Visual Storytelling in Molecular Animation: Accuracy and Design

AMI 2016 Workshop - July 20

Instructions

You are tasked with designing a storyboard that shows part of a cell signaling pathway

- Divide into groups of 3-4.
- Assume that a final animation will depict a more complete story of the full pathway; for this exercise, just focus on the smaller section.
- Assume that narration will be written to accompany your storyboard. You may make notes about what your intended narration will be.
- Use the **conceptual theme objectives** as primary guides for structuring your story. Use the **factual details** to guide what individual shots contain.

Timeline

- Spend **~5 min** reading the Brief, Objectives, and Things to Consider
- Spend **~15 min** discussing in your group how to structure your story, “big picture”.
- Spend **~30 min** sketching out thumbnails to help you visualize key story points and refine the story.
- Spend **~40 min** drawing 8-12 panels as needed to tell your story.
- Choose one group member to give a **3 min** presentation of the storyboard to all participants.

Resources

1. Use the provided **Character Sheet** to guide your drawings of the molecules. You may change the size, orientation, placement, and even level of detail of these molecules, to suit your shots.
2. Use the provided **Storyboarding Quick Reference** to guide your shots and annotations. Incorporate some of the suggested techniques to tell your story.
3. Draw the storyboard panels in the provided **Storyboard Template**. Make notes about what actions are happening and how the camera is moving, and add any other comments or questions.
4. Indicate shots and panels on your template. A single shot might be drawn with multiple panels: e.g. Shot 3, Panel 2.

Story Brief

A typical G-protein-coupled receptor pathway involves the **amplification** of a signal and its **migration** from the cell membrane to the nucleus. Adenylyl cyclase (AC), cyclic adenosine monophosphate (cAMP) and protein kinase A (PKA) are members of this process. AC, a transmembrane protein, converts ATP into cAMP, a second messenger. Four of these cAMP molecules bind to the regulatory subunits of PKA, thus activating it. The catalytic subunits of PKA dissociate and enter the nucleus. These components of a larger pathway allow a trigger such as glucagon or epinephrine to influence changes in gene expression.

Animation Audience

- Undergraduate (2nd year) Biology student

Audience Learning Objectives

Conceptual themes

- Signal is amplified
- Signal migrates from membrane into nucleus
- *Bonus: Signal is not always on, i.e., it is off, it is turned on, then rapidly turned off again*

