mber biology

Teaching students to question their world

Goals

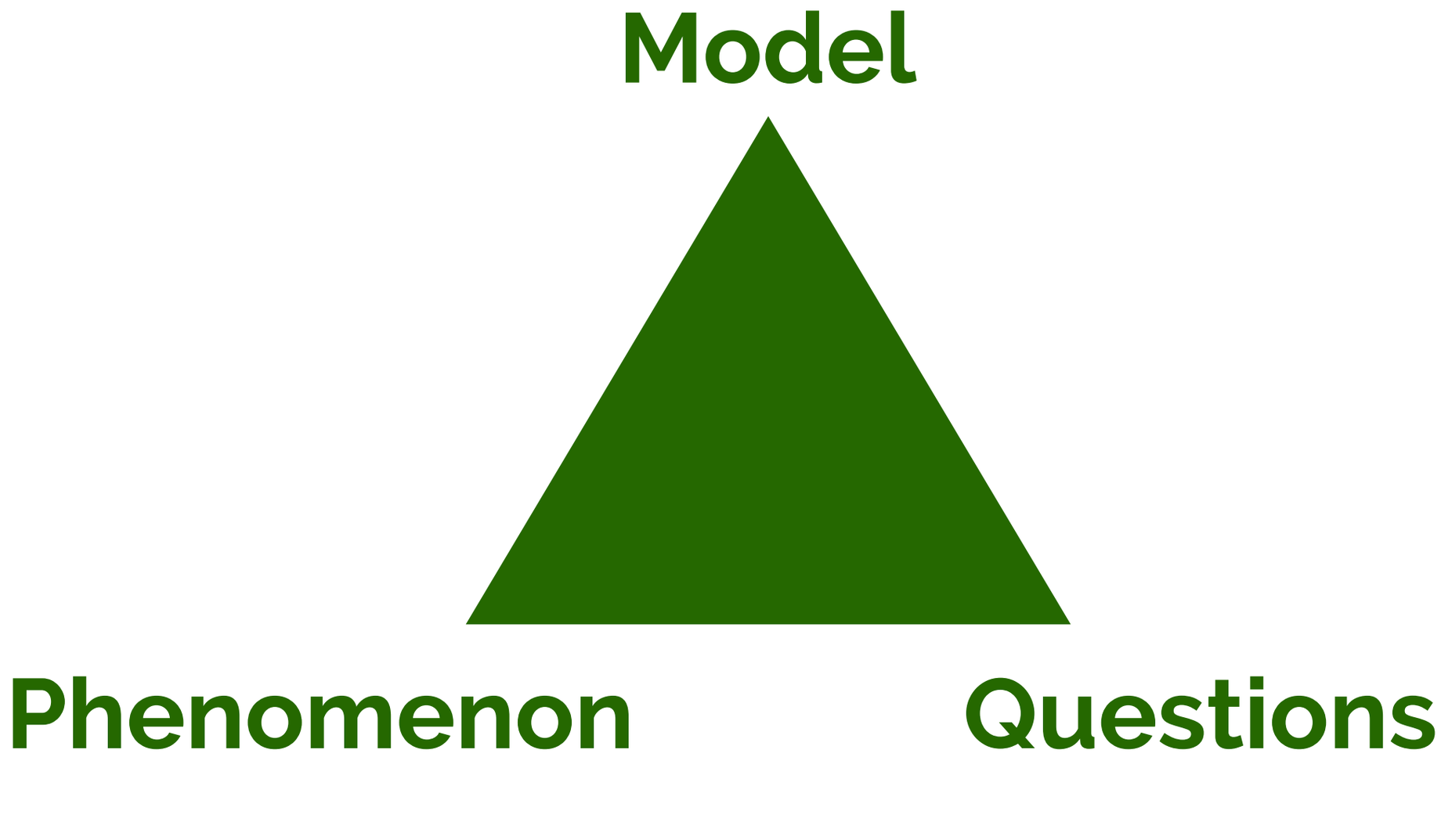
For our curriculum: to bring the scientific practice into the classroom, shift from learning about science to **figuring out** science.

