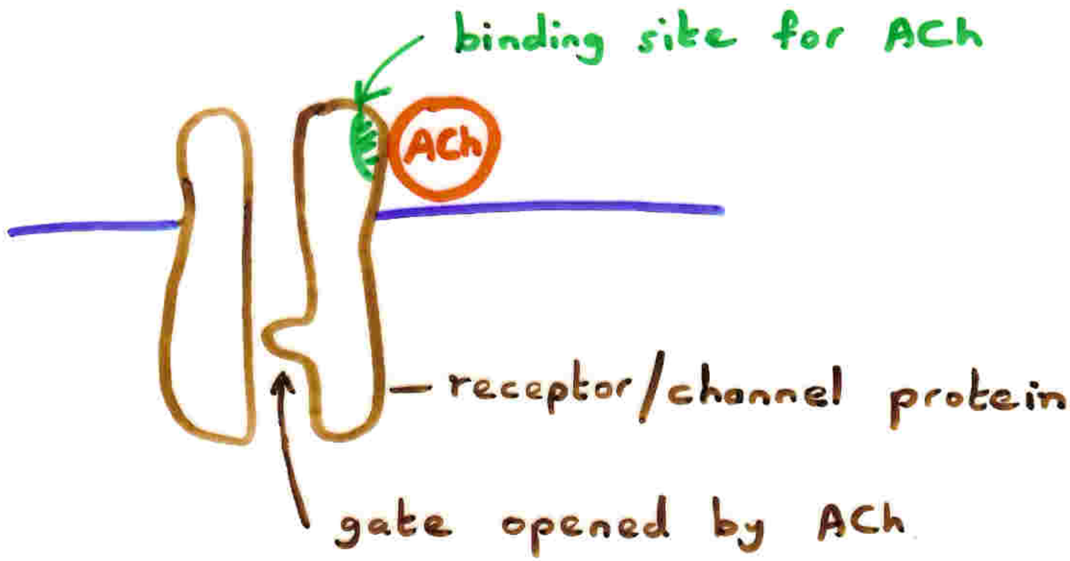
# Neurotransmitter Receptors

## End-plate channels




endplate channel is integral protein (5-subunits) forming ion channel and receptor for ACh.

