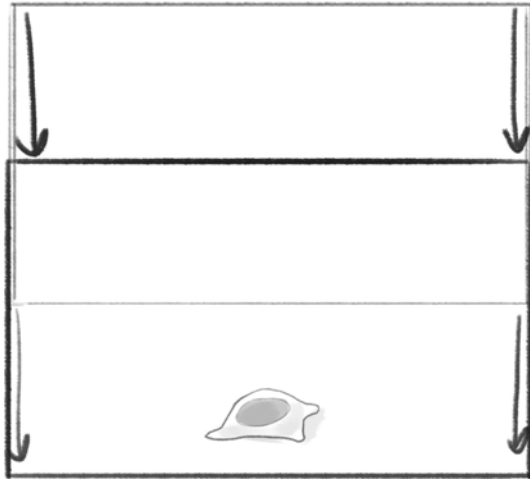


10a



Now that you have a basic understanding of the differences in scale between a representative animal cell and its components, --

Pan down from a plain background to center on a lone fibroblast.

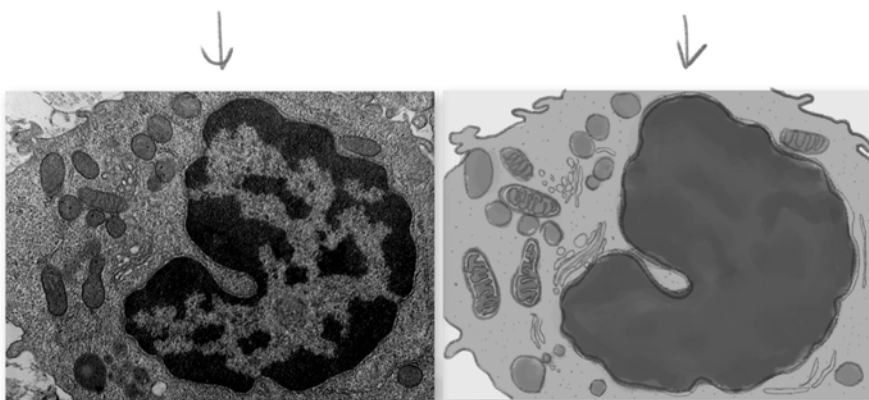
10b



-- let's talk about how these relationships have been and continue to be visualized in illustrations.

At the end of the shot, the camera defocuses so the fibroblast is blurred and lightened.

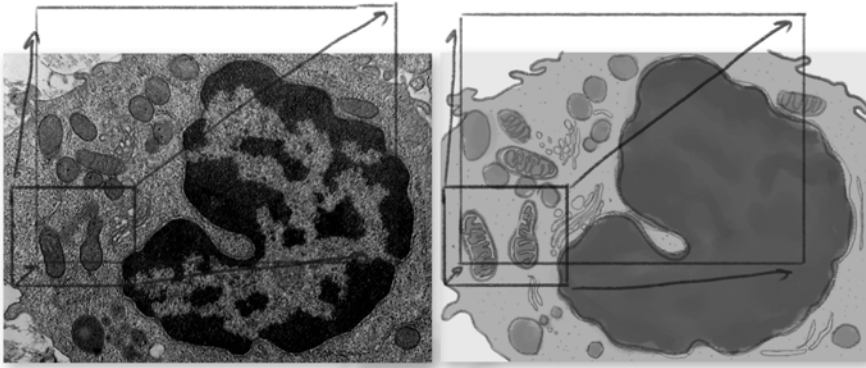
11a



You may wonder: why don't we just use micrographs? While they do show scale accurately, micrographs have noise that makes it difficult to distinguish features, and it's impossible to see some of the smaller structures like ribosomes.

Micrograph and illustration slide in from the top of the frame, in the foreground in front of the cell.