For students: to be active participants of the scientific process by:

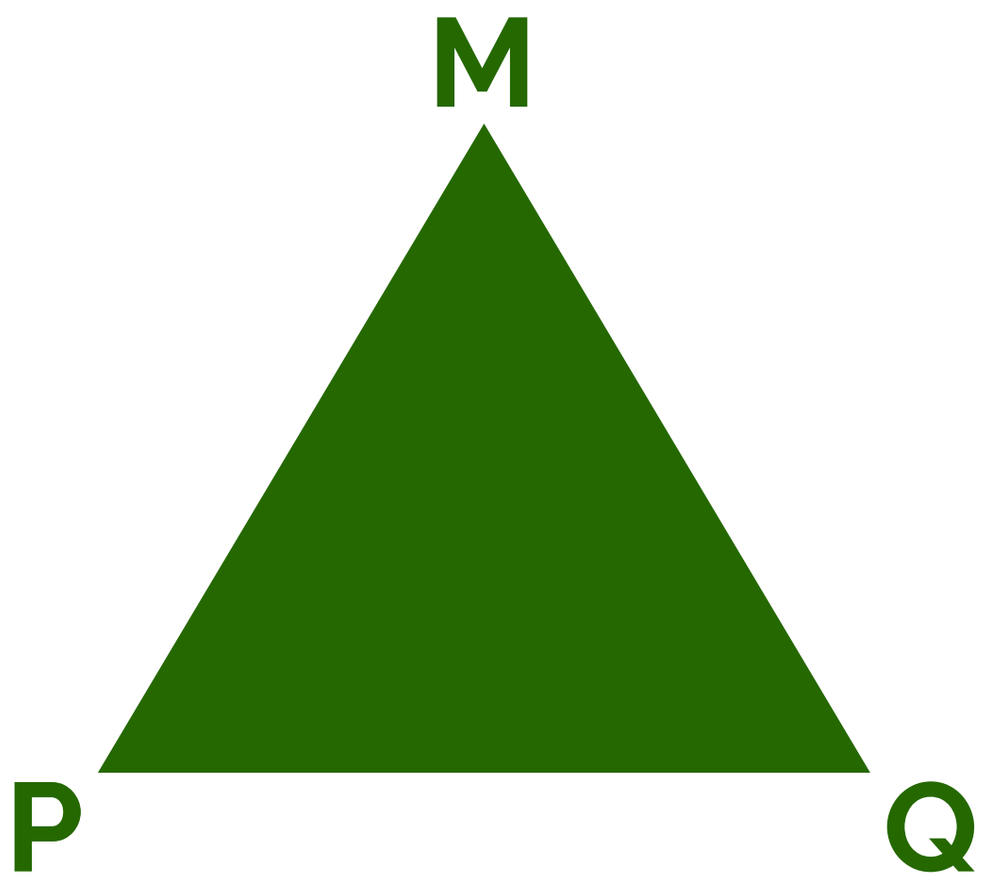
- Asking questions
- Collecting and analyzing data
- Explaining their reasoning
- Discussing evidence and its interpretation
- Communicating science

How do we reach these goals?

