8. Acetylcholine receptor (AChR) proteins are found at the synapse between neurons and skeletal muscle cells. Acetylcholine released from neurons binds to a specific site on the receptor proteins, which causes an ion channel in the receptors to open and allow sodium ions (Na^+) to enter muscle cells. The resulting depolarization of muscle cells initiates muscle contractions. Another molecule, nicotine, can also bind to certain types of AChR proteins and activate the receptors.

   A researcher is investigating two different types of AChR proteins: type 1 and type 2. To determine which stimuli activate the receptors, the researcher exposes muscle cells expressing the different types of receptor proteins to stimuli and observes the results indicated in Table 1.

TABLE 1. RESPONSE OF AChR PROTEINS TO DIFFERENT STIMULI

AChR Protein Type	Acetylcholine	Nicotine
Type 1	+	+
Type 2	+	–

+ indicates activation
– indicates no activation

(a) **Describe** the difference in the structure AND function between AChR type 1 and AChR type 2.

(b) Acetylcholinesterase is an enzyme that breaks down acetylcholine in the synapse. **Describe** the effect of inhibiting acetylcholinesterase on the muscle cells with AChR type 2.

STOP

END OF EXAM

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Question 8

Acetylcholine receptor (AChR) proteins are found at the synapse between neurons and skeletal muscle cells. Acetylcholine released from neurons binds to a specific site on the receptor proteins, which causes an ion channel in the receptors to open and allow sodium ions (Na^+) to enter muscle cells. The resulting depolarization of muscle cells initiates muscle contractions. Another molecule, nicotine, can also bind to certain types of AChR proteins and activate the receptors.

A researcher is investigating two different types of AChR proteins: type 1 and type 2. To determine which stimuli activate the receptors, the researcher exposes muscle cells expressing the different types of receptor proteins to stimuli and observes the results indicated in Table 1.

TABLE 1. RESPONSE OF AChR PROTEINS TO DIFFERENT STIMULI

AChR Protein Type	Acetylcholine	Nicotine
Type 1	+	+
Type 2	+	–

+ indicates activation
– indicates no activation

(a) **Describe** the difference in the structure AND function between AChR type 1 and AChR type 2.

Description (2 points)

Points may be earned from only one row.

Structure (1 point maximum)	**Function (1 point maximum)**
Binding sites differ in shape/ specificity/number	• Differential binding of molecules to type 1 and type 2 receptors • Activated by one (ACh) molecule or both (ACh and nicotine) molecules • No difference in response (both open channels OR both result in depolarization OR both cause muscle contraction)
Differential binding of molecules to type 1 and type 2 receptors	• Activated by one (ACh) or both (ACh and nicotine) molecules • No difference in response (both open channels OR both result in depolarization OR both cause muscle contraction)
Receptors activated by one (ACh) or both (ACh and nicotine) molecules	• No difference in response (both open channels OR both result in depolarization OR both cause muscle contraction)

(b) Acetylcholinesterase is an enzyme that breaks down acetylcholine in the synapse. **Describe** the effect of inhibiting acetylcholinesterase on the muscle cells with AChR type 2.

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Question 8 (continued)

Description (1 point)

- Continued activation
- Repeated opening of sodium channels OR repeated depolarization OR muscle spasms