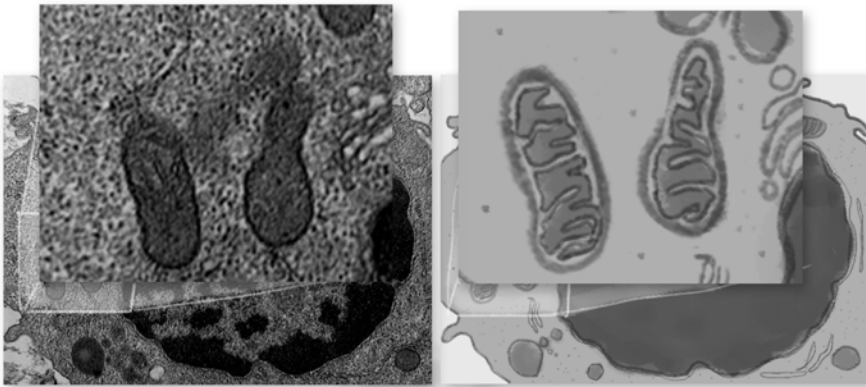
11b



An illustration makes clear distinctions between structures, simplifies distracting textures, and can emphasize the sizes of structures to make things less confusing. But this can lead to the problem of misrepresenting scale.

Still view of the micrograph and illustration.

12a



For example, these mitochondria have been enlarged so the inner membranes are more visible. This makes the illustration technically inaccurate even though it is now clearer.

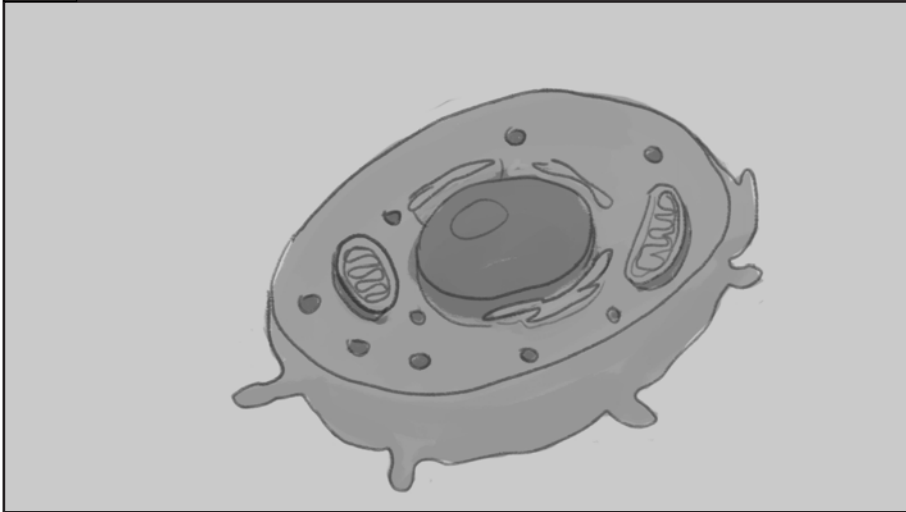
Insets of the same mitochondria in each image enlarge toward the camera.

12b

Why is this a problem, you might wonder?

All images cut to white.

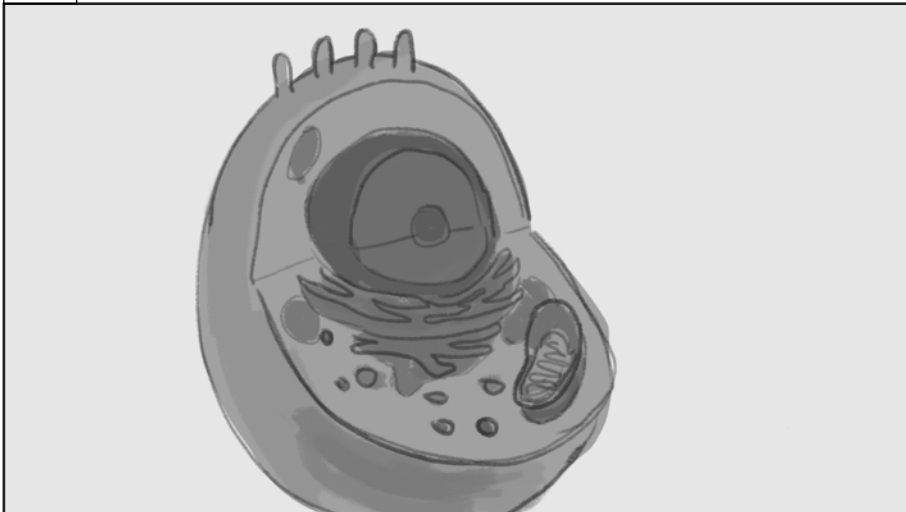
13a



When you're constantly exposed to small exaggerations in the size of mitochondria --

Montage of a few illustrations with improperly proportioned structures.