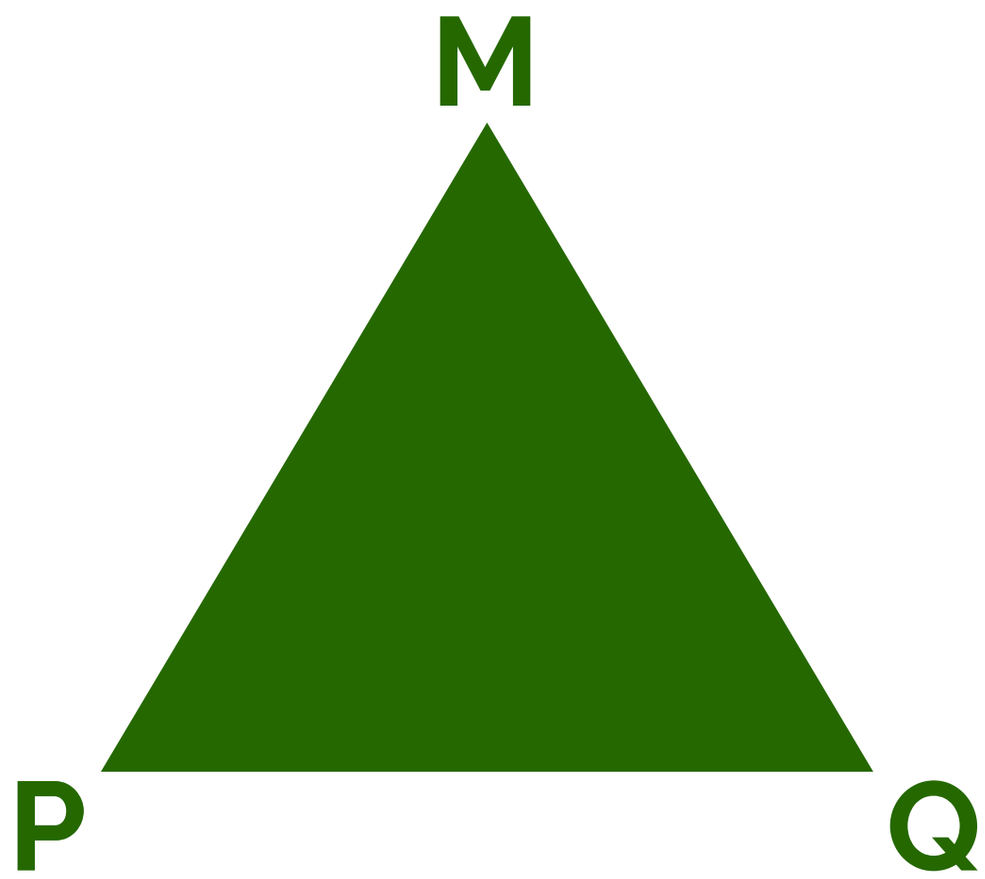
We will use the **PQM** triangle as a tool to guide student reasoning process.



How do we use the PQM triangle?

