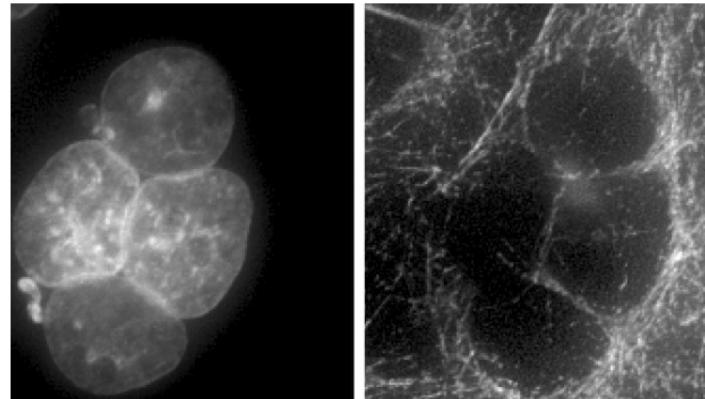


[public] Use cases doc

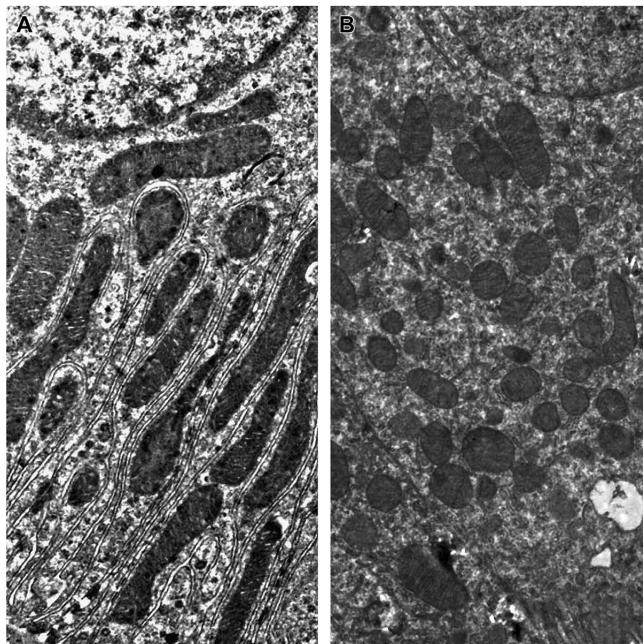
What is a question? A question includes an image (or set of images), some context information in text, and a question in text. Then you also provide the answer that you'd hope to get:

Context: I screened my cells with several new drugs, and one of them shows these results. The images show different channels of the same images. The first is nucleus, the second is cytoskeleton.
Question: What cellular pathways are affected?
Answer: The nuclei are clumped together in a single cell: they are multinucleated. This could be due to disrupted cell division, potentially cytokinesis.



You might have multiple questions that follow on from each other in a natural way:

Context: These are images are transmission electron microscopy of retinal ganglion neurons in culture at baseline (A, left) vs. treated with experimental compound BHO8651 (B, right).
Question: Describe what's in the two images.
Answer: Left: well-organized mitochondria of relatively uniform size and diameter Right: smaller, fragmented, and disorganized mitochondria
Question: What biological processes or organelles could be disrupted?



These kinds of 'multi-question' conversations are encouraged. This would count as "2 questions" when counting contributions for authorship.

No need to repeat yourself in conversation

Notice how the second question might rely on some information from the first question. For example, to answer the second question, it helps to know the information in the "context" box, and it might help to know the answer to the

previous question. That's fine, and when you submit follow-up questions, you should not rewrite all of that old information.

So, when the second question says "what biological process is disrupted", that's enough information. It remembers what you told it before.

Let the model see for itself

The 'context' and the 'question' text should NOT describe the image features in detail. In this example. While it's okay to say "this is an EM image", it is NOT okay to say "the left image has mitochondria that is well-organized.". Let the model see the image for itself.

Use cases

The questions fall under 3 broad categories. They are:

- What is unusual or interesting in these images? And why is it unusual or interesting?
- Why am I seeing this? What are the possible cellular pathways causing it?
- How can I verify my hypothesis in an experiment?

We'll now give some examples of each.

Use case 1: What is unusual or interesting in these images? And why is it unusual or interesting?

The questions are about identifying the important features of an image, and interpreting their significance.

Typical questions

- What is this structure and why is it significant in this context?
- Is this feature normal or abnormal? Why is it abnormal, and how can you tell?
- Why are these fluorescent markers distributed in this pattern?
- (given 2 images) Why does this cell at the edge of the colony appear different from a typical cell under similar conditions?