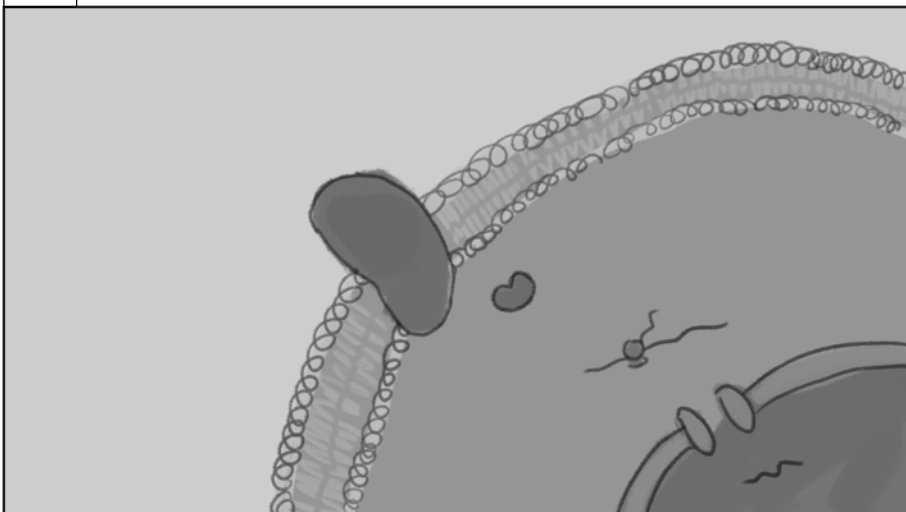
13b



-- or the size of ribosomes, or the thickness of plasma membranes --

Cut to next image in montage. The timing is on a beat, not necessarily fitting with the words.

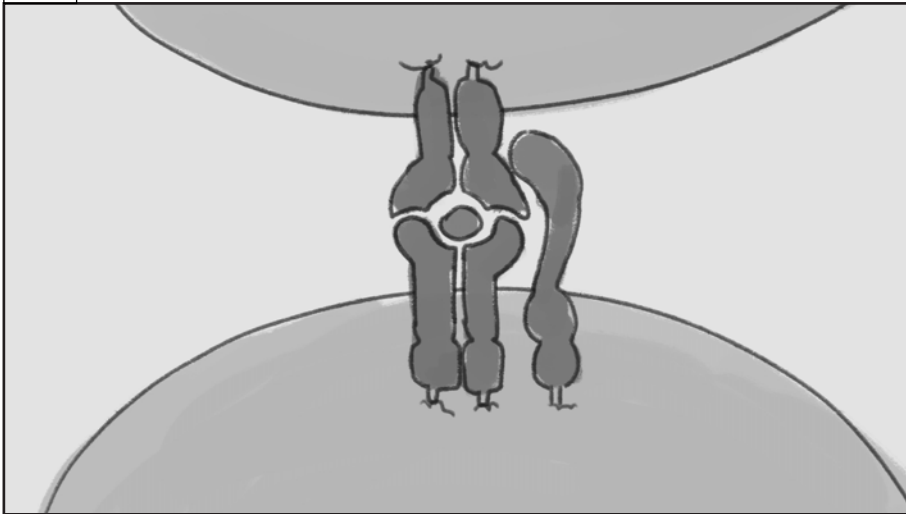
13c



-- you start to lose the true sizes of these structures.

Cut to next image in montage.