Factual details

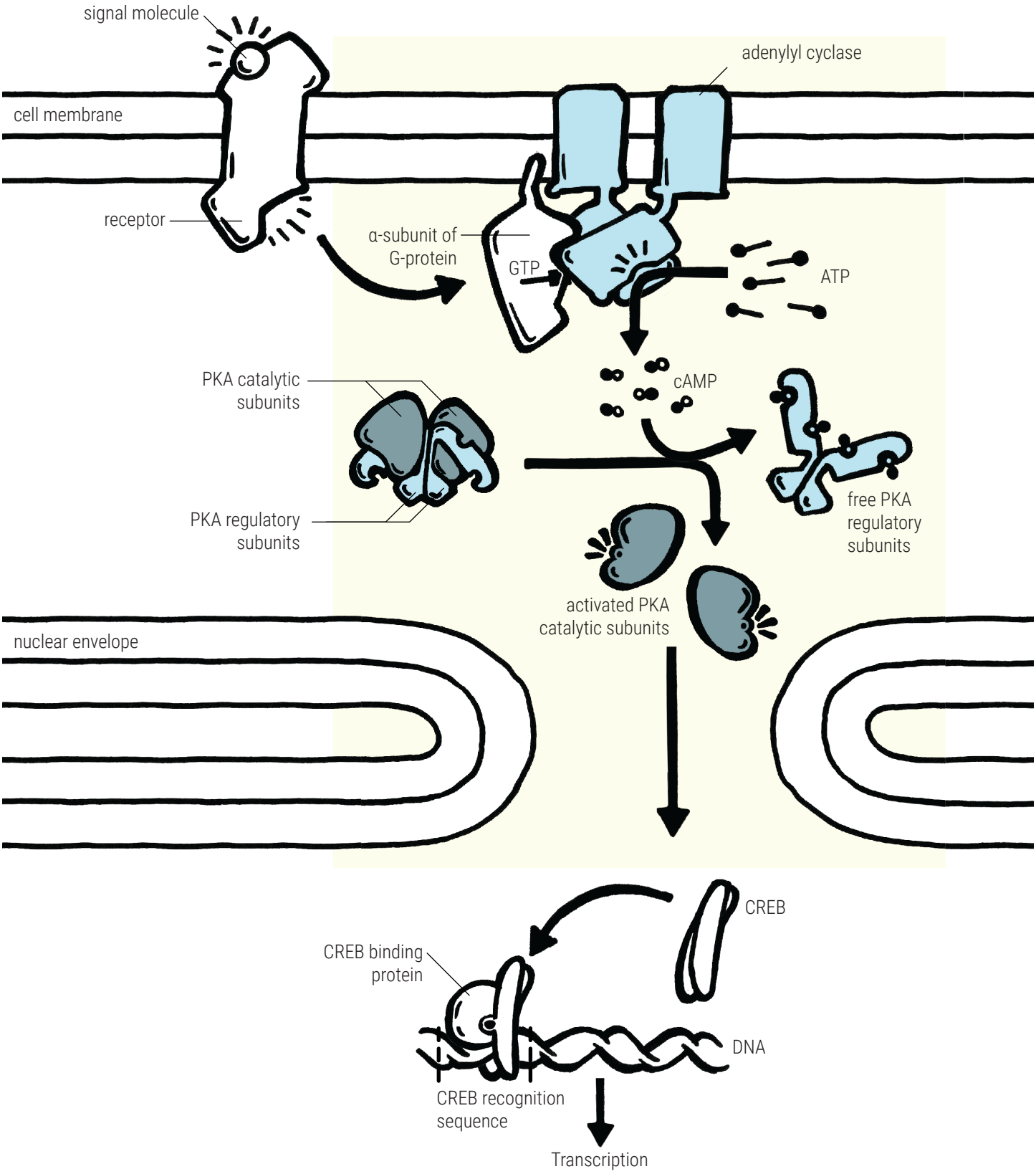
- Location
  - » AC is in the plasma membrane
  - » cAMP is in the cytoplasm
  - » PKA is in the cytoplasm
  - » Downstream targets are in the nucleus
- Structure
  - » AC is a transmembrane protein
  - » cAMP is a small molecule
  - » PKA has two regulatory subunits and two catalytic subunits
- Function
  - » AC converts ATP to cAMP
  - » Four cAMP molecules are required to activate PKA, two for each regulatory subunit
  - » The two catalytic subunits of PKA dissociate from the rest of the molecule

Things to consider

- Is there logic to the sequence of events?
- Do the shots support the main learning objectives?
- What will the audience be paying attention to in this frame?
- Is a clear sense of location established?
- Is there enough continuity across the shots?
- Are types of motion clearly communicated?
- Are dynamic molecular concepts that support the learning objectives present?

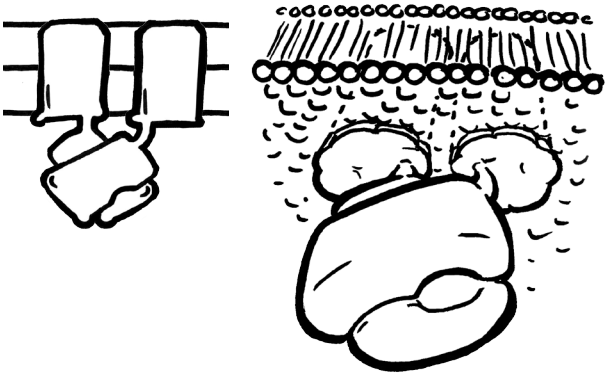
Signal transduction pathway

cAMP amplification & PKA activation



Character sheet

Adenylyl cyclase

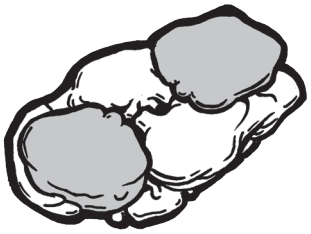


Adenosine triphosphate (ATP)

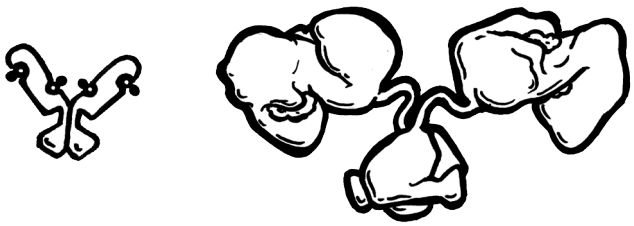
Cyclic adenosine monophosphate (cAMP)