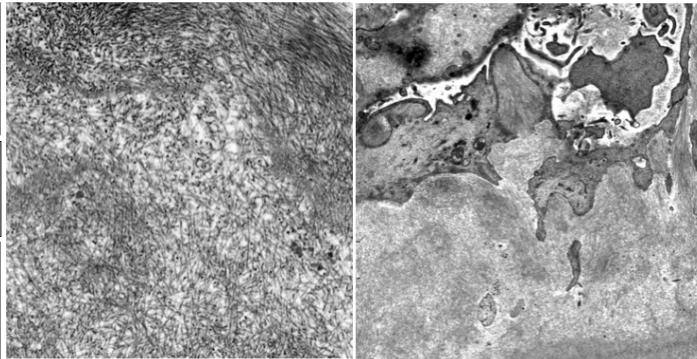
'Whats and whys'

In this category, questions can often be split into a 'what' followed by a 'why'. That's fine, and you can submit them as 2 separate questions (and that will be counted as 2 questions when counting total question contributions). However IF you submit a what, it must be paired with a 'why' question as well. 'What' questions by themselves are not interesting enough.

Examples

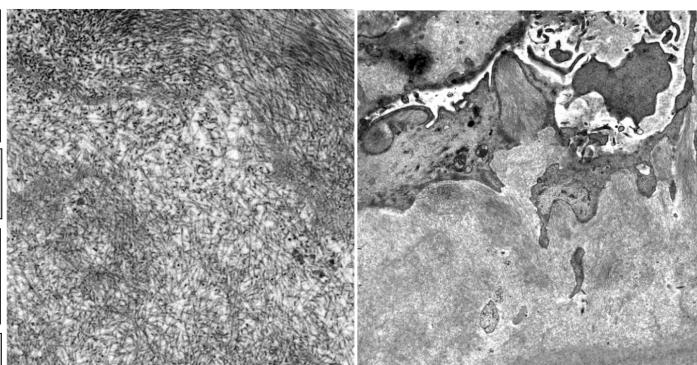
Example 1.1

<p>Context: We have a mouse model of <disease>. We are performing electron microscopy to evaluate for defects in blood vessel. Image 2 is a low power view.</p>	<p>Question: What is in these images, focusing on what is unusual? If it is unusual, then why is it unusual?</p>	<p>Answer: There seems to be an accumulation of disorganised thin fibrils with uniform width/thickness. This is uncommon for blood vessels, which typically demonstrate ...</p>	
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This question has a 'what' and a 'why'. It would be acceptable to break this into two questions like this:

<p>Context: We have a mouse model of <disease>. We are performing electron microscopy to evaluate for defects in blood vessel. Image 2 is a low power view.</p>	<p>Question: What is in these images, focusing on what is unusual?</p>	<p>Answer: There seems to be an accumulation of disorganised thin fibrils with uniform width/thickness.</p>	
<p>Question: Why is that unusual?</p>	<p>Answer: This is uncommon for blood vessels, which typically demonstrate ...</p>		



Use case 2. Why am I seeing this? What are the possible cellular pathways causing it?

Create questions that link what you see in the image to some underlying mechanism. E.g. the underlying biological processes, pathways, genes, or conditions. Understanding that mechanism requires good biological knowledge.

Typical questions

- **What** cellular pathways might be disrupted based on the observed abnormalities in the image?
- **Why** is this cellular pathway or protein disrupted?
- **Why** do all cells not express this particular protein when treated with X?
- **Why** is the protein expressed in multiple subcellular locations?
- Comparative Question: Why are these two tissue samples showing different levels of marker expression after similar treatments?

Use case 2 questions might follow on from use case 1 questions

So for example 2.1 below, we ask about a cellular pathway causing multinucleated cells. But you could create a separate question asking "what is unusual about this image?". If you want to do that, then submit them as separate questions.

Examples

Example 2.1

Context:

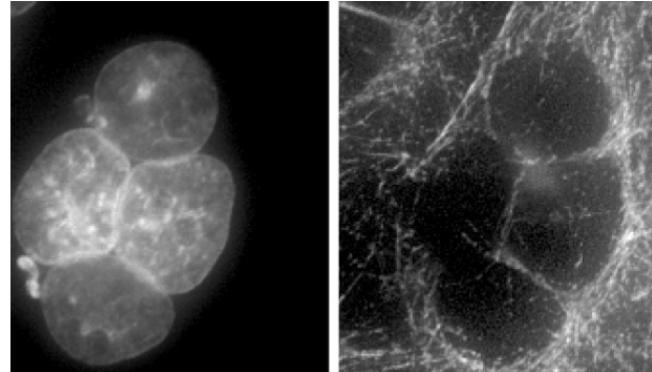
I screened my cells with several new drugs, and one of them shows these results. Image 1 is nuclear stain, image 2 is cytoskeleton.

Question:

What cellular pathways are affected?

Answer:

The nuclei are clumped together in a single cell: they are **multinucleated**. This could be due to disrupted cell division, potentially cytokinesis.