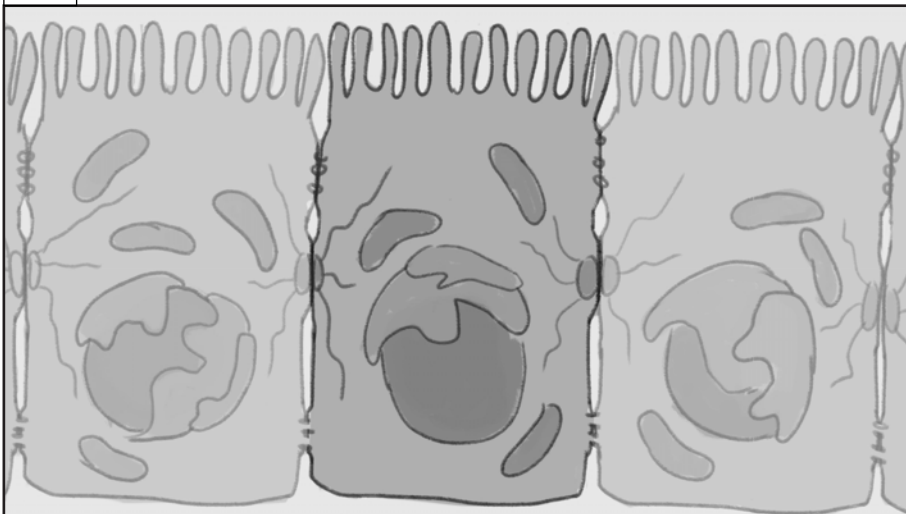
13d



It is important to be aware of whether a visualization is being spatially accurate --

Cut to next image in montage.

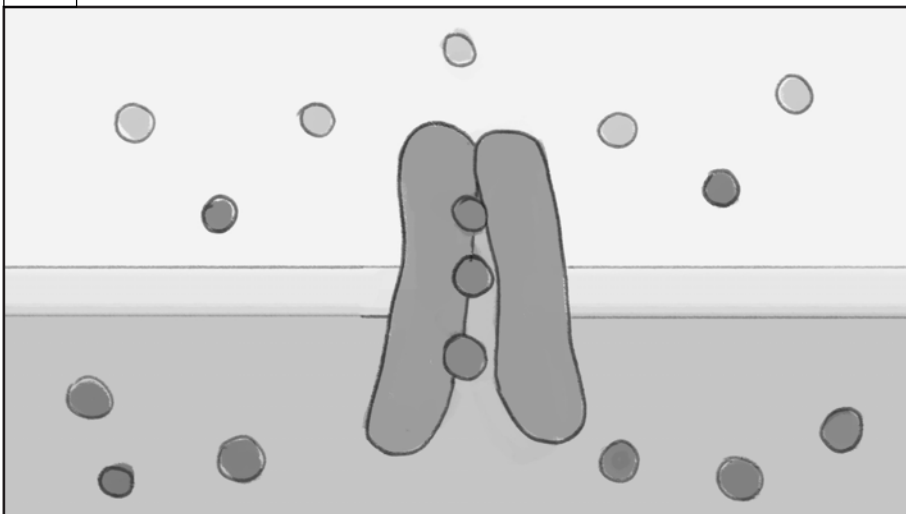
13e



-- or if it is emphasizing structural details to get a message across.

Cut to next image in montage.

14a

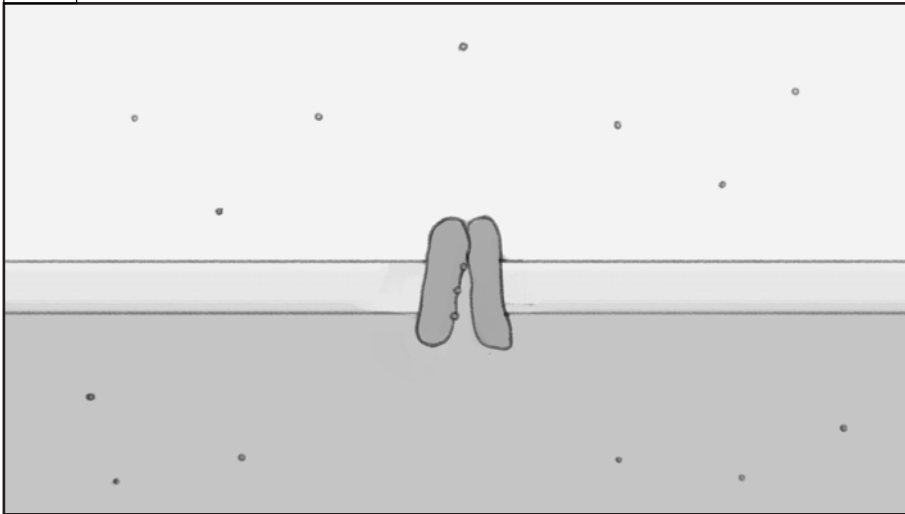


Let's take a look at another visualization.

Is this one spatially accurate?

Cut to this illustration.