Protein kinase A (PKA)

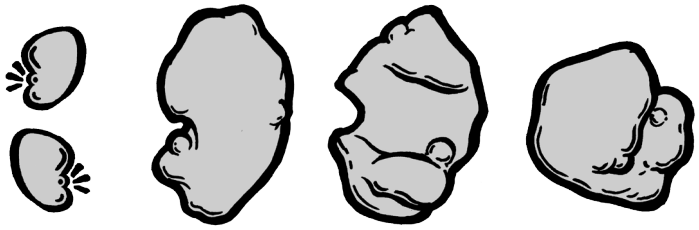
inative tetramer



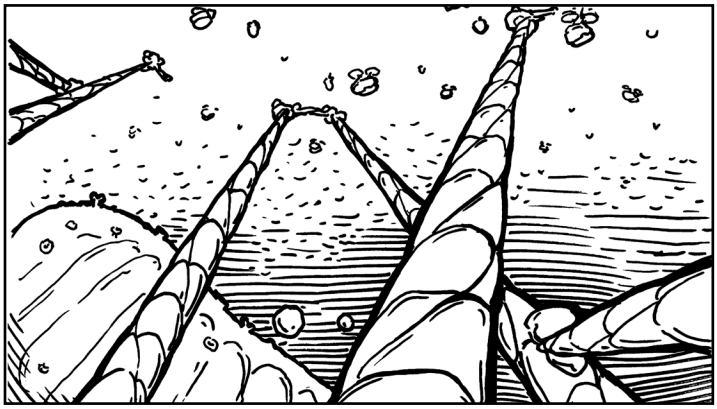
cAMP-bound regulatory subunits

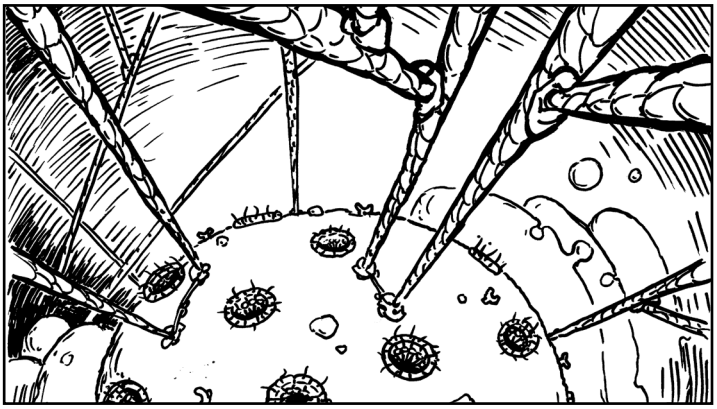


activated catalytic subunits



Environment examples



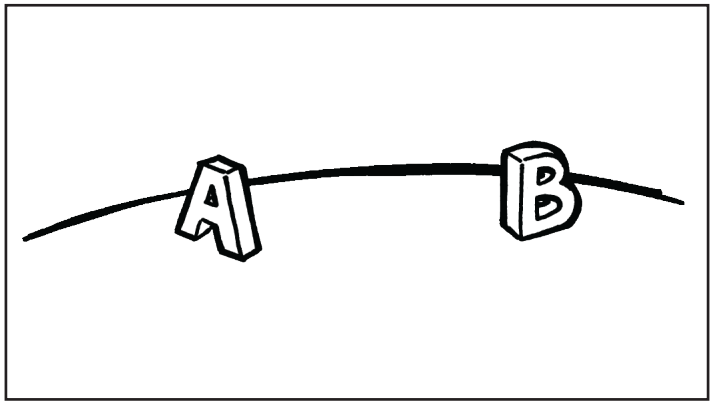


Storyboarding Quick Reference

Shot types

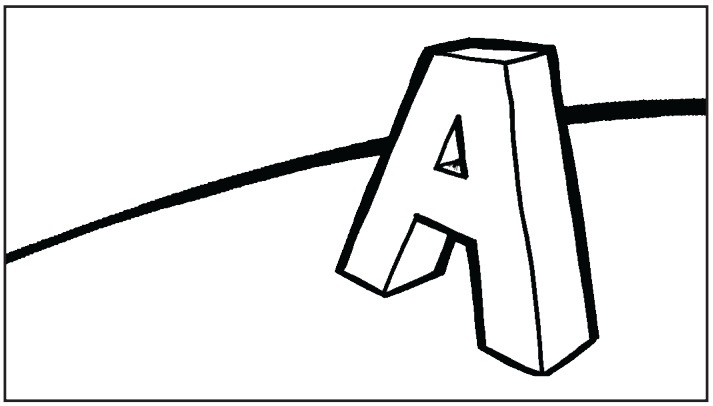
Different shots are defined by how close the camera is to the subject.