3. What should we do next and why?

(Alt: evaluate hypotheses)

Typical questions

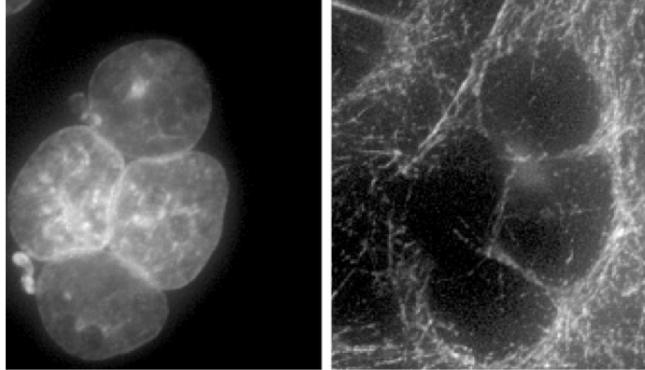
- Given the observed progression of cell behavior in these images, what might be the next step in this experiment?
- **Why** would this be the best next step as opposed to an alternative next experiment?
- **Why** might we expect different outcomes if we alter the current experimental conditions?
- Based on this imaging data, what hypotheses can we form about the cell cycle progression?
- **Why** is the cell arrested/stopped?
- Comparative Question: Given the differences observed in these images over time, what can we infer about the treatment's effectiveness?
- **Why** is the treatment effective/ or not effective? (edited)

Examples

Example 3.1

Question:
I screened my cells with several new drugs, and one of them shows these results. What cellular pathways are affected? Can you suggest an experiment?

Answer:
The multinucleated cells in the image could be due to disrupted cell division, potentially cytokinesis. To test this hypothesis, you could do # to inhibit cytokinesis. Proteins involved in cytokinesis include #, so your drug may alter their function...



Important types we do NOT include

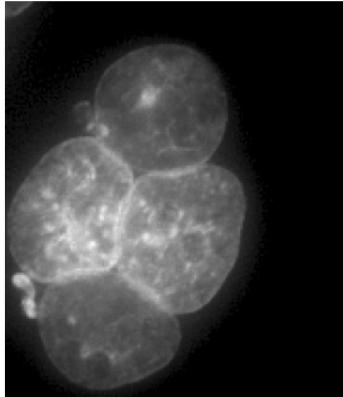
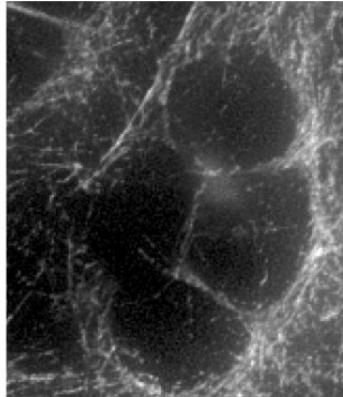
Our collaborators suggested a lot of very interesting use cases that we had to exclude for two reasons. First, we wanted to focus on questions that require image interpretation. Second, including more categories would make the scale too big for this first project. However we hope to explore these ideas in the future. So you should NOT submit questions under these use cases.

- Brainstorming new ideas without the use of images to guide the conversation.
- Experimental design, like "I have these microscopes and want to image X, what antibody stain should I use?"
- Assessing image quality, like "is this image in focus? If not, should I collect it again, or can I post-process it? If I can post-process it, can you provide code?"
- Interpreting scientific charts.
- Linking to relevant scientific articles.
- Recommending how to create scientific figures.

Recommend bad answers

For each question, we want you to provide one "wrong answer" to your question.

Why are we asking this? Because one way to test models like ChatGPT is to ask multiple choice questions. It's important that the 'wrong' choices seem reasonable. For example:

Context: I screened my cells with several new drugs, and one of them shows these results. The images show different channels of the same images. The first is nucleus, the second is cytoskeleton.		
Question: What's unusual about this image		
Correct answer: The cell is multinucleated		
Incorrect but reasonable-seeming answer: The cytoskeleton is fragmented		
Incorrect but reasonable-seeming answer: The cytoskeleton is fragmented		
Incorrect but reasonable-seeming answer: The cells are unusually large		
Incorrect and silly answer: Golgi apparatus in this cell is directly connected to the central vacuole		
Incorrect and silly answer: Yes, this cell appears to be undergoing mitosis and meiosis simultaneously		

What makes an answer reasonable?

- Suppose you knew the 'context' about the image — in this case that we have fluoro microscopy stained with nucleus and cytoskeleton — but you couldn't actually see the image. What would be a decent guess? Maybe that the cytoskeleton is fragmented.

On the other hand, you should NOT provide a completely silly answer. For example, you wouldn't talk about the Golgi because the Golgi isn't even stained in this image.