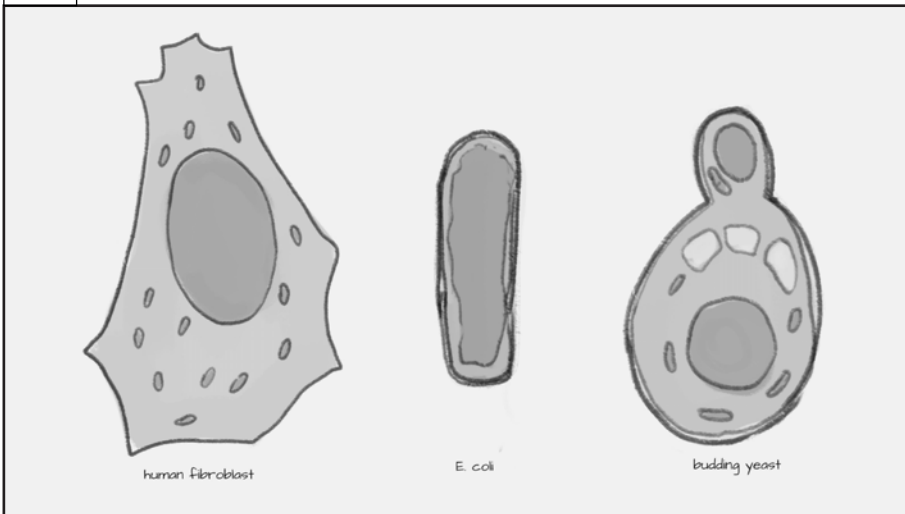
14b



No, the sizes of the membrane proteins and ions have been exaggerated to focus on that process.

Proteins and ions shrink to their proper size. The plasma membrane stays the same.

15a

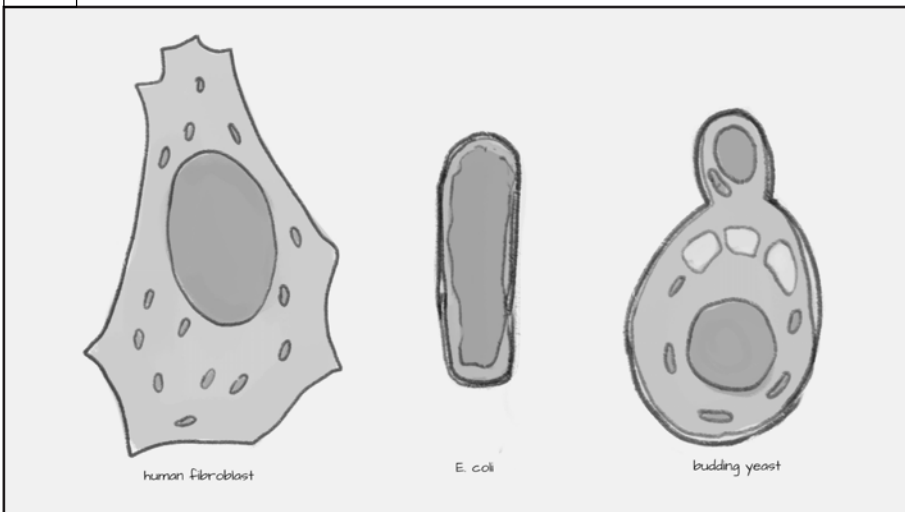


Now you try. Pause the video and think about the answer.

Is this one spatially accurate?

Cut to this new illustration. The narration pauses for a few seconds after asking the question to allow the student to pause the video.