Establishing shot



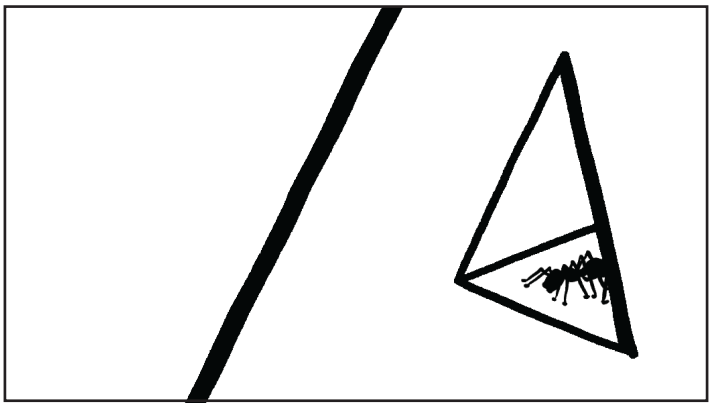
- Shows a wide field of view
- Provides spatial context
- Typically shown at start of scene

Medium or “action” shot



- Frames the subject
- Shows an event or action

Close-up shot

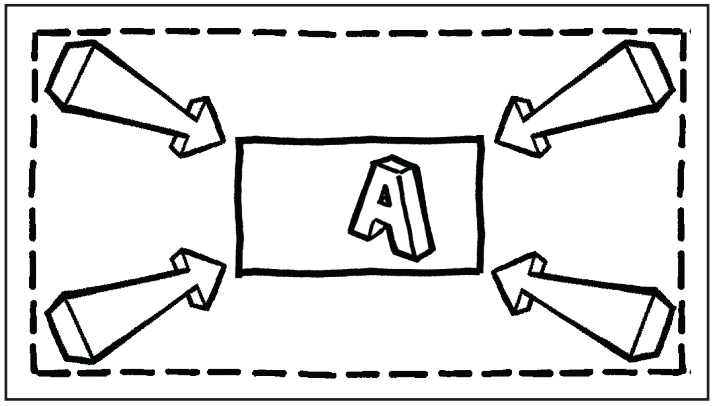


- Frames part of the subject
- Focuses on a detail or smaller scale

Camera motion

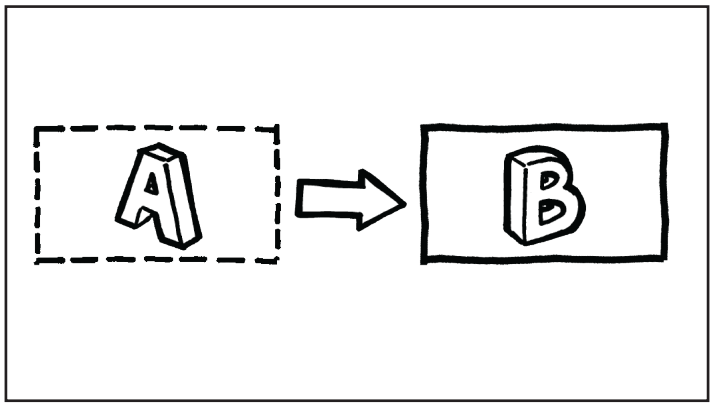
Draw a dotted line to show the camera frame at the start of the motion. Draw a solid line to show the framing at the end of the motion. Add arrows indicating the move from start to finish.

