

Exercise walk-through

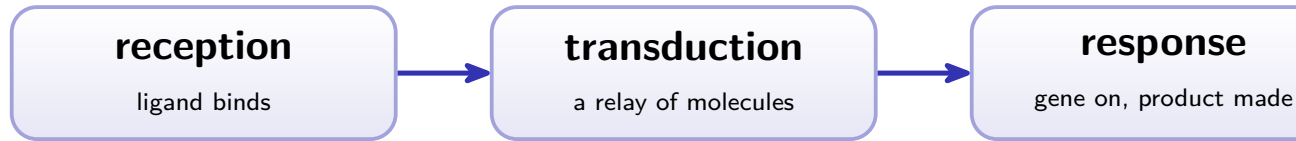
4.3

Signal Transduction Pathways

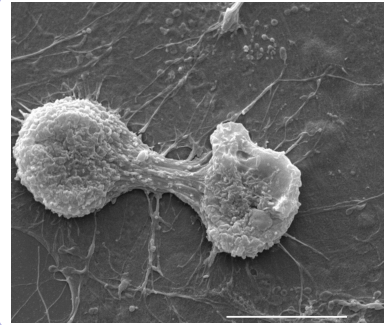
AP Biology

Signal transduction

Turning an outside message into an inside action, in three stages:

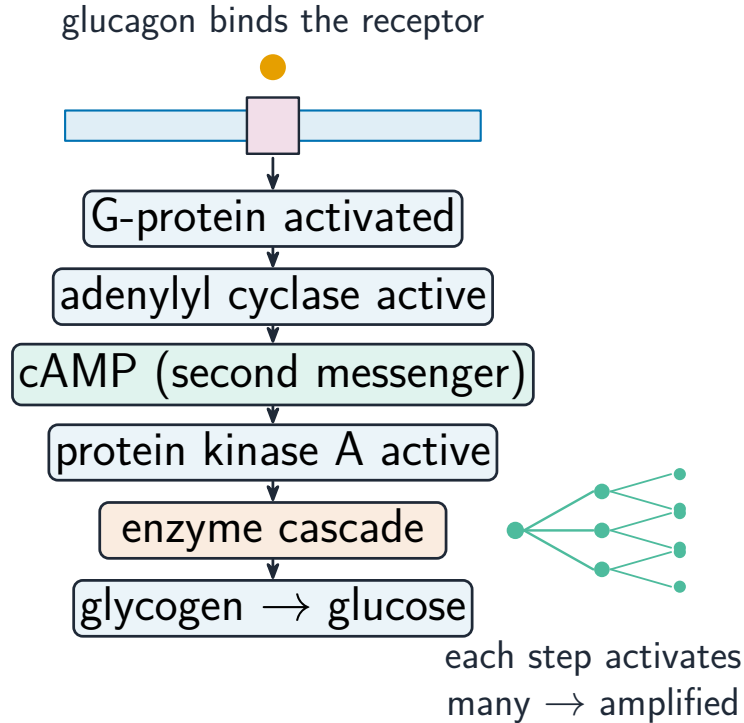


Second messengers (cAMP, Ca^{2+}) and a
phosphorylation cascade give huge
amplification : 1 → 100 → 10,000 → millions.



Cytokinesis fibroblast

Signal Transduction Pathways



A signalling cascade amplifies the message inside the cell

Transduction, and the checkpoints

reception	a signal molecule – often a hormone – binds a specific receptor
transduction	the signal passes through a pathway : often a cascade of proteins that activate one another
why a cascade	each step amplifies , so a few signal molecules can change thousands of targets
response	a change in gene expression, or in the activity of an existing protein
checkpoints	the cell cycle is controlled at points that verify conditions before proceeding
what they check	<i>Is the DNA intact? Are the chromosomes attached?</i> – and a failed check halts the cycle

Cancer is largely a failure of these controls: a checkpoint that no longer stops the cycle, or a pathway stuck in the on position.

Exercises 2.1-2.3

2.1 What is a signal cascade?

[1]

2.2 How does a small signal cause a large response?

[1]

2.3 Give an example of a second messenger.

[1]

Exercises 2.1-2.3

2.1 What is a signal cascade? [1]

2.1

- A series of molecules that each activate the next, relaying the signal
-

2.2 How does a small signal cause a large response? [1]

2.2

- Each step activates many of the next molecule, amplifying the signal
-

2.3 Give an example of a second messenger. [1]

2.3

- Cyclic AMP (or calcium ions)

Exercise 3.1

3.1 Signal amplification means that one signal molecule can lead to

[1]

☐

A no response

B exactly one product

C many activated molecules

D the receptor breaking down

Exercise 3.1

3.1 Signal amplification means that one signal molecule can lead to

[1]

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A no response

B exactly one product

C many activated molecules

D the receptor breaking down

3.1 C

- many activated molecules

Exercise 3.2 (a)

3.2 The same hormone triggers different responses in two cell types.

(a) Explain how this is possible.

[2]

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3.2 The same hormone triggers different responses in two cell types.

(a) Explain how this is possible.

[2]

(a)

- Each cell type has a different set of internal proteins and genes, so the same signal is acted on differently

Exercise 3.2 (b)

3.2 The same hormone triggers different responses in two cell types.

(b) State one advantage of amplifying a signal.

[1]

Exercise 3.2 (b)

3.2 The same hormone triggers different responses in two cell types.

(b) State one advantage of amplifying a signal.

[1]

(b)

- A small amount of signal can produce a large, fast response

Exercise 3.3

3.3 Describe how a cascade relays and amplifies a signal from the receptor to the response. [3]

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3.3

- The receptor activates the first molecule, which activates the next, and so on (a cascade); at each step one active molecule activates many of the next, so the signal grows and reaches the response amplified