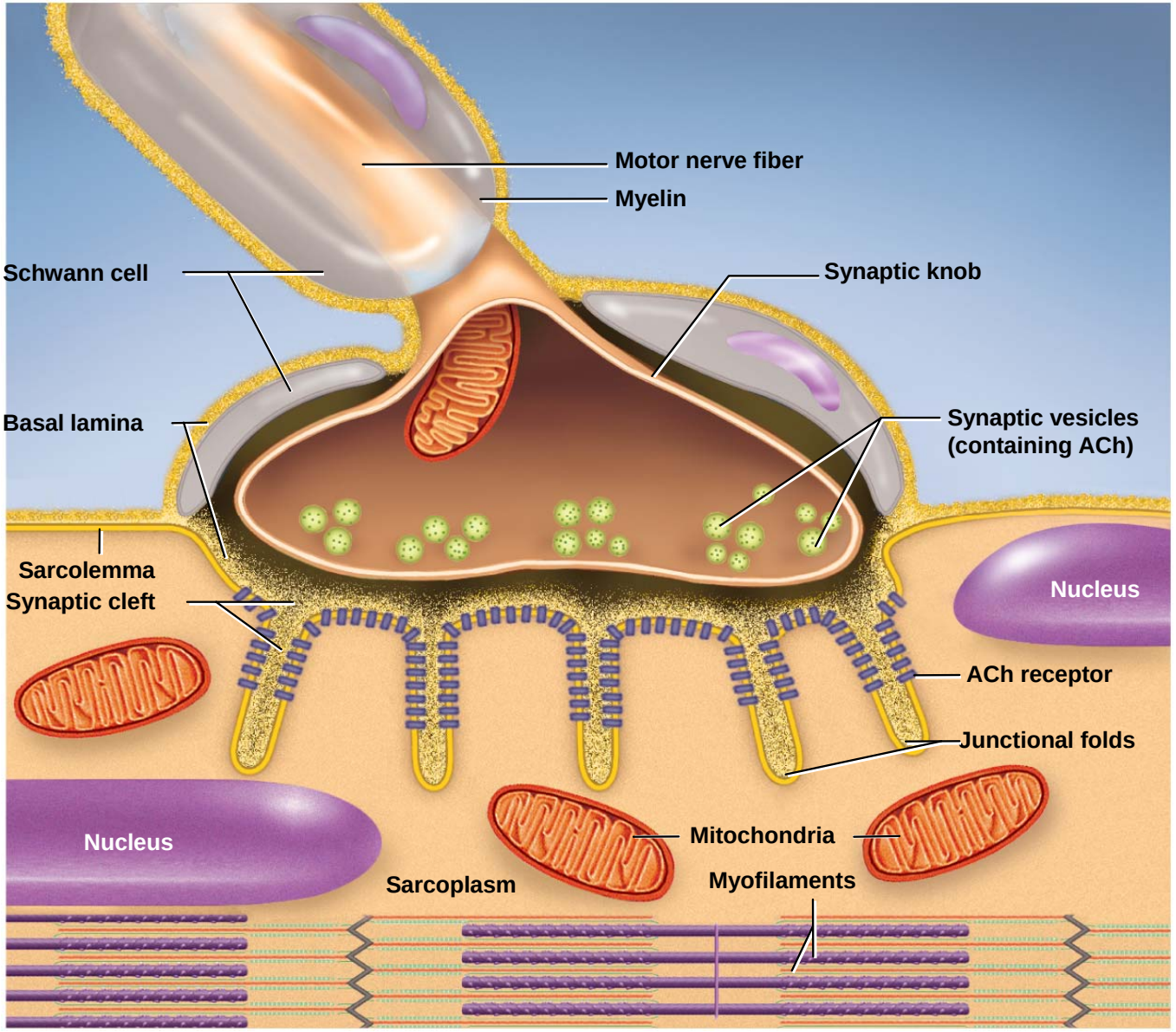


Remember, you need to know the structure and the function!

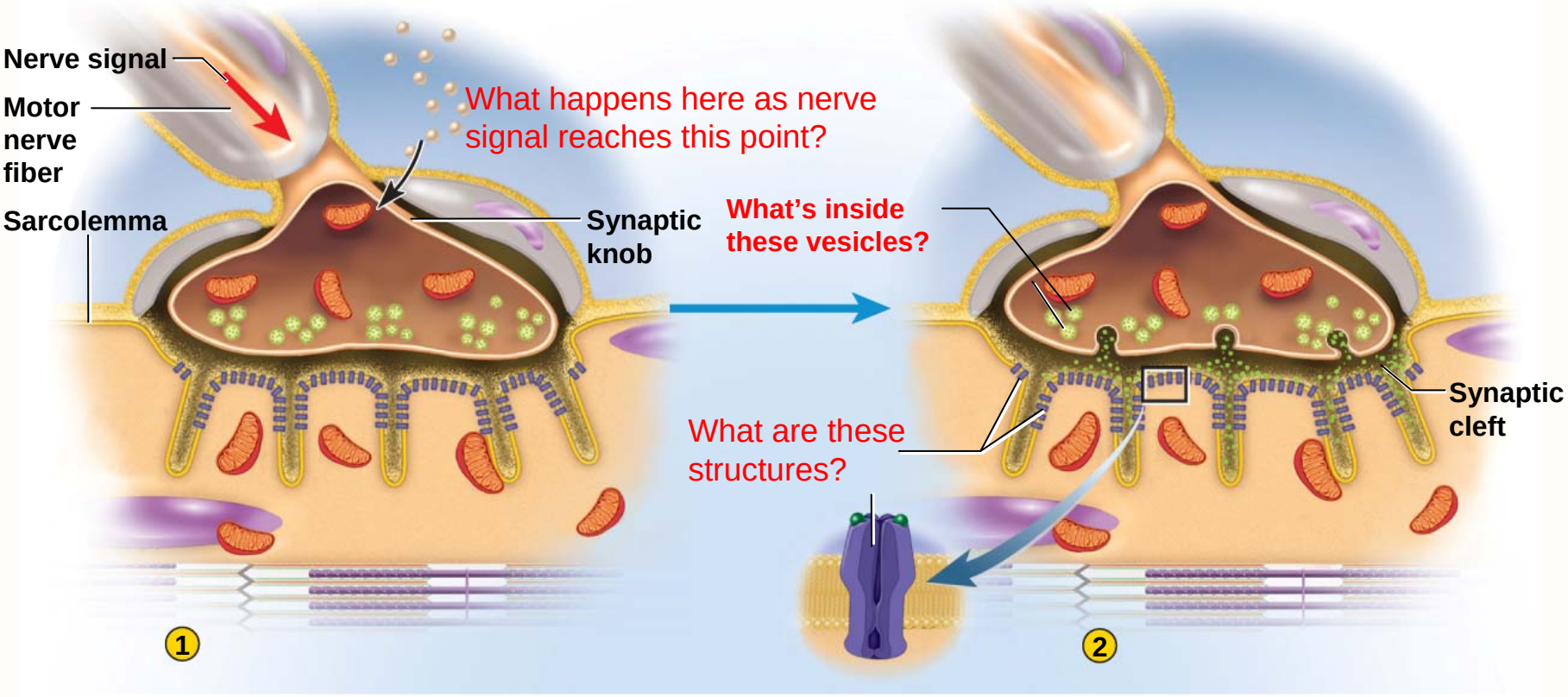
What is this called?