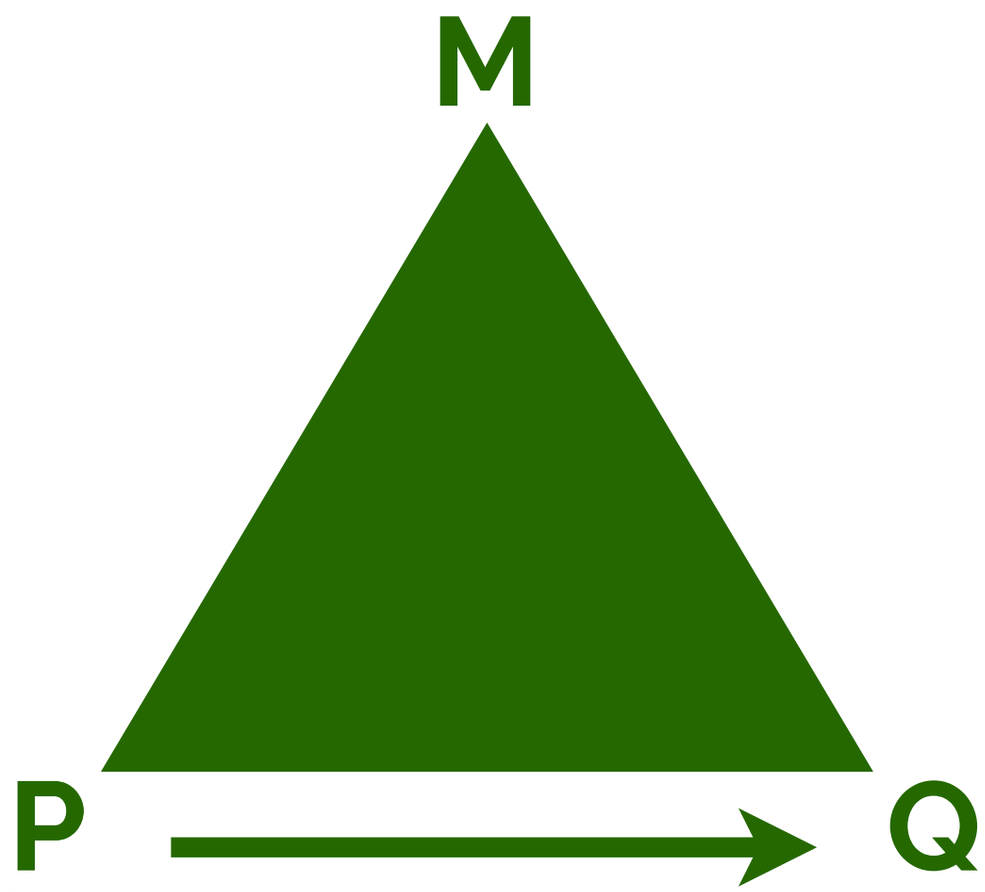


We can start by describing a phenomenon



Phenomenon
we present students with observations, a data set, or any processes that is puzzling and engaging.

The phenomenon should elicit students' questions



Phenomenon
we present students with observati
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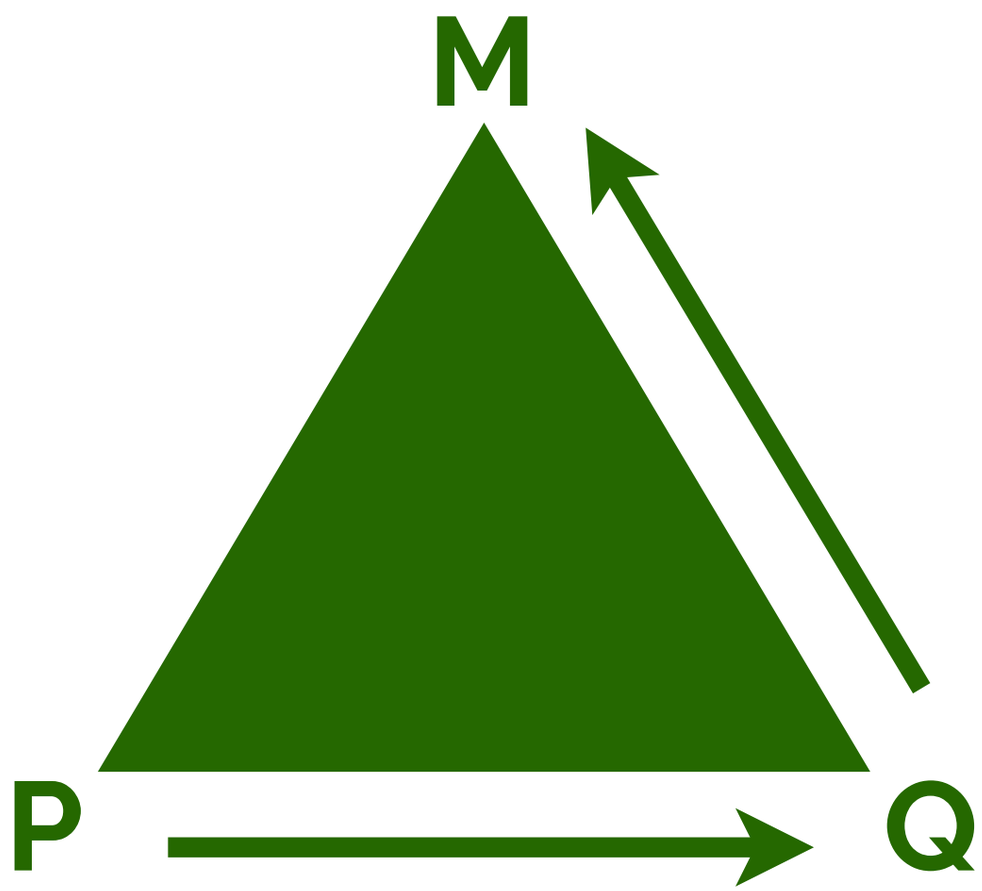
Questions
based on the phenomenon what are we **curious** about?

Students build a model

Model
set of ideas that answer the question.