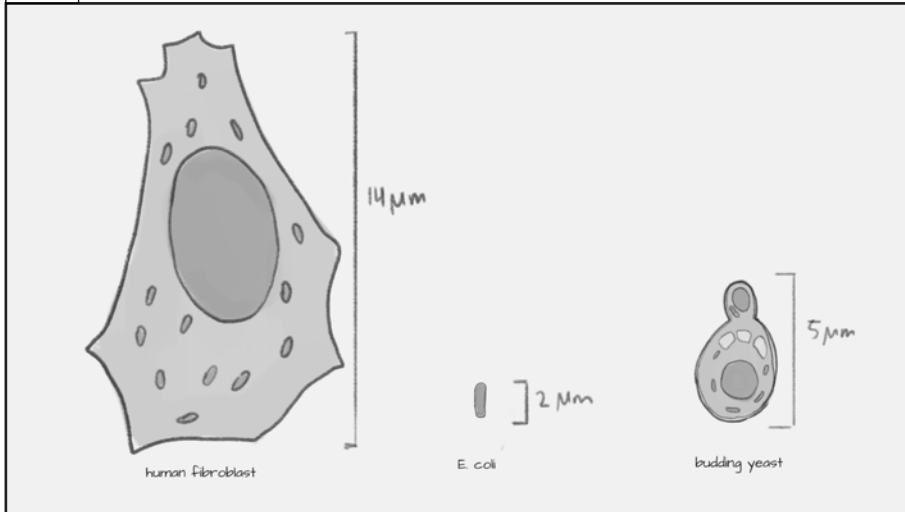
16a



Trick question! The organelles are all spatially accurate, but the cells themselves should be different sizes. The yeast and bacteria were enlarged for visibility, but in reality, they should be this small --

The narration continues after a few seconds.

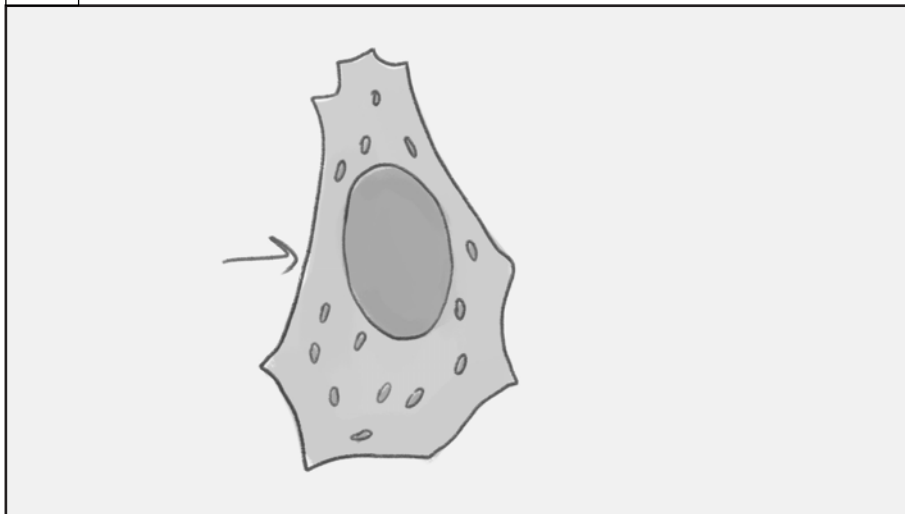
17a



-- compared to animal cells. It seems obvious when you think about it, but the trick is knowing when to think about it in the first place.

The bacterial cell and yeast shrink to their respective sizes, and measurement bars spring out from the ground.

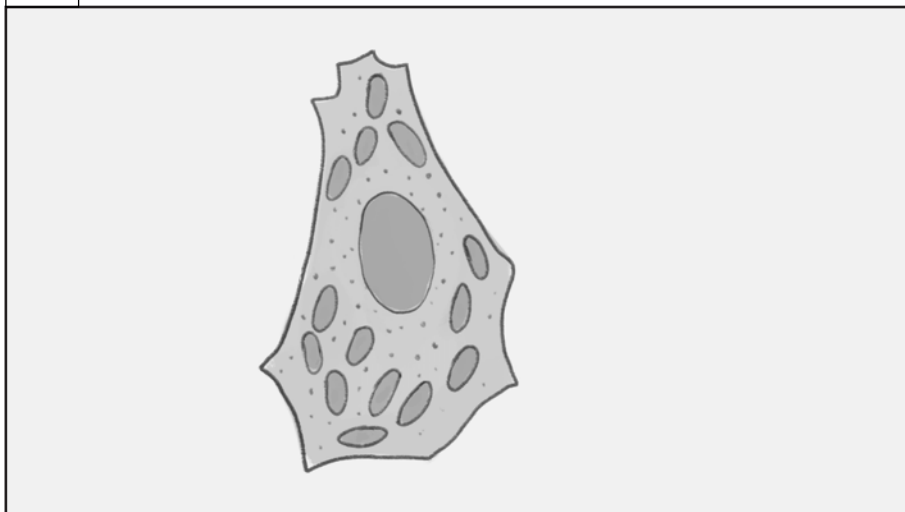
18a



Now you know that visualizations may --

The yeast and bacterial cells fade out, leaving only the fibroblast, which slides closer to the centre fo the frame.