The Neuromuscular Junction

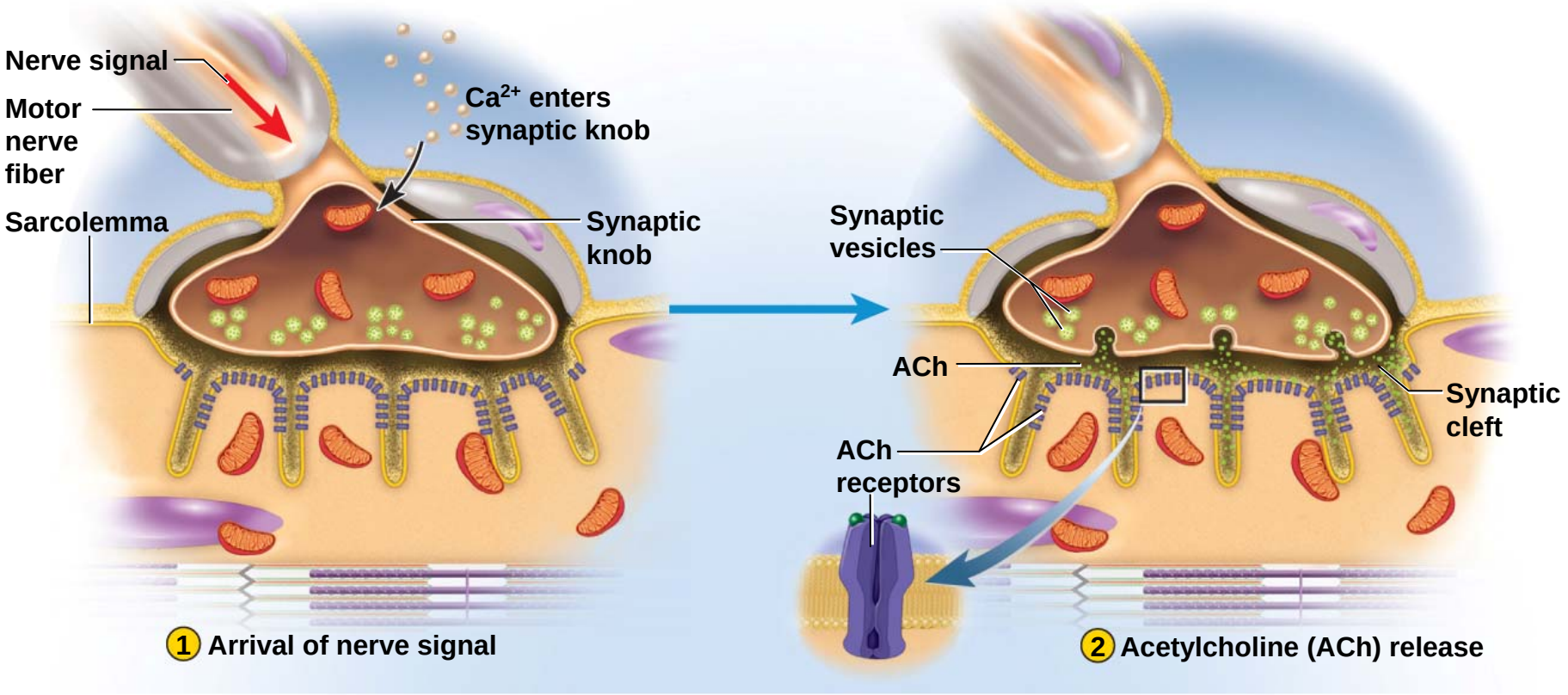


What is this step called? (steps 1 and 2)



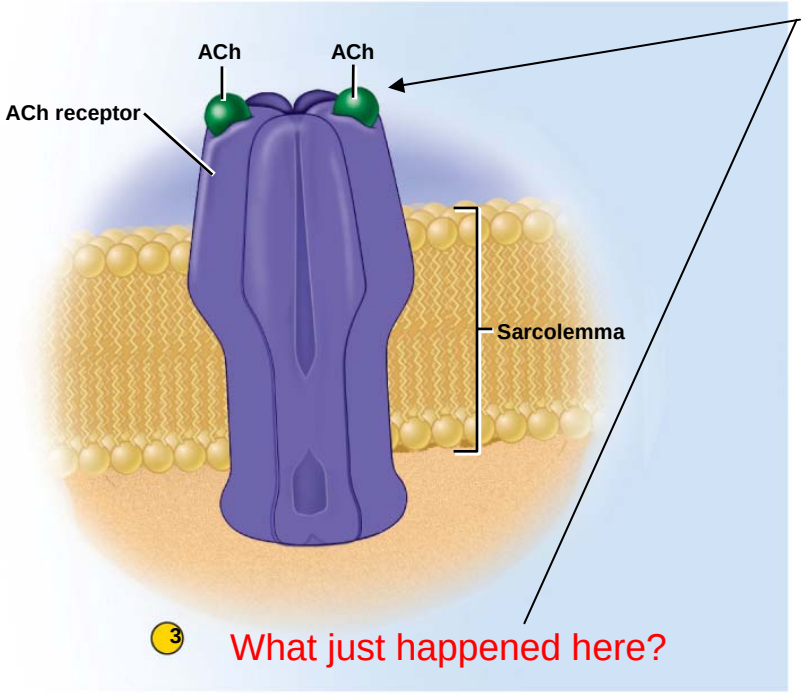
- What happens at #1?
- What happens at #2?

Excitation (steps 1 and 2)

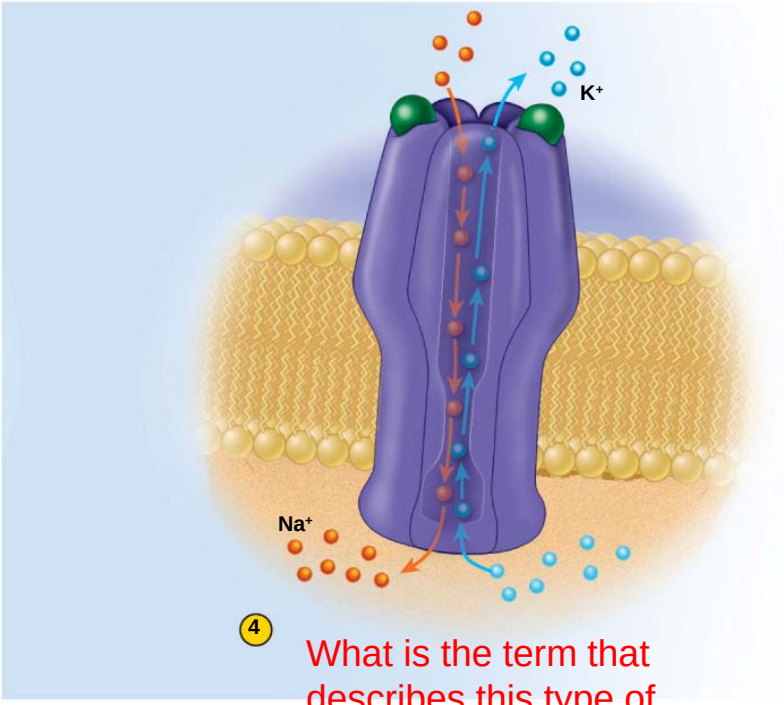


- nerve signal opens voltage regulated calcium gated channels in synaptic knob
- calcium stimulates exocytosis of ACh from synaptic vesicles
- ACh released into synaptic cleft

This is part of what process? (steps 3 and 4)



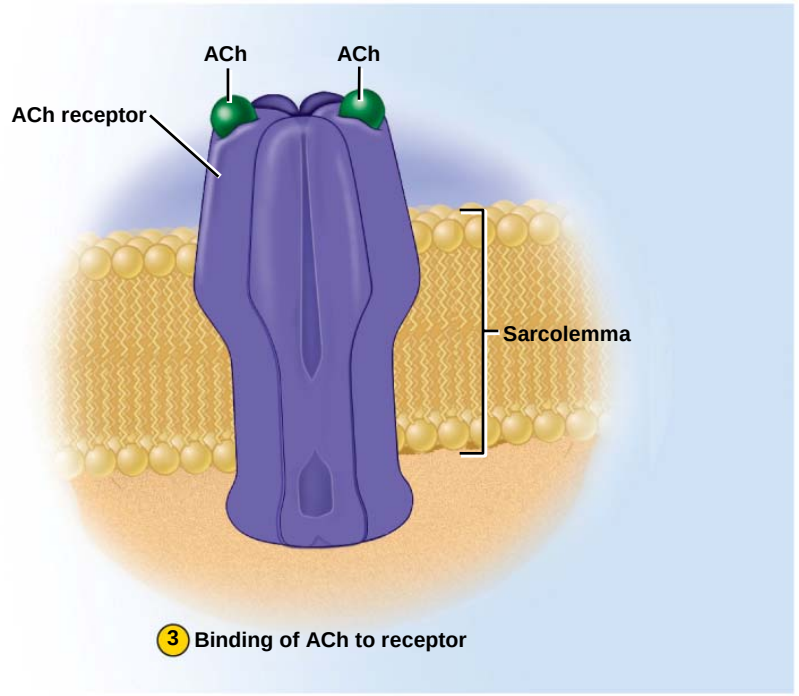
What just happened here?

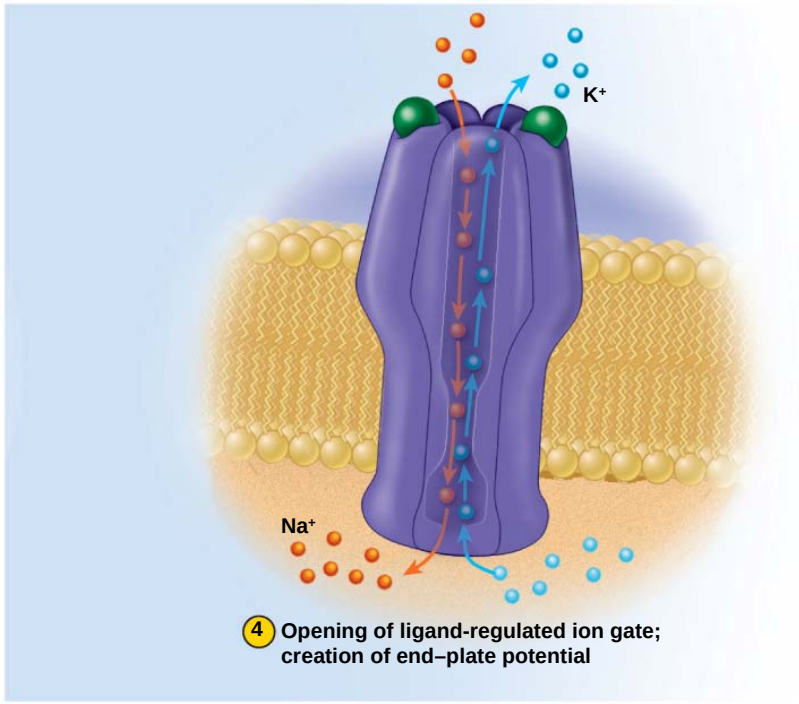


What is the term that describes this type of potential?

