Running time: 2:50

Feedback Inhibition and Allosteric Regulation: Storyboard

Jacqueline Mason



AUDIO: Our cells are amazing molecular machines. Every day,...

ANIM: Fade into three cells, gears are rotating, cells have random slight noise on them.



AUDIO: they convert food into energy, such as ATP,

ANIM: The forground cell "flies" downward. Food flies in from left. Arrows animate from food throught cell, then cell products in bottom right show up as arrow exits the cell.



AUDIO: ..., that drive the millions of biochemical processes...

ANIM: slight zoom into cellular products, with pan to the right. Animated arrows fly out and point towards pathways. The pathway arrows are animated.



AUDIO: necessary for keeping us alive. The pathways used to convert substrates (such as glucose)...

ANIM: Pathways move to the riight, camera follows. Outline of person appears on screen; glows.



AUDIO: ...into products, are collectively referred to as metabolic pathways.

ANIM: Pathways align next to the body. The text "Metabolic Pathways" fades in. Then zoom into one of the pathways.



AUDIO: The drivers of these metabolic pathways are enzymes.

ANIM: Arrows are animated. Enzymes glow as the word "enzymes" is spoken. Zoom into one of the enzymes.

Running time: 2:50

2-1

AUDIO: Enzymes are usually proteins that work to assist chemical reactions by building...

ANIM: Enzyme "scrubs over" the substrates and the substrates come together to form one product (not shown very well here).



- AUDIO: ... or breaking down molecules.
- **ANIM**: Enzyme "scrubs over" the substrates and the substrates break apart (not shown very well here).



AUDIO: However, enzymes don't drive reactions at a constant rate.

ANIM: Enzyme scrubs around the circle of products and substrates while they build up and break down.



AUDIO: The rate of reaction can...

ANIM: Enzyme scrubs around the circle of products and substrates while they build up and break down.



AUDIO: ... speed up,...

 $\ensuremath{\mathsf{ANIM}}$: The speed of the enzyme scrubbing increases.



AUDIO: ... slow down...

ANIM: The speed of the enzyme scrubbing decreases.

2-6

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AUDIO: or stop completely according to the cell's needs.

ANIM: The enzyme stops moving. Substrates and products stop breakig down and forming.



AUDIO: This process is analogous to an assembly line where raw materials are converted into products.

ANIM: Scene fades out into a factory assembly line scene. Conveyer belt is moving to the right. Robotic arm is moving the products.



AUDIO: The assembly line must be monitored to ensure that the supply of products does not exceed demand.

ANIM: Camera pans to the right. The big boxes glow with the word "supply." The letters of DEMAND glow with the word "demand"



AUDIO: If products are being created at a rate that is faster than they can be used, both resources and products are being wasted.

ANIM: Scene quickly fades to a scene where there are too many boxes. The robotic arm continues to place items in the demand bin; boxes are tumbling out. Zoom into machine.



AUDIO: The assembly line can produce at a slower rate...

ANIM: The crank on the right pulls down slightly. The arrow on the bottom moves slightly. Conveyer belt slows down.



AUDIO: ...or stop completely so that products and resources are not wasted.

ANIM: The crank on the right pulls down all the way. The arrow on the bottom moves all the way to the left. Conveyer belt stops moving.

Running time: 2:50

Jacqueline Mason



AUDIO: In cells, this process is called 'feedback inhibition'.

ANIM: The machine fades out and a cell fades in. 'feedback inhibition" text fades in next.



AUDIO: Feedback inhibition is...

ANIM: Zoom into cell.

4-3 Allosteric Regulation

AUDIO: ...achieved through a process called allosteric regulation

ANIM: Cellular environmet is seen. The text "Allosteric Regulation fades in.



AUDIO: ...and plays an important role in pathways such as glycolysis. many metabolic pathways.

ANIM: Below text: a simple, 3-enzyme pathways comes into view from bottom (not shown well here). Then, zoom into enzyme.



AUDIO: Enzymes have a unique area called...

ANIM: Substrates are seen floating toward the active site. Slight noise on the products (circles).





ANIM: "Active Site" text appears as it is spoken.

Running time: 2:50



AUDIO: ...substrates can bind.

ANIM: Substrate binds, and the enzyme "closes"



AUDIO: Enzymes that can be regulated have an additional area...

ANIM: The substrate transforms and is seen moving to the right. The enzyme "re-opens"



AUDIO: called the allosteric site.

ANIM: "allosteric site" text appears as it is spoken.



AUDIO: Downstream products can...

ANIM: The enzyme is seen contining to transform substrates into products. Down stream products are seen floating into view.



AUDIO: ... bind to this regulatory site causing the enzyme...

ANIM: Downstream proudct binds to enzyme



AUDIO: ...to change shape and prevent it from binding with its substrates.

ANIM: Enzyme is seen changing shape. A substrate that was nearby bounces off of the active site. Then, zoom out

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Running time: 2:50

AUDIO: This causes the entire pathway to halt and new products are no longer formed.

ANIM: The entire pathway is seen slowing down, then stops. All of the intermediates are used up.



AUDIO: . Conversely, when the amount of downstream product gets too low,...

ANIM: End products are seen floating away from path to be used.



AUDIO: ...the enzymes interact with their usual substrates and begin forming products again.

ANIM: The bound downstream product breaks off from the enzyme, and the enzyme resumes trandforming substrate-product.



AUDIO: Feedback inhibition plays a critical role in preventing....

ANIM: Zoom out



AUDIO: ... cells from wasting resources and energy.

ANIM: Three cells come into view; slight noise on cells.



AUDIO: Mutated enzymes that do not respond to allosteric regulation....

ANIM: The front cell starts dividing

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Running time: 2:50

Jacqueline Mason



AUDIO: have been linked to disease states such as cancer.

ANIM: Celle continue to divide. Then the scene fades out completely to the background.



AUDIO: Many processes in our bodies rely on feedback inhibition to keep everything running smoothly...

ANIM: Body fades in, with a pulsing glow effect.





ANIM: The pathways from earlier fly in from the sides. Scene fades out.



works in a common but very important metabolic pathway: Glycolysis.

ANIM: A schematic of glycolysis fades in. Will match the position of enzymes in the interactive overiew.

ANIM:

ANIM: