AP BIOLOGY • EXERCISE SHEET

4.2 Introduction to Signal Transduction

Name: _____ Class: _____ Date: _____ **Total: 12 marks**

KEY WORDS signal transduction 信号转导 • receptor 受体 • ligand 配体

Objective

Build the skills to answer exam questions on **signal transduction** — reception, transduction, response.

You must be able to:

- name the three stages: **reception, transduction, response**
- explain that a signal is converted into a cellular change
- describe binding at the receptor as the first step

1 Worked examples

Study these first. Each one shows the method for a question type used later — follow the steps and you can do the Practice and Exam-style questions yourself.

The three stages

Signal transduction has three steps:

1. **Reception** — the signal molecule binds its receptor.
2. **Transduction** — the signal is passed and changed through a series of molecules inside the cell.
3. **Response** — the cell does something (e.g. turns a gene on, changes activity).

Reception

The signal (**ligand**) binds a specific **receptor**, often on the membrane. This binding **changes the receptor's shape**, starting the pathway.

Transduction relays the message

A chain of molecules passes the signal along, often amplifying it, converting the outside signal into an inside action.

A worked example

Adrenaline binds a receptor (reception) → activates internal messengers (transduction) → the cell breaks down glycogen for energy (response).

2 Practice

Now apply the methods above.

2.1 Name the three stages of signal transduction. [3]

2.2 What happens during reception? [1]

2.3 What is the final stage called? [1]

3 Exam-style questions

3.1 The first stage of signal transduction is [1]

- **A** response
- **B** transduction
- **C** reception
- **D** replication

3.2 Adrenaline binds a receptor and the cell breaks down glycogen.

(a) Identify the reception and response steps. [2]

(b) State what happens during transduction. [2]

3.3 Explain why binding of the signal changes the receptor, and why this matters. [2]

Solutions

2.1 Reception, transduction, response.

2.2 The signal molecule binds its receptor.

2.3 Response.

3.1 C — reception.

3.2 (a) Reception: adrenaline binds the receptor; response: glycogen is broken down. (b) The signal is relayed and amplified through a chain of internal molecules that carry the message to the response.

3.3 Binding changes the receptor's shape, which activates it to start the internal pathway; without this change the signal could not be passed on.