Channel is permeable to both $Na^+$ and $K^+$

# Channel gating

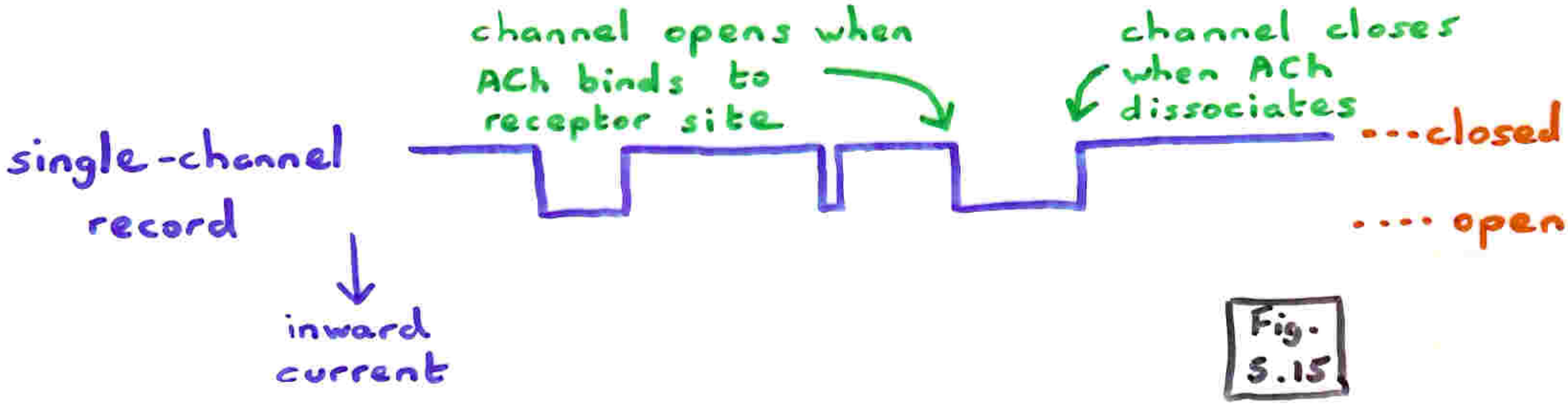
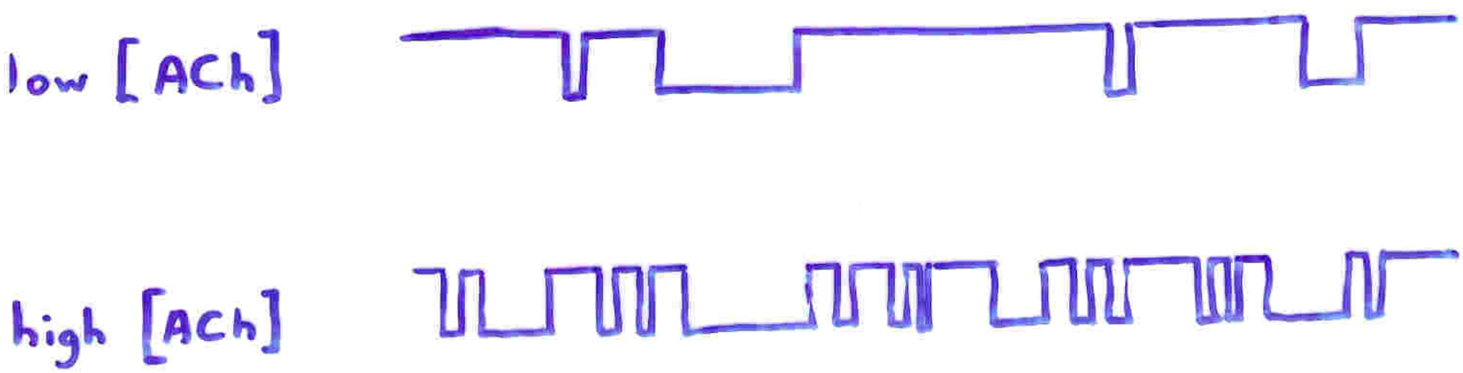



Fig. 5.15

increasing [ACh] increases frequency of channel openings; not duration of opening or size of current through channel.




Overall current at endplate increases with increasing [ACh] because more channels are open at any instant of time.