- What is the form of regulation (type) at these gates?

Excitation (steps 3 and 4)

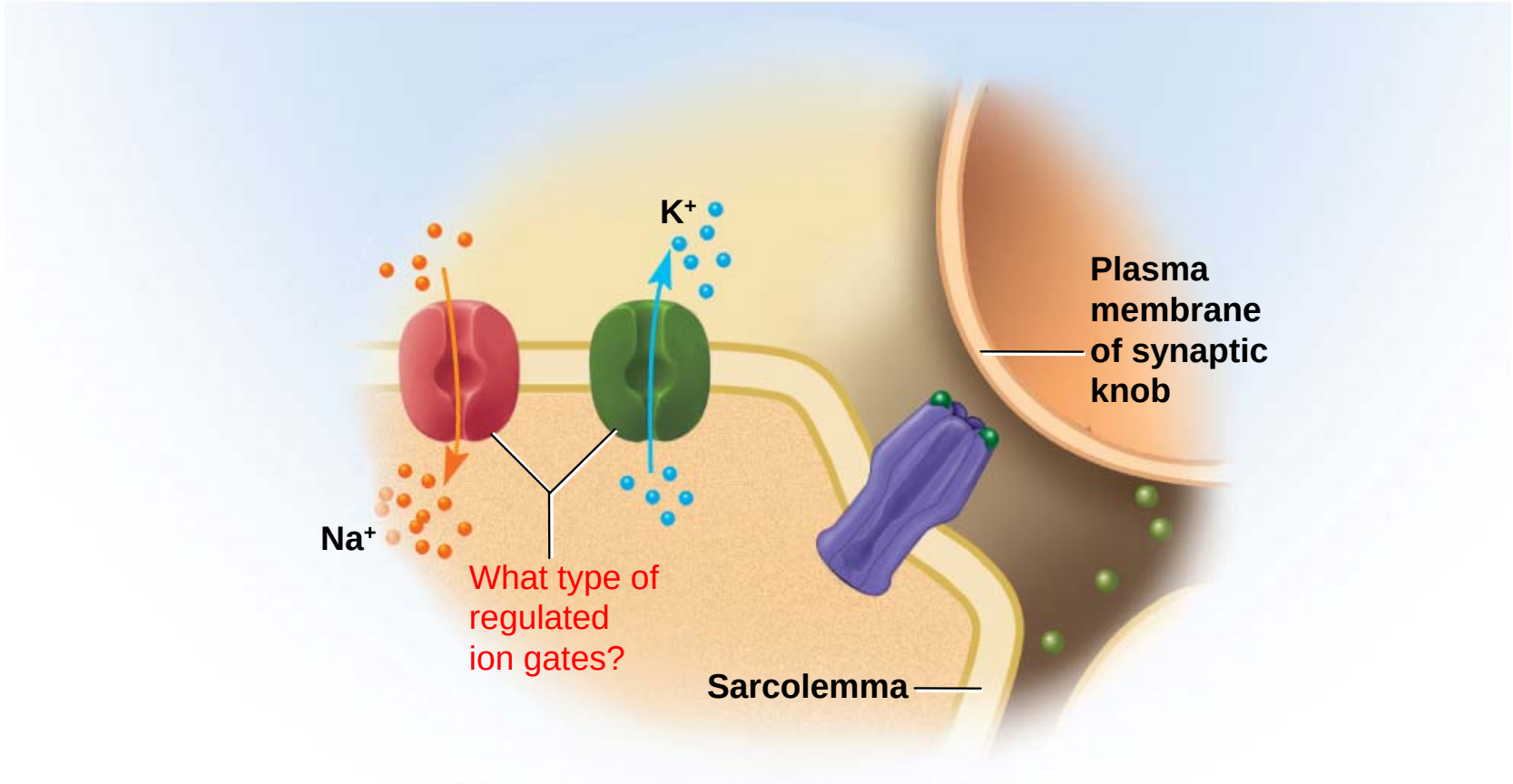




- two ACh molecules bind to each receptor protein, opens ligand regulated Na^+ and K^+ channels. (i.e. Ach is the ligand)

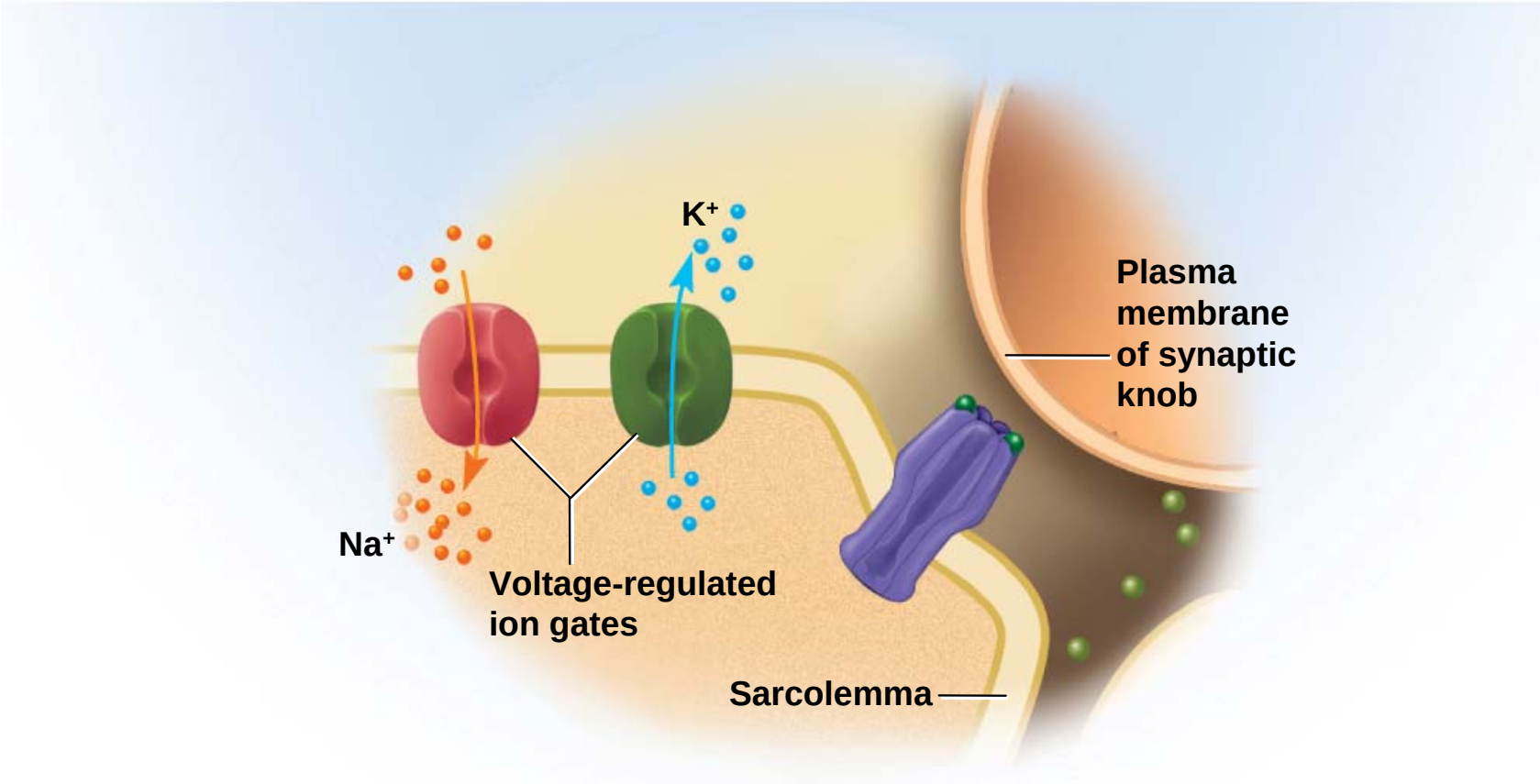
- Na^+ enters shifting RMP /// goes from -90mV to +75mV /// then K^+ exits and RMP returns to -90mV /// quick voltage shift is called the **end-plate potential (EPP)** // a type of action potential

This is part of what process? (step 5)



5 What is being created just outside of the “neuromuscular endplate”?

Excitation (step 5)