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Questions
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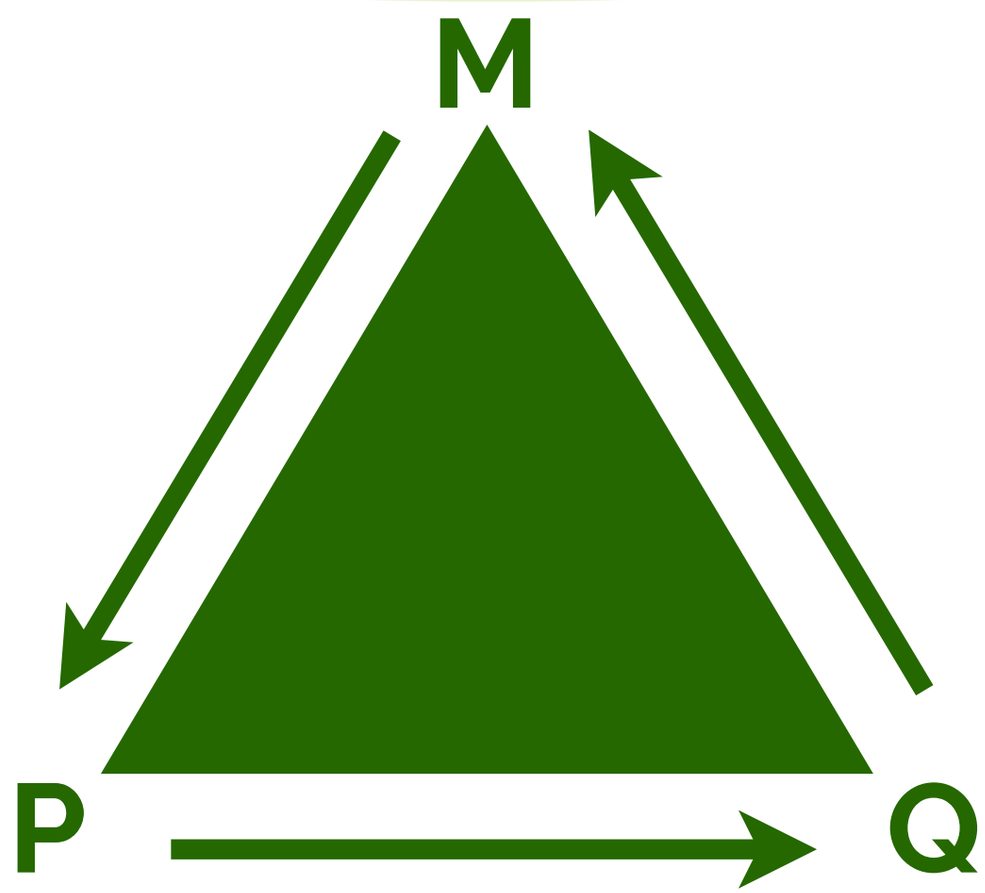
Students apply their model

Model
gets applied to **explain** new phenomena.