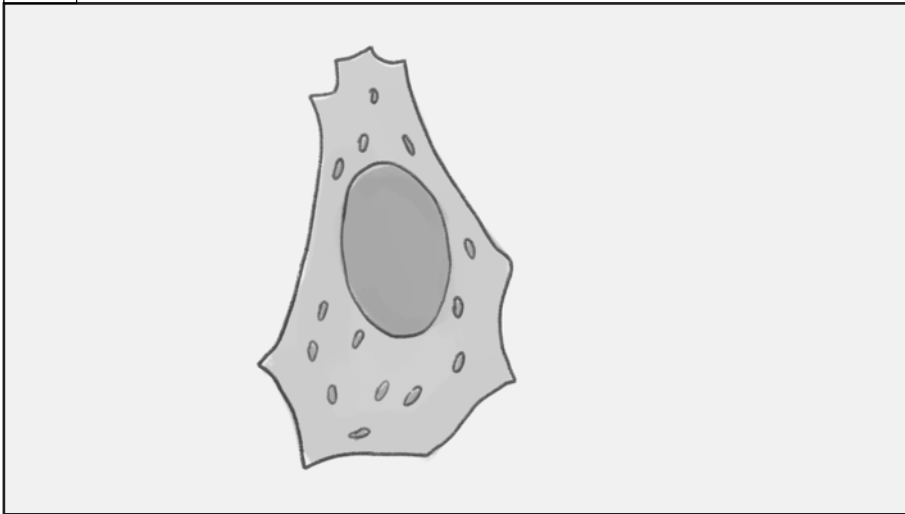
18b



-- exaggerate the scales of things --

The mitochondira and ribosomes grow and the nucleus shrinks as exaggeration is mentioned.

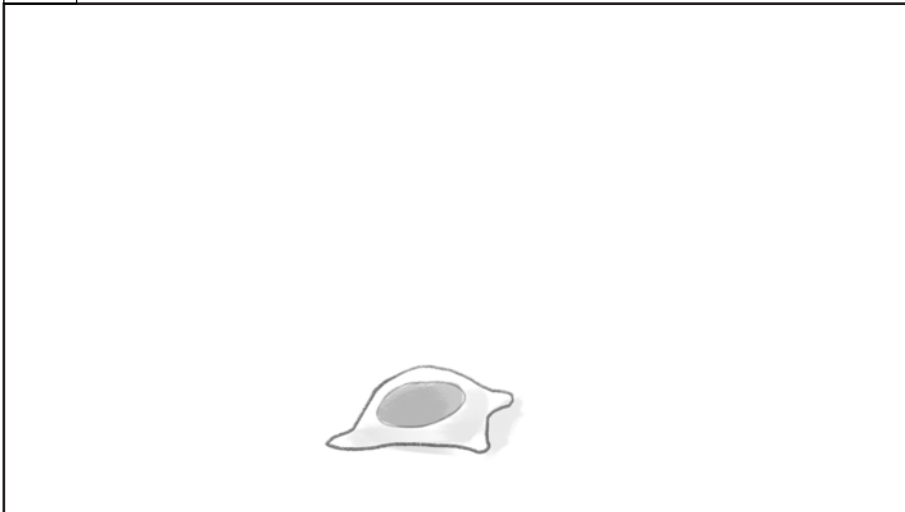
18c



-- to make the message clearer, and that structures may be shown as different sizes depending on the lesson being taught.

The organelles return to their original size.