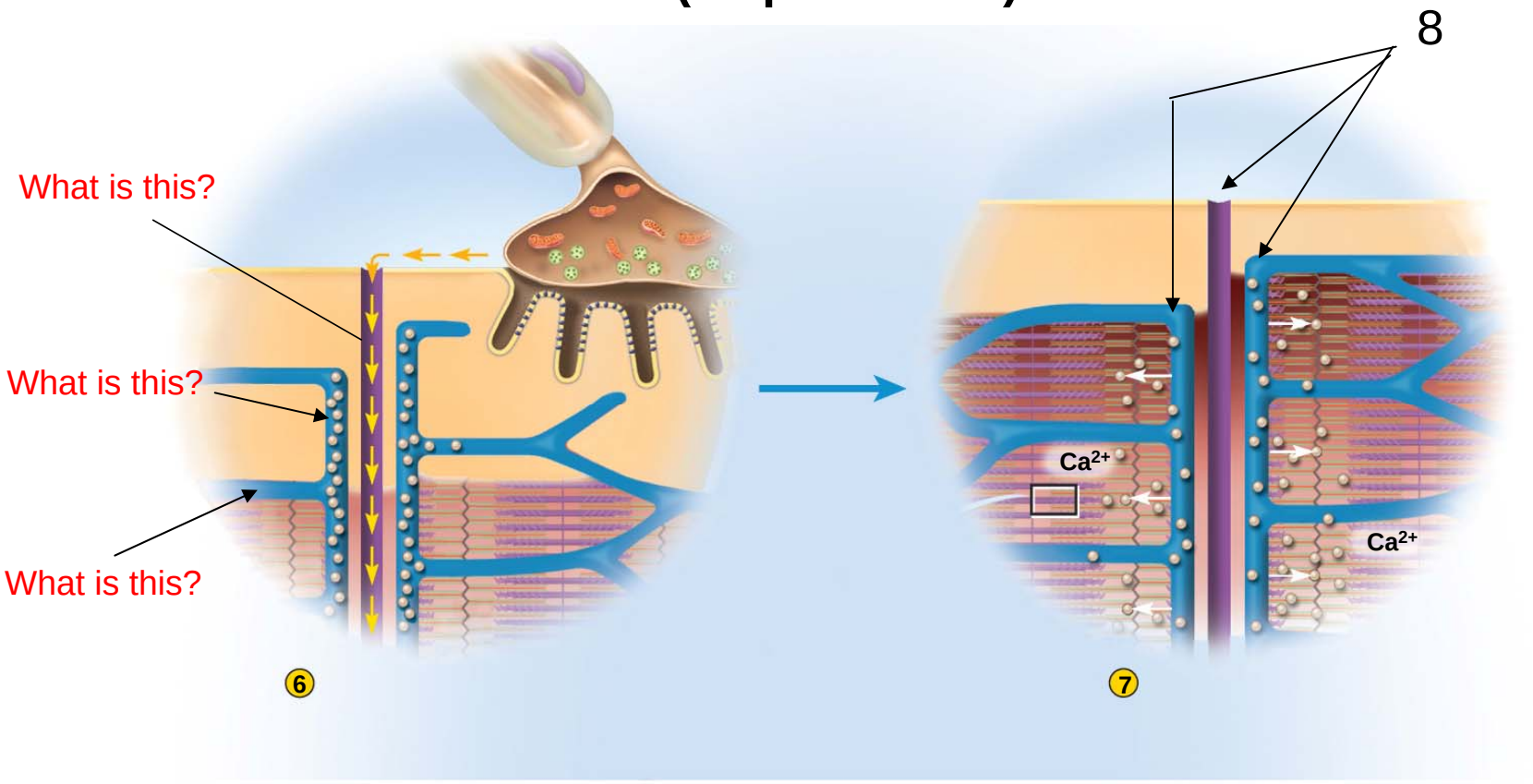


5 Opening of voltage-regulated ion gates; creation of action potentials

Voltage change (in end-plate region) spreads to nearby voltage regulated gated Na and K channels to produce an action potential just outside of the neuromuscular junction that then spreads over entire muscle surface.

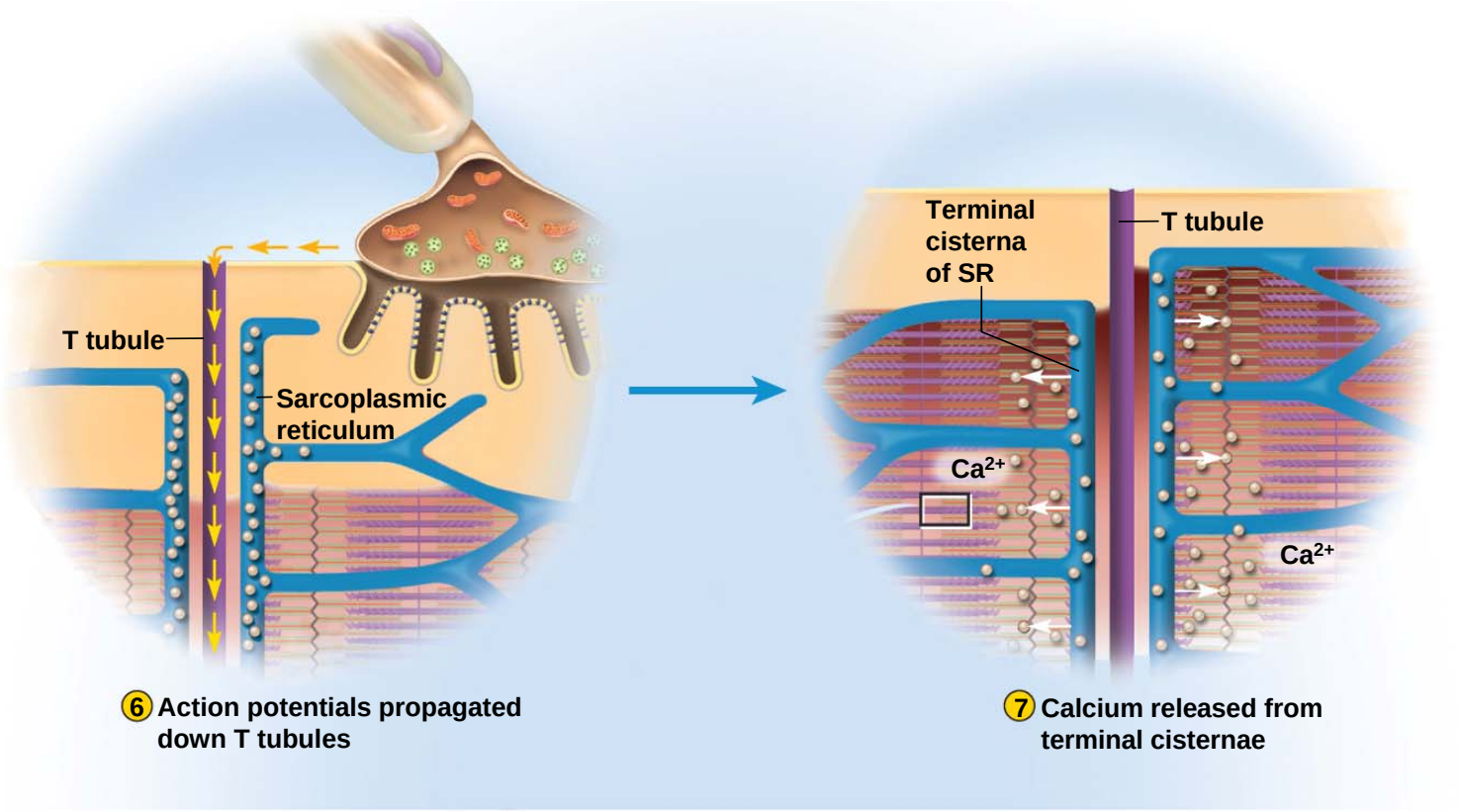
What is this step called?

(steps 6 and 7)