# Channel opening requires binding of 2 ACh Molecules

ACh-activated channel formed from 5 subunits

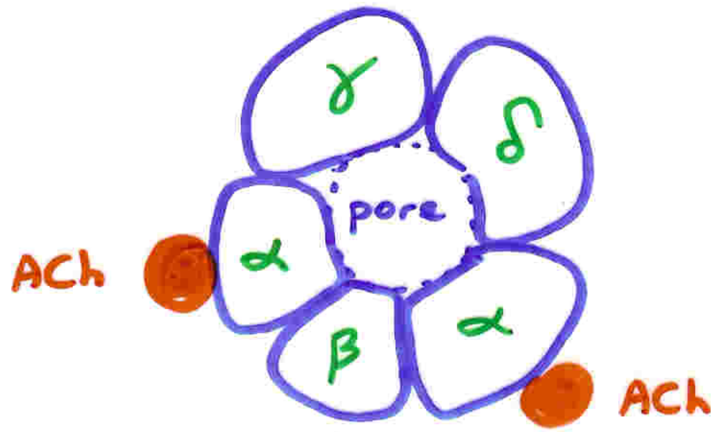



Fig. 6.3B

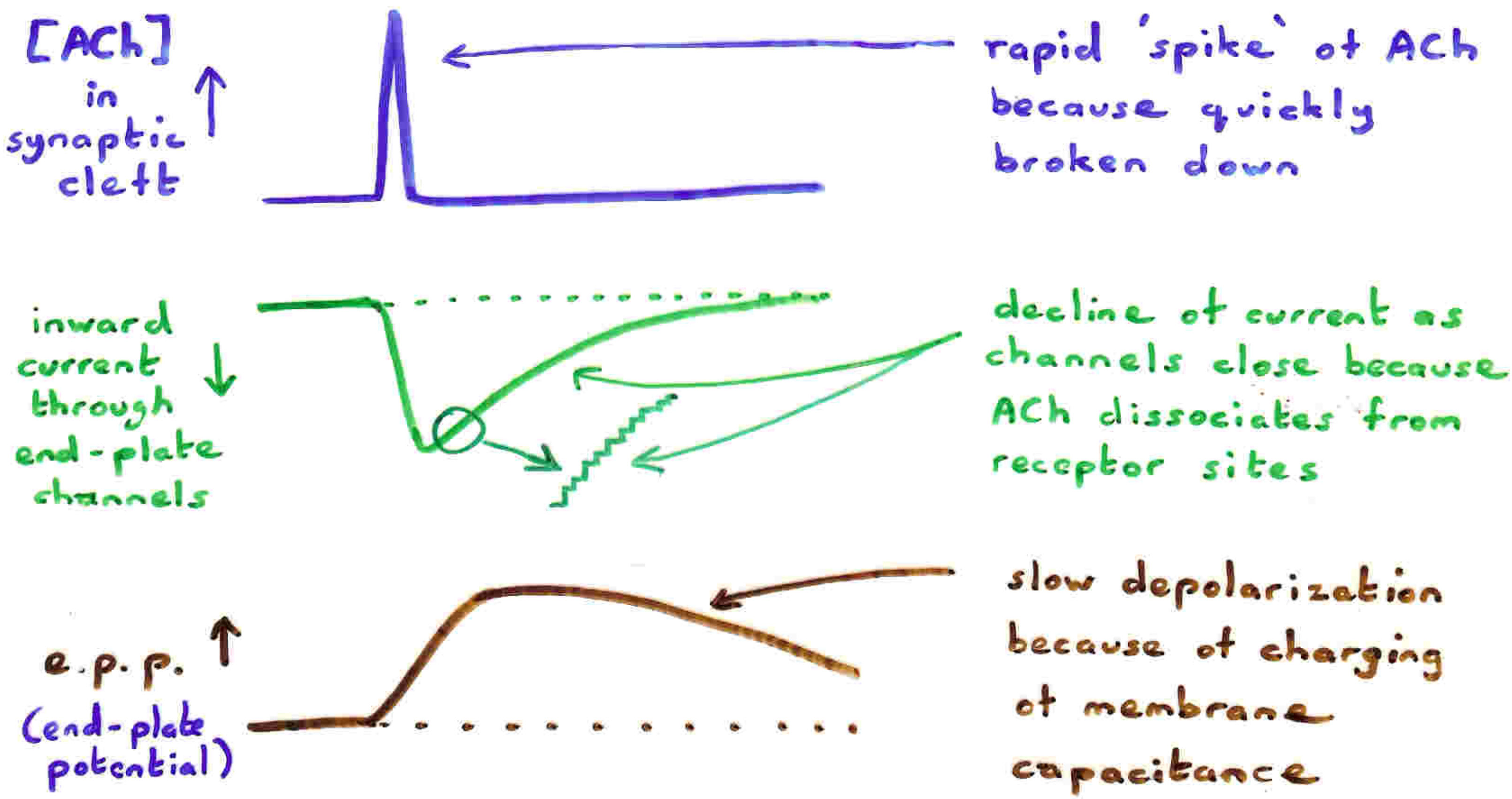
ACh-binding sites are on α subunits. There are 2 of these in each channel.