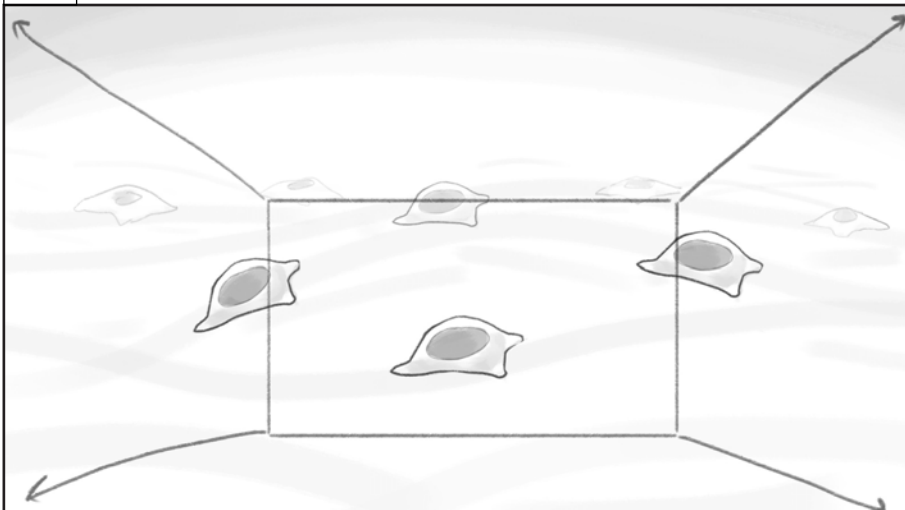
19a



Now when you encounter new images of cells, you'll be able to think critically about how scale is shown by thinking back to our fibroblast cell --

The illustration fades out, and we focus back on the original background fibroblast. The camera zooms out from the fibroblast...

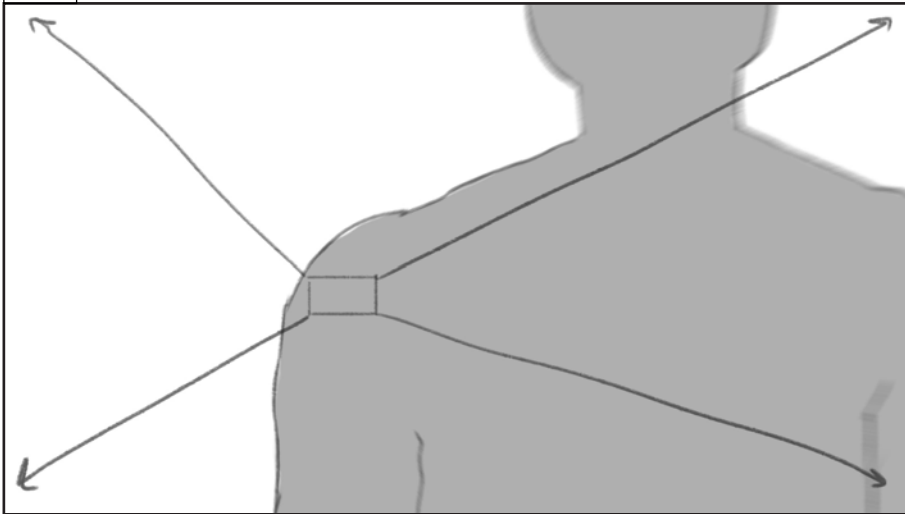
19b



-- 100,000 times smaller than a human, --

The camera continues zooming out, revealing an environment of other fibroblasts. The other fibroblasts and extracellular matrix also fade in from white.

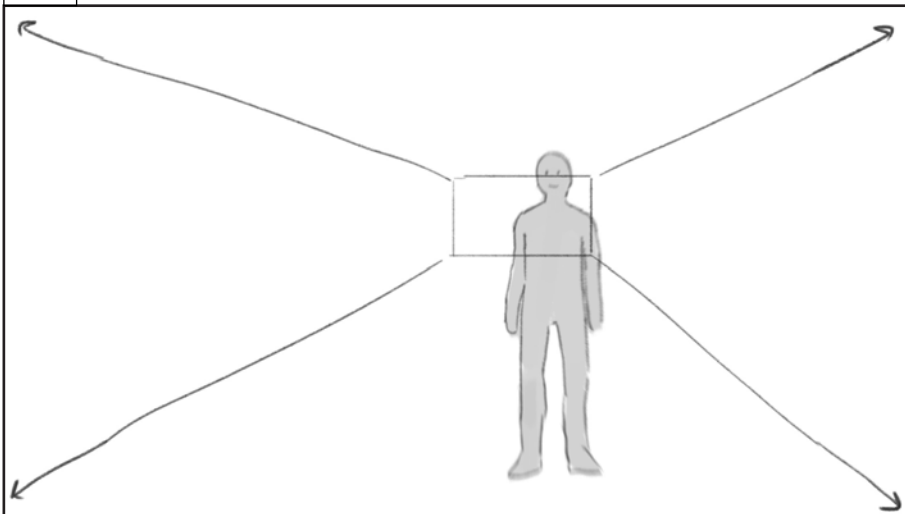
19c



-- and the trillions of other cells --

The camera continues zooming out, revealing our human figure.

19d



-- that make up a human.

The camera keeps zooming out as the figure fades out to white.

20a



Credits roll over a white background.