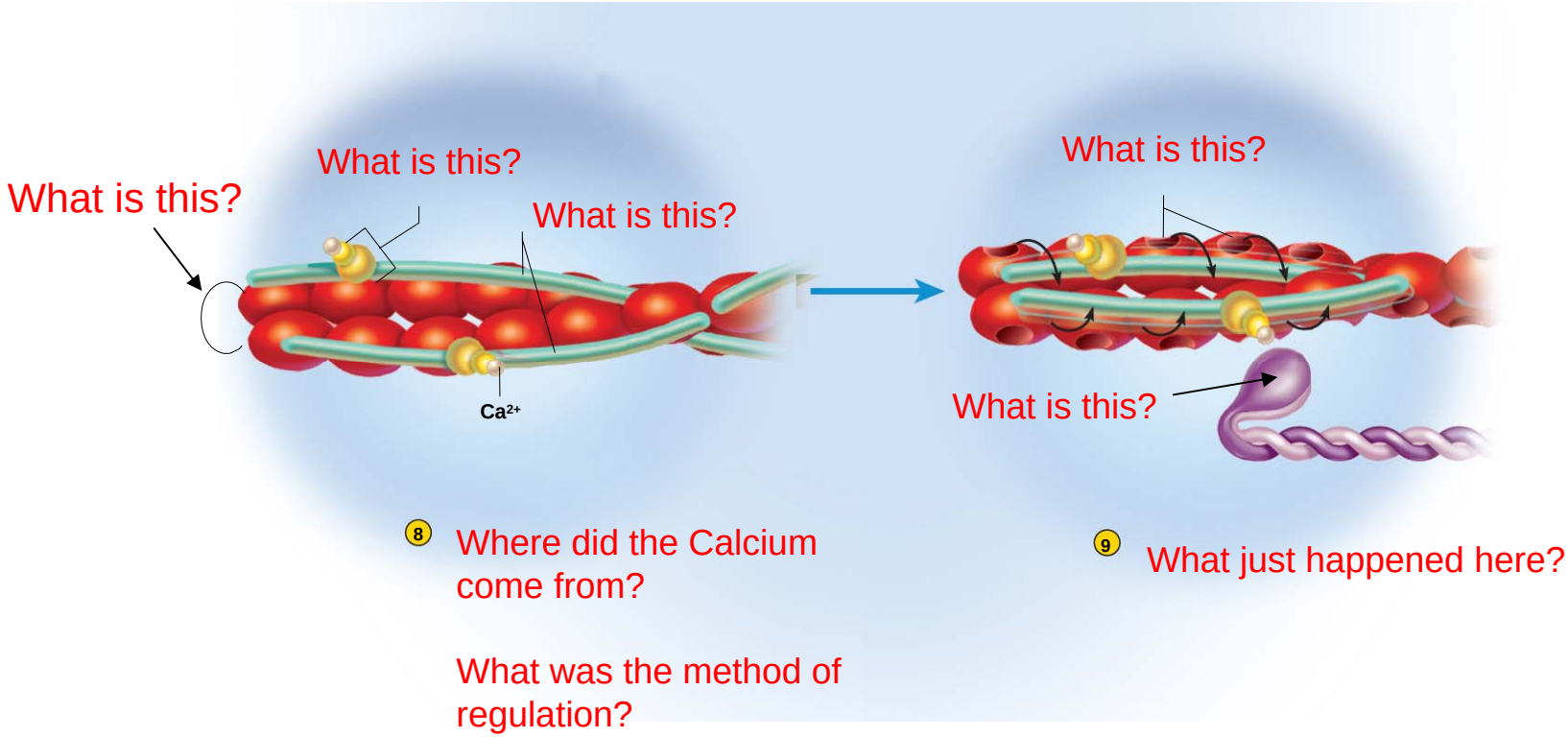
- #6) What term describes the movement of the yellow arrows?
- #7) What event is occurring? Is it active or passive?
- #8) What do these three structures form?

Excitation-Contraction Coupling
(steps 6 and 7)



- action potential (AP) spreads from sarcoplasm into T tubules
- AP flows from T tubules to sarcoplasmic reticulum
- AP opens voltage regulated gated calcium ion channels in SR
- Ca^{+2} diffuse into the cytosol

This is part of what process? (steps 8 and 9)

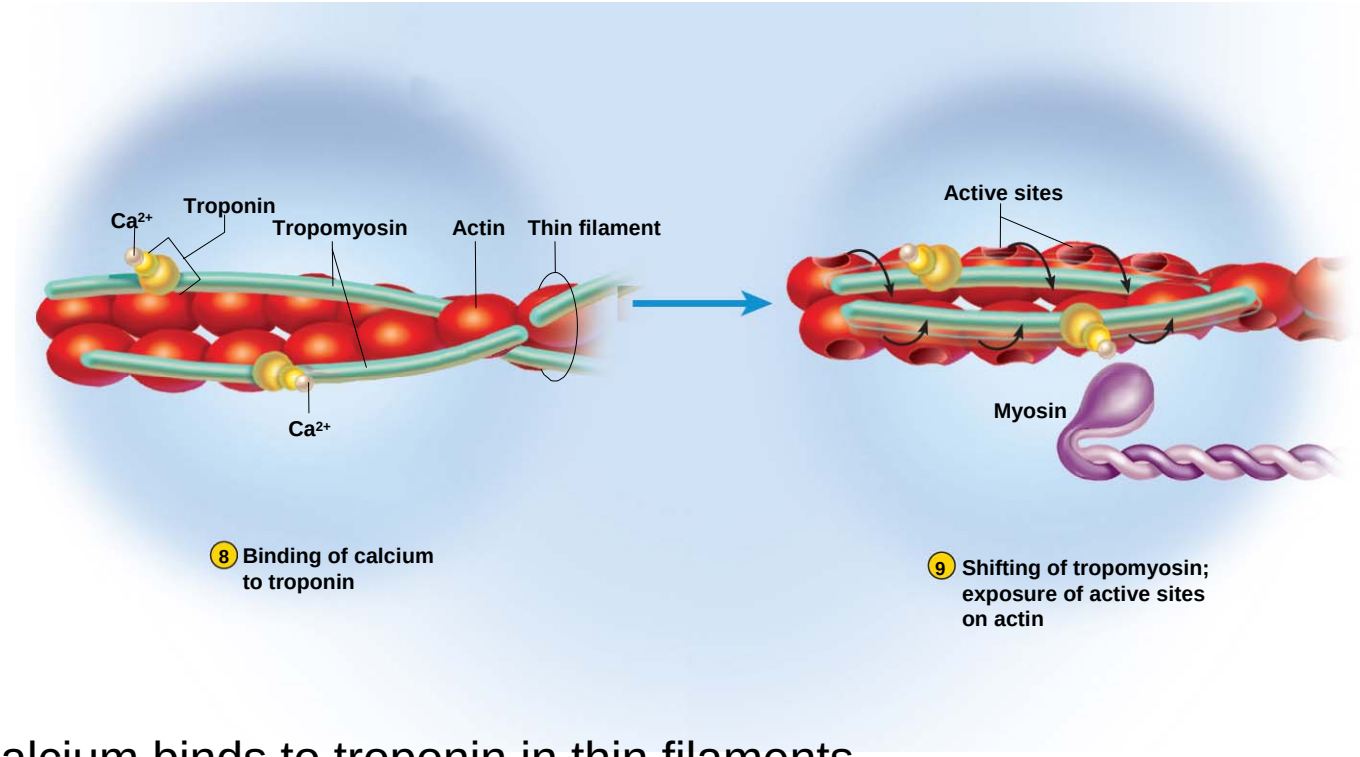


8 Where did the Calcium come from?

What was the method of regulation?

9 What just happened here?

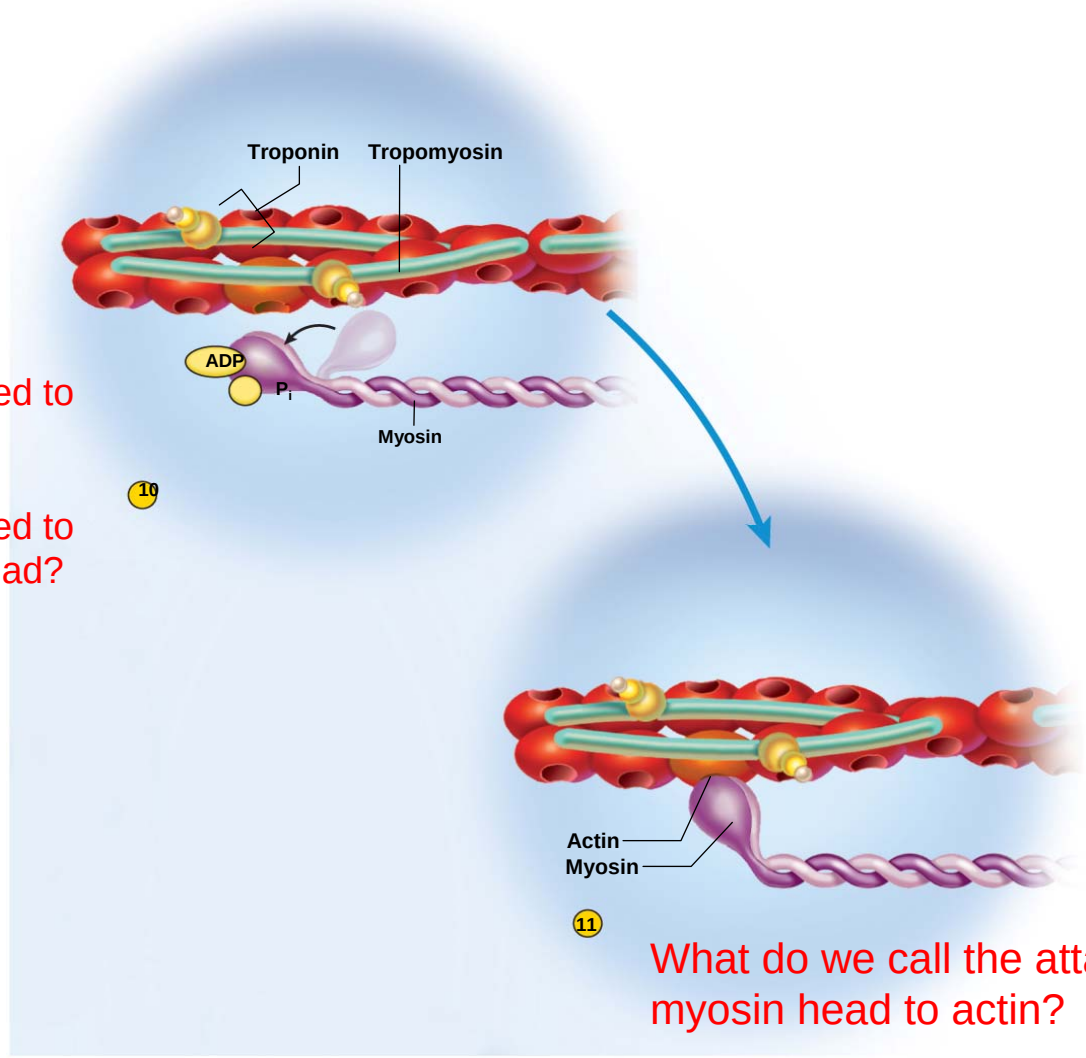
Excitation-Contraction Coupling
(steps 8 and 9)



- calcium binds to troponin in thin filaments
- troponin-tropomyosin complex changes shape and exposes active sites on actin
- this is the site where the “energized myosin head” must bind to in order for a muscle to shorten

What is this step called?

