5.8 Nervous organisation, receptors and habituation

Name: _____ Class: _____ Date: _____ **Total: 20 marks**

KEY WORDS autonomic • reflex arc • habituation • nociceptor

Objective

Practise statements 8.8-8.10: the organisation of the nervous system, receptors as transducers (rods, cones and the rest), the spinal reflex arc, and habituation.

1 Key knowledge and worked examples

■ The wiring diagram

CNS = brain + spinal cord. PNS splits into the **somatic** system (voluntary, to skeletal muscle) and the **autonomic** system (involuntary: sympathetic accelerates - fight or flight; parasympathetic calms - rest and digest).

■ Receptors are transducers

Each converts one stimulus energy into a generator potential and then action potentials: rods (many per bipolar cell - dim-light sensitivity, no colour), cones (three types, one-to-one wiring - colour and acuity), plus thermoreceptors, chemoreceptors (CO2/pH), baroreceptors (pressure), nociceptors (pain), proprioreceptors (position).

■ The reflex arc

stimulus, receptor, sensory neurone, relay neurone in the spinal cord's grey matter, motor neurone, effector. Three-neuron reflexes pass the CNS; two-neuron (monosynaptic) reflexes like the knee jerk skip the relay. Fast, involuntary, protective.

■ Habituation

A decreasing response to a repeated, harmless stimulus: with repeated stimulation, calcium channels open less, less transmitter is released, and the postsynaptic threshold is no longer reached. Learning to ignore, not to fail.

■ Worked example: reading a rod/cone table

Rods: 120 million per retina, all sharing few bipolar cells - summation gives sensitivity at the cost of detail. Cones: 6 million, one-to-one wiring at the fovea - detail at the cost of light. The exam table is this trade-off.

2 Practice

2.1 Name the two divisions of the autonomic nervous system. [2]

2.2 State one advantage of rods sharing bipolar cells. [1]

2.3 Put these in order: motor neurone, receptor, relay neurone, effector, sensory neurone. [2]

3 Exam-style questions

3.1 Describe the pathway of a spinal reflex from stepping on a pin to withdrawing the foot, naming each component in order and stating why the response is faster than a voluntary one. [5]

3.2 Explain why a person can read small print in bright light but not dim light, referring to cone and rod distribution and their wiring. [5]

3.3 A sea slug retracts its gill when touched, but after 20 touches the response fades. Explain this observation, and suggest what has changed at the synapse. [5]