Dolly/zoom



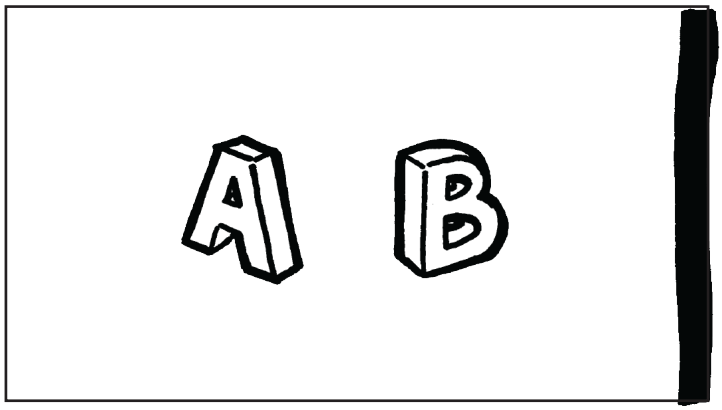
- ***Camera move in or zoom in***
  - » Focuses attention, or
  - » Shows change to smaller scale
- ***Camera move out or zoom out***
  - » Reveals new information, or
  - » Shows change to larger scale

Pan/track



- ***Camera turns or moves, left or right***
  - » Follows the action, or
  - » Changes focus from one subject to another

Indicate a cut (transition)

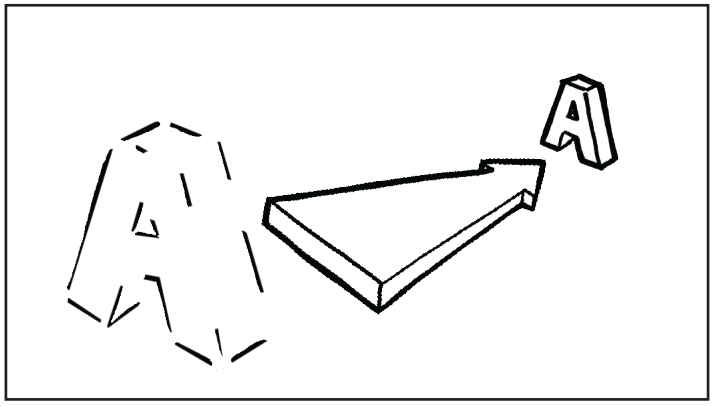


- Cut marks the end of a shot
- Place a thick line at the right side of the panel

Character motion

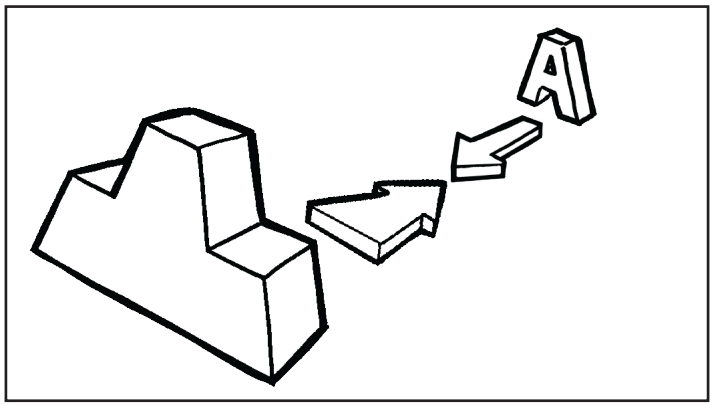
Use arrows to show where characters will go.

Simple event shown in single frame

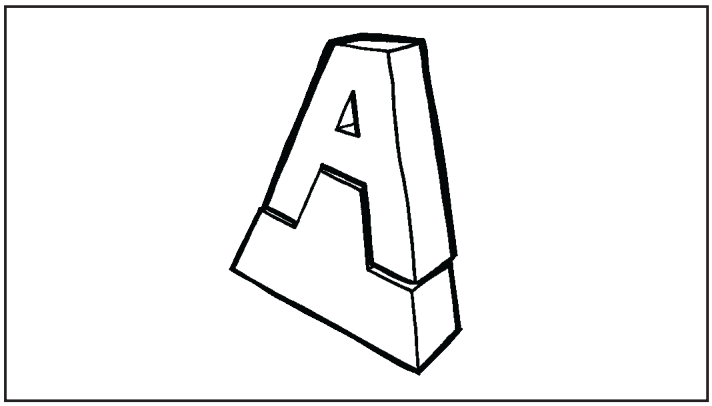


- Draw an arrow showing where the character will go.
- Draw the character at the start of the motion faintly. Draw the character at the end of the motion with solid lines.

Complex event shown in two frames



- Draw arrows in the first panel showing where the character will go.



- Draw the end state of the characters in the second panel.