(steps 10 and 11)



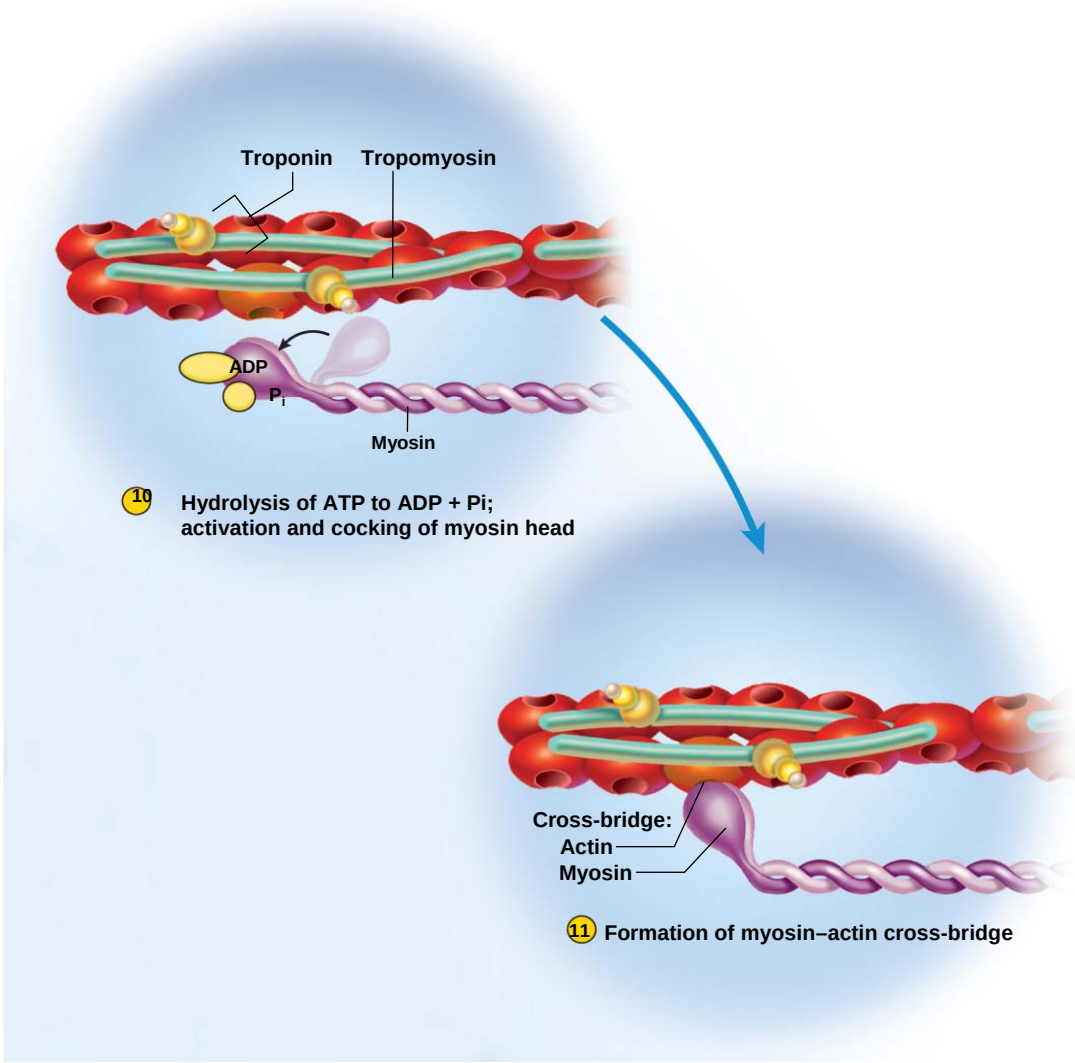
What happened to the ATP?

What happened to the myosin head?

What do we call the attachment of the myosin head to actin?

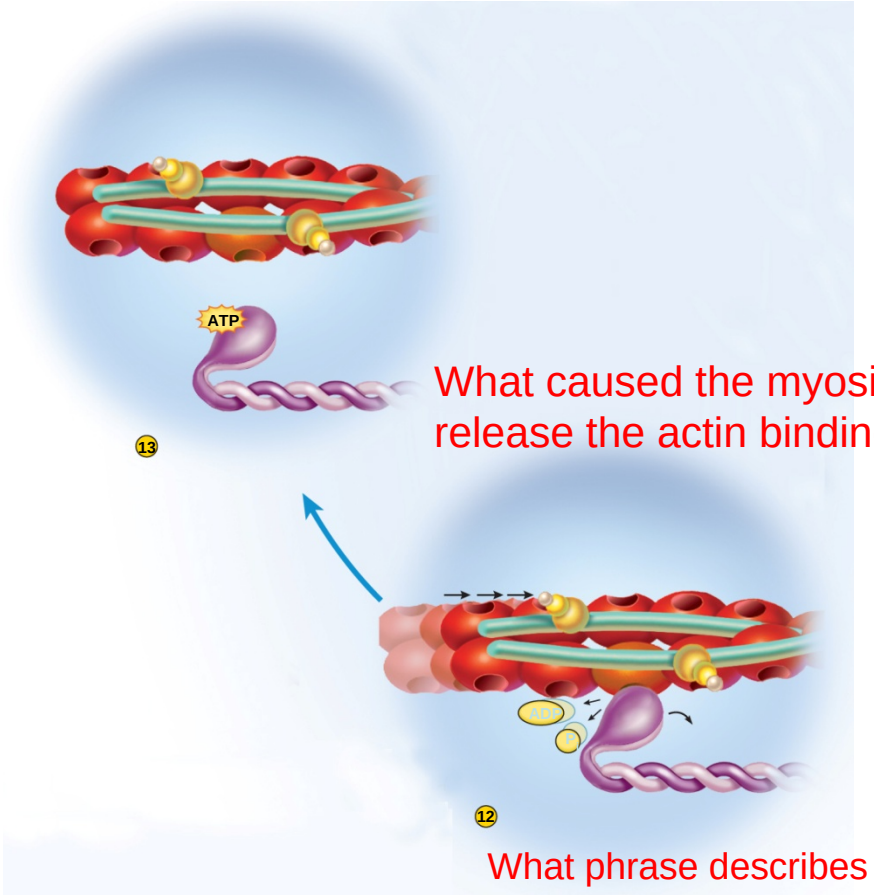
What happens to the myosin head after it attaches to the actin binding site?

Contraction
(steps 10 and 11)



- myosin ATPase enzyme in myosin head hydrolyzes ATP molecule
- This reaction occurs independent of the actin – troponin – tropomyocin event
- Myosin head is activated = the head "cocks" to extends head /// ADP + P_i remain attached to head
- head binds to actin active site forming a myosin - actin cross-bridge
- *Now ADP + P released from the myosin head*

This is part of what process? (steps 12 and 13)



What caused the myosin head to release the actin binding site?