ACh must bind to **both** sites before channel opens. Thus, channel opening increases as the **square** of [ACh].

[eg. if double [ACh], probability that a single site will bind ACh doubles. Thus, probability that both sites bind ACh quadruples]

# Time course of channel openings during e.p.p.

ACh released into synaptic cleft is very quickly broken down by enzyme, acetylcholinesterase. [hydrolyzed to choline and acetic acid : choline is recycled by nerve to make more ACh]



# Ionic basis of the end-plate potential

End-plate channels let through $Na^+$ and $K^+$ ions. Equilibrium potential is thus midway between equilibrium potentials for $Na^+$ (+60mV) and $K^+$ (−90mV).

Voltage-clamp muscle and record end-plate current that flows when clamp at different potentials.

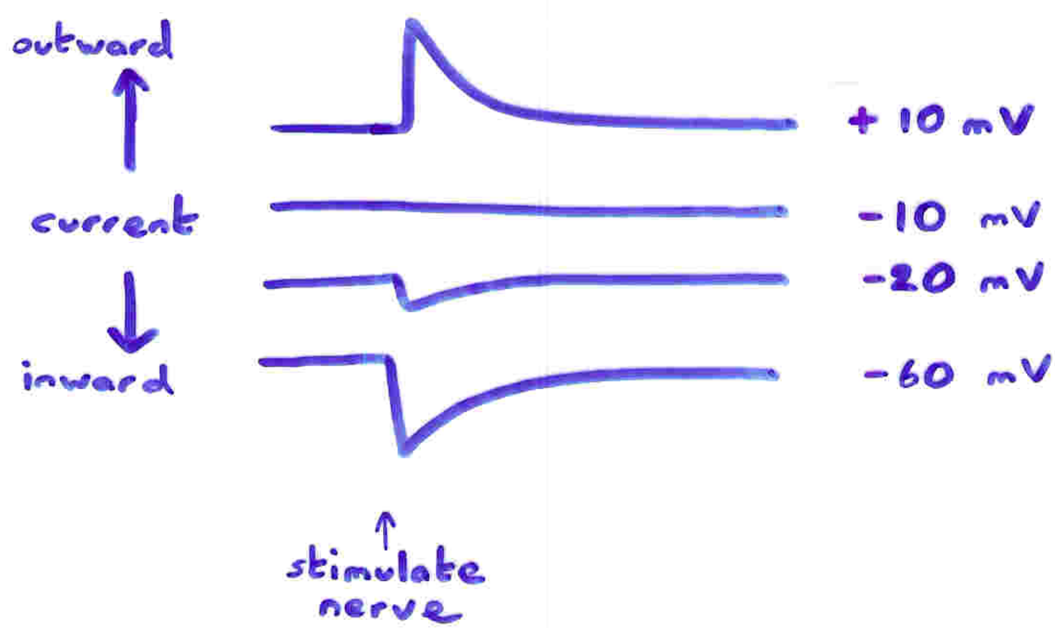
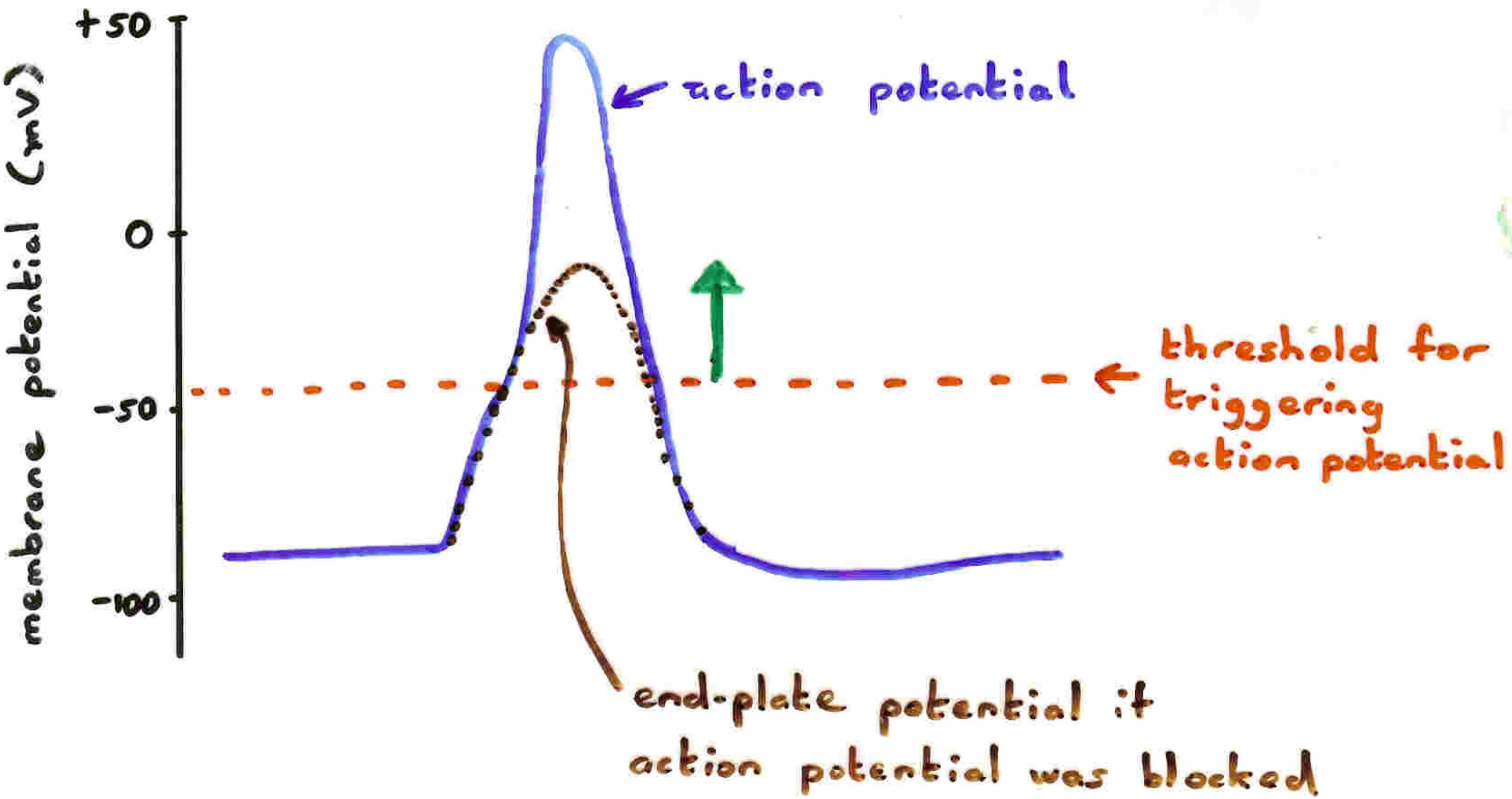



Fig. 5.16

No matter how much ACh is released, the end-plate potential cannot depolarize a muscle fibre beyond −10 mV.

However - depolarization to -10 mV is more than enough to trigger an action potential.



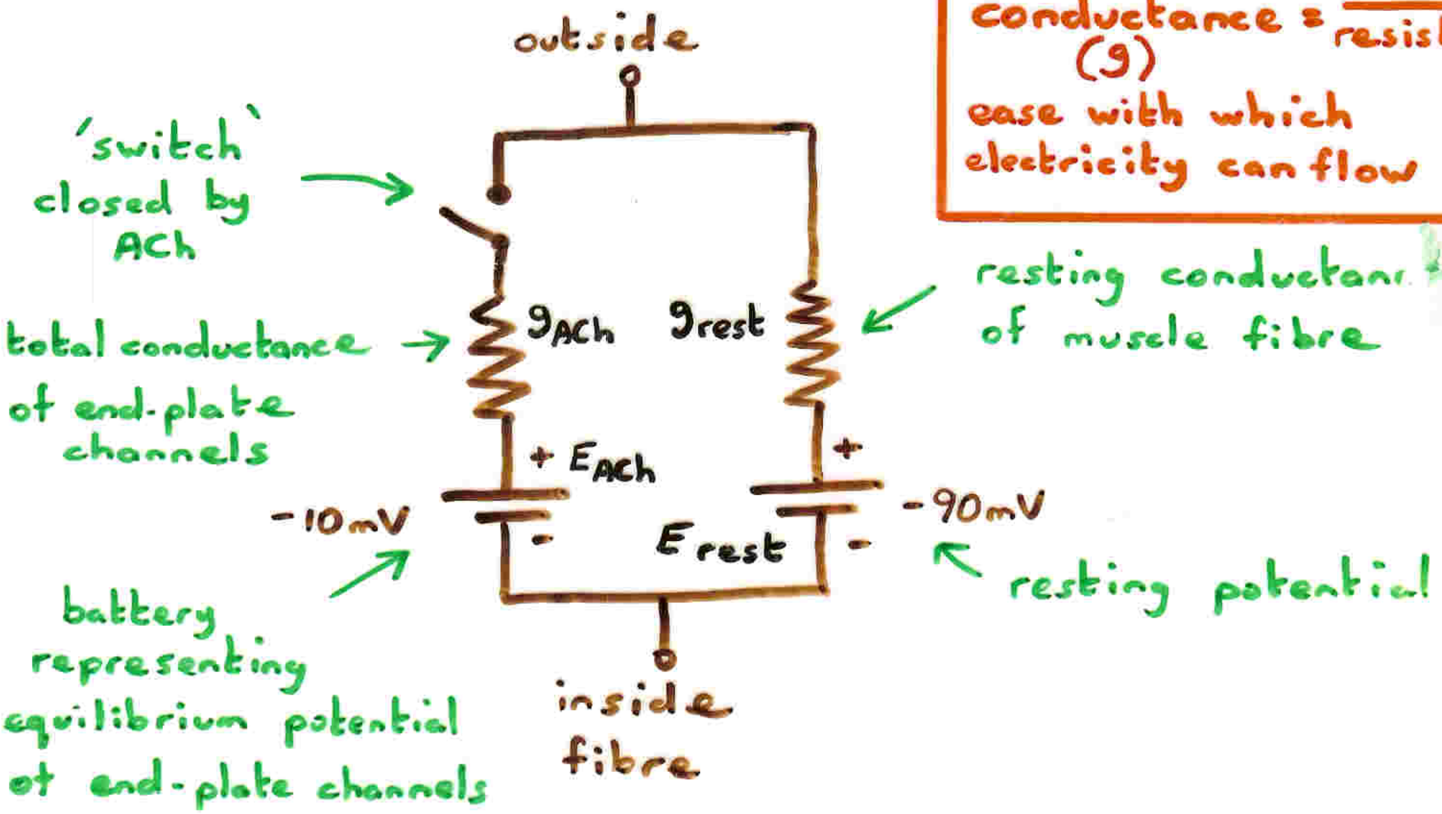
# Equivalent electrical circuit for endplate

Resting potential tends to hold muscle fibre at −90 mV.

Current through end-plate channels tends to depolarize to −10 mV.

Resulting potential depends on relative conductance of end-plate (how many channels open)

conductance (g) = $\frac{1}{\text{resistance}}$
ease with which electricity can flow




final voltage of muscle $E = \frac{g_{ACh} \times E_{ACh} + g_{rest} \times E_{rest}}{g_{ACh} + g_{rest}}$