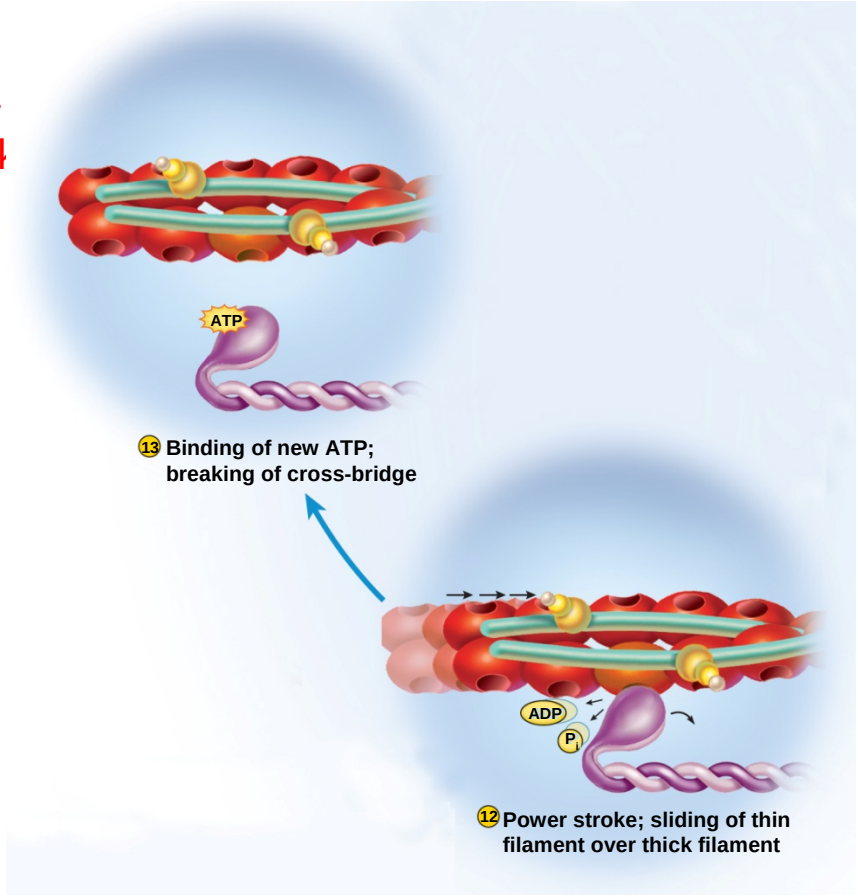
What phrase describes this event?

What is released from the myosin head as it binds to actin?

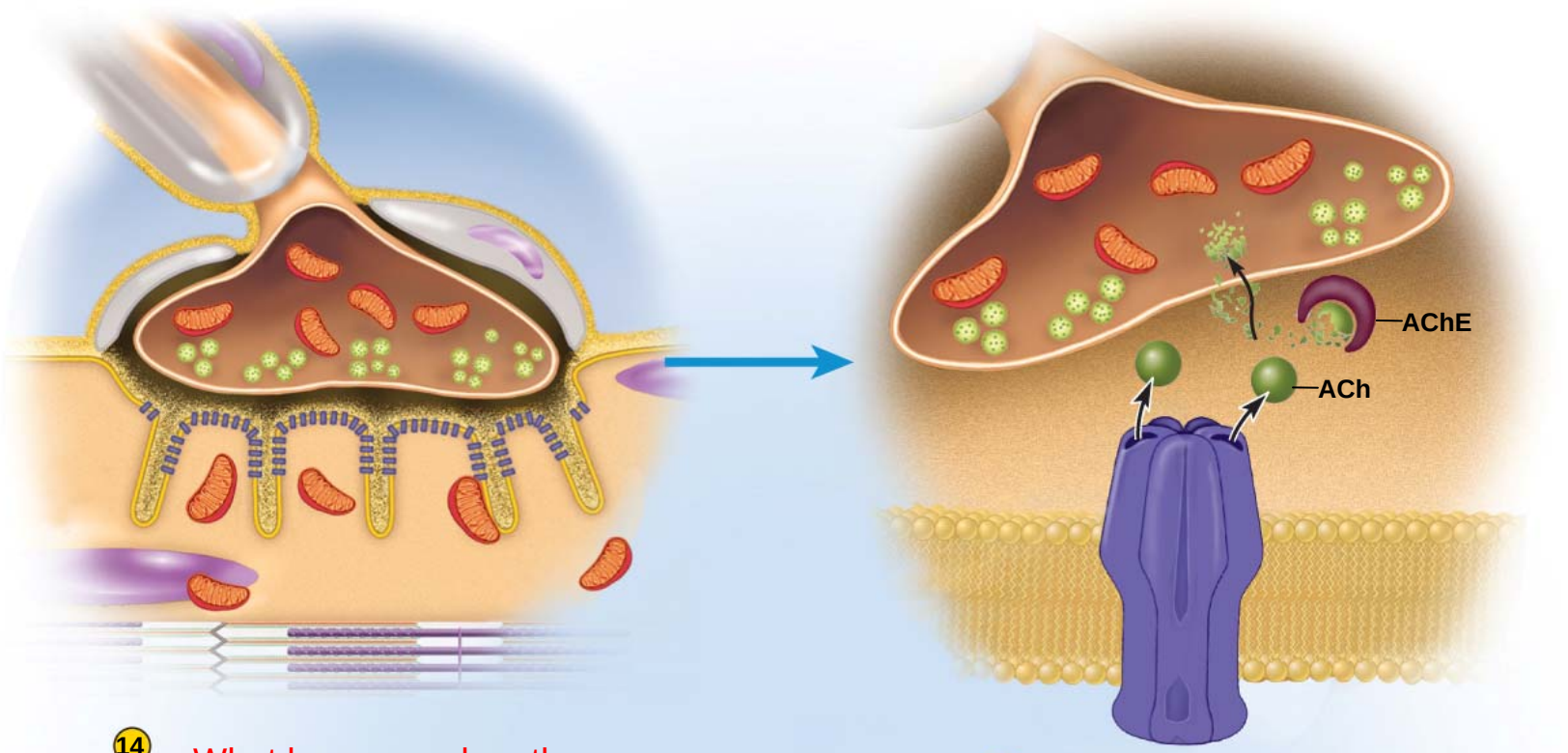
Contraction (steps 12 and 13)

- **The Power Stroke**
  - Myosin head flexes
  - Pulls thin filament over thick filament // Z disc move closer together
  - Myosin head can not release actin until new ATP molecule binds to myosin // this "breal the bridge"

- Only upon binding more ATP to the myosin head
  - myosin releases actin and the process is repeated
  - each head performs 5 power strokes per second
  - each stroke utilizes one molecule of ATP
  - As one bridge is broken many more are formed which maintains tension in muscle



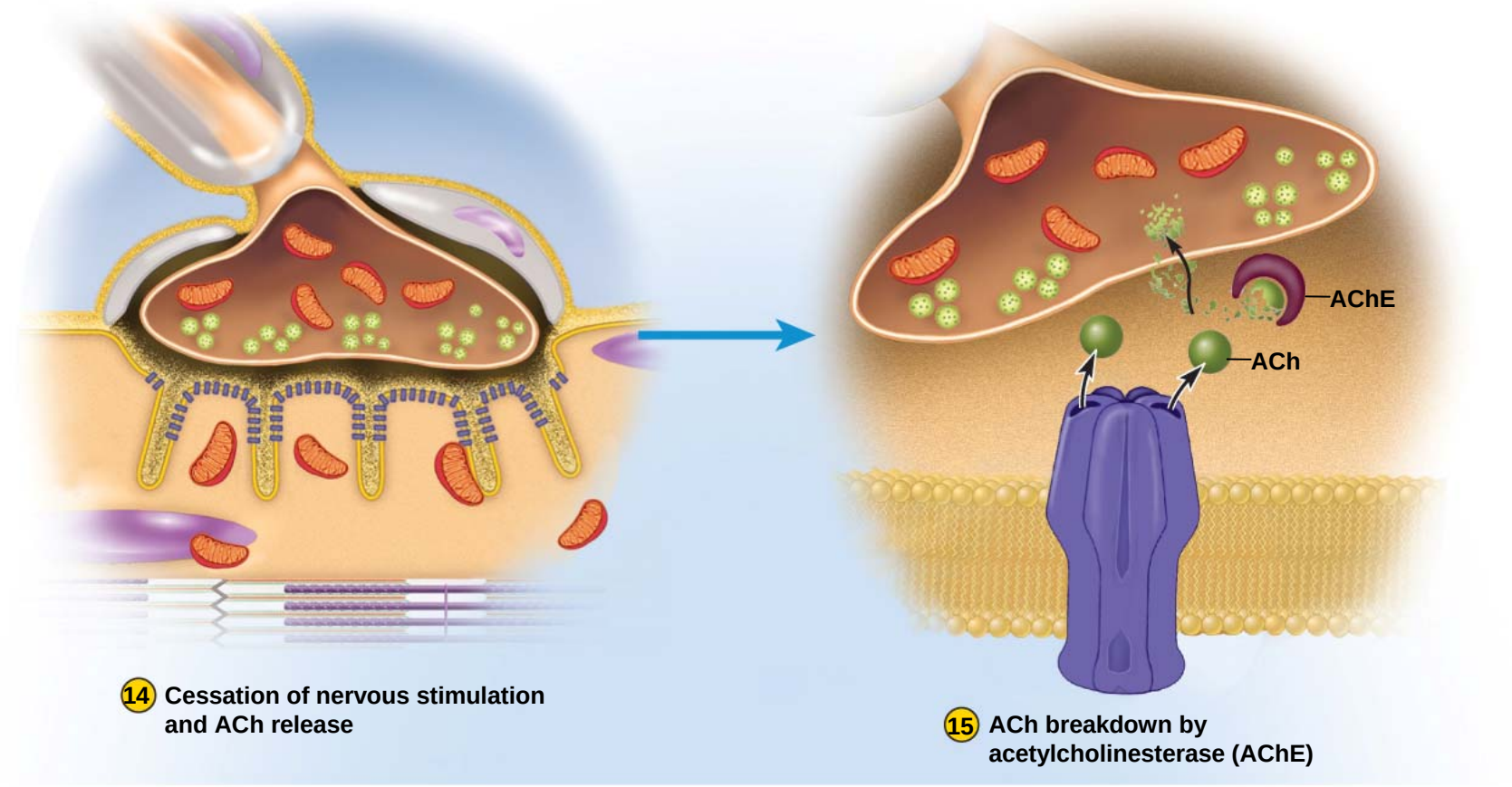
What is this step called? (steps 14 and 15)



14 What happens when the nerve's action potential stops?

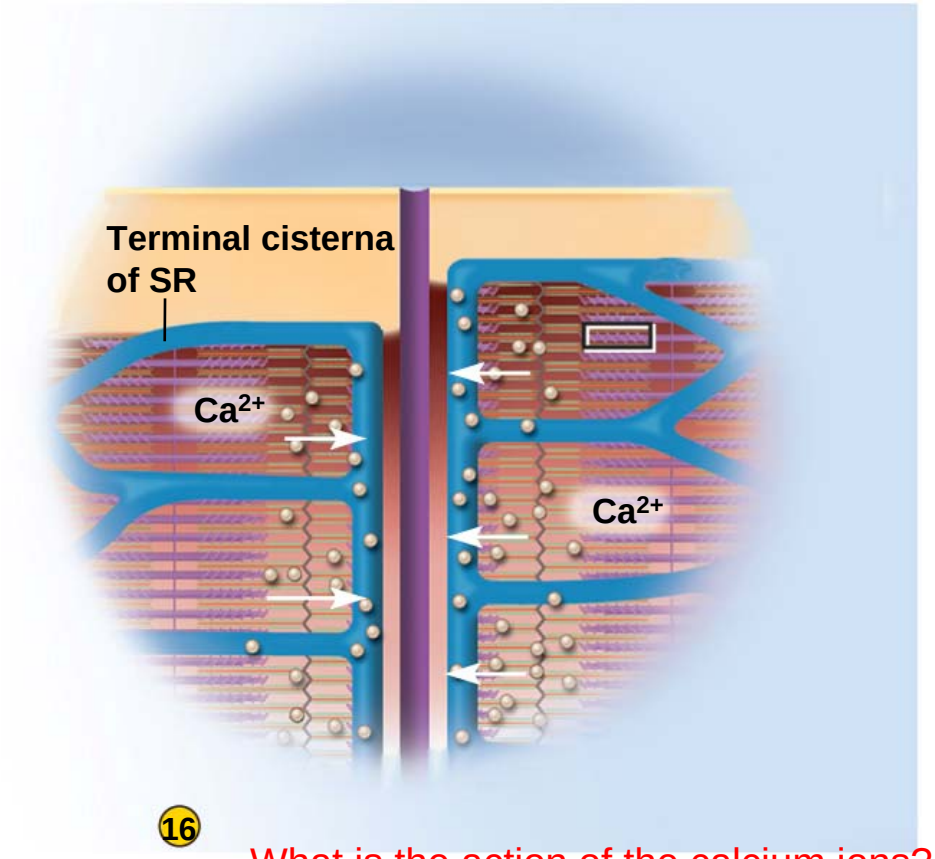
15 What is the function of acetylcholesterase?

Relaxation (steps 14 and 15)



- Stop nerve stimulation to stop ACh release
- AChE breaks down Ach // fragments reabsorbed into synaptic knob
- This stops stimulation by ACh // reverses all “downstream” events

This is part of what process? (step 16)



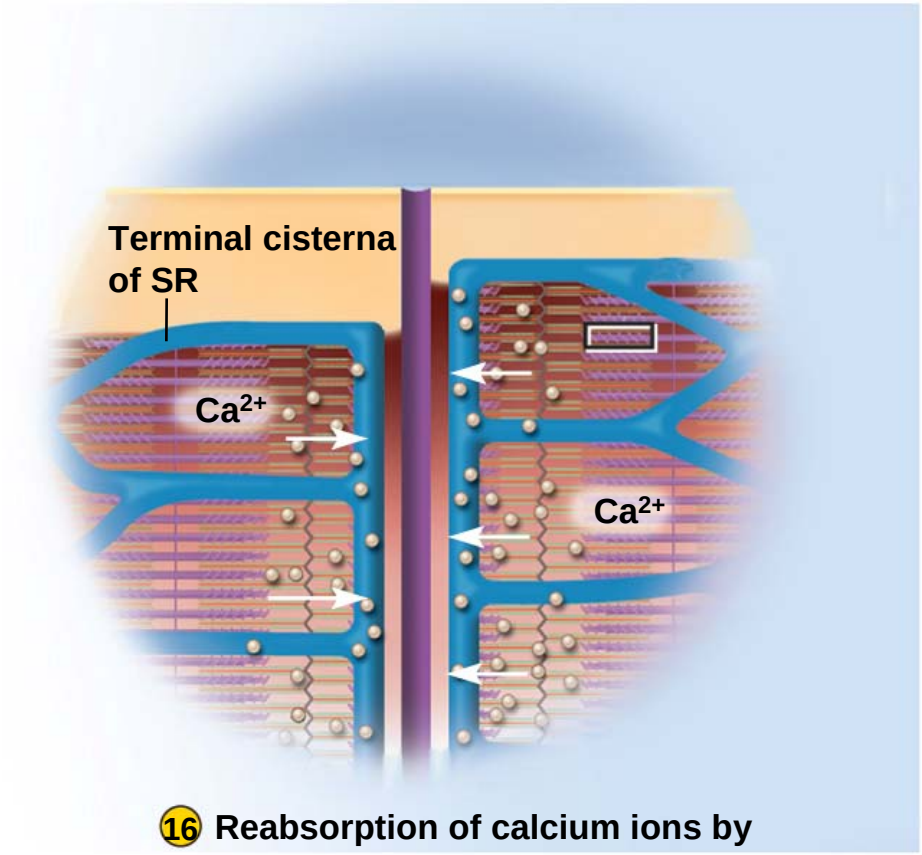
What is the action of the calcium ions?

What is it called?

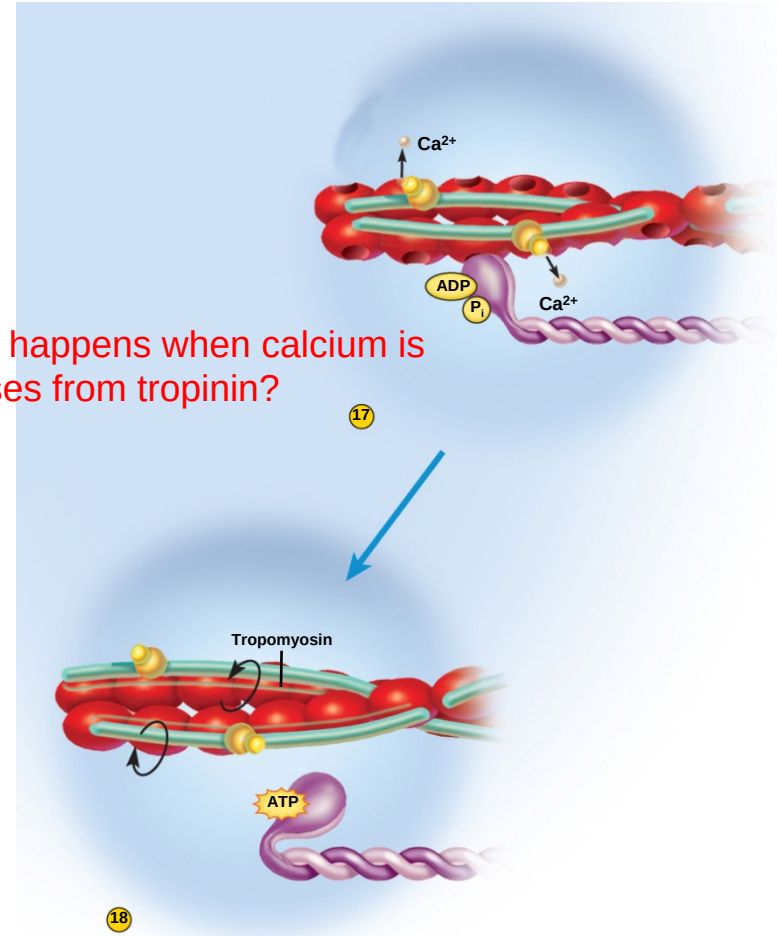
Is it active or passive?

Relaxation (step 16)

- Ca^{+2} pumped back into SR by active transport. // this is active transport (Why?)
- Ca^{+2} binds to calsequestrin while in storage in SR
- <u>ATP is needed for</u>
  - <u>muscle relaxation</u>
  - <u>as well as muscle contraction.</u>



This is part of what process? (steps 17 and 18)



What happens when calcium is releases from tropinin?

Where did the tropomyosin move?

Relaxation (steps 17 and 18)

- Ca^{+2} removed from troponin is pumped back into SR
- tropomyosin blocks once again the myosin binding sites
- muscle fiber ceases to produce or maintain tension
- muscle fiber returns to its resting length
  - due to recoil of elastic components & contraction of antagonistic muscles