Phenomenon
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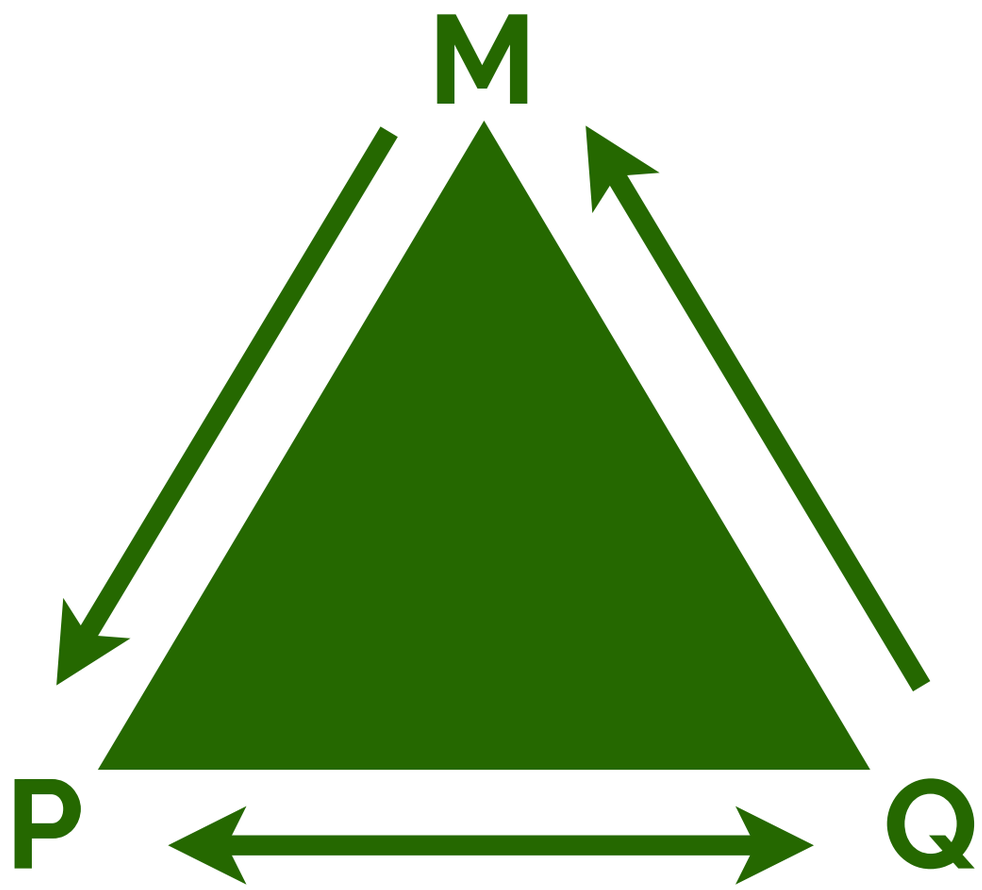
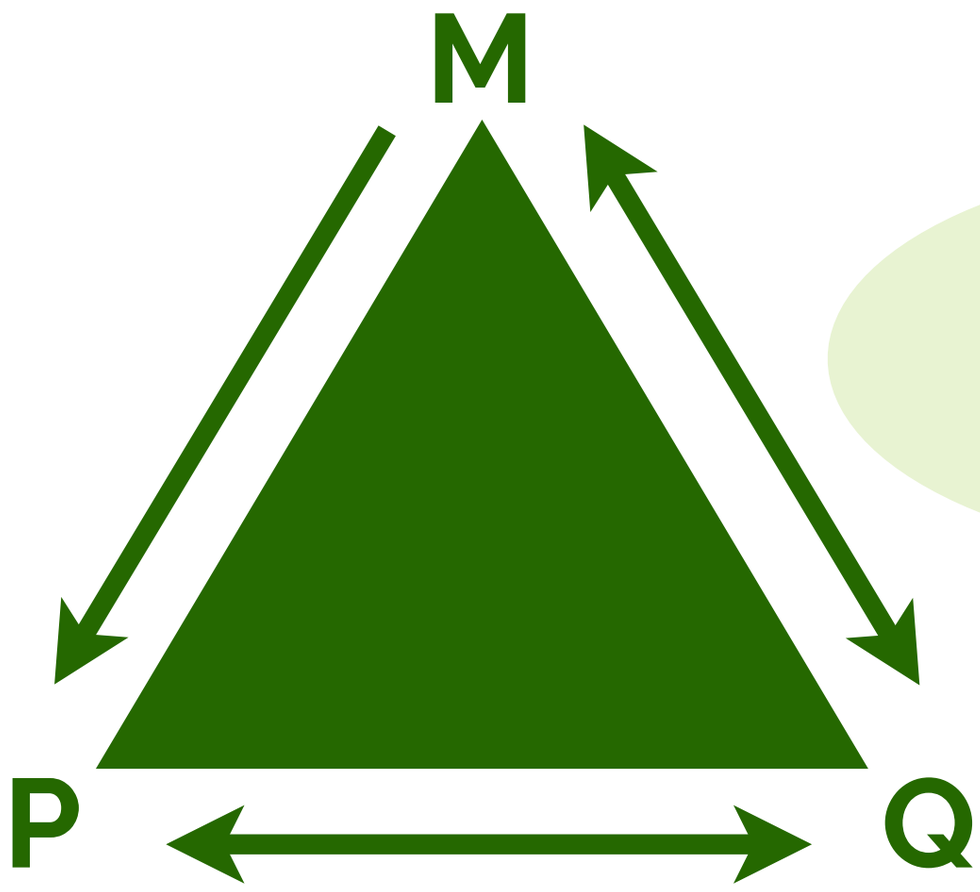
Questions
based on the phenomenon what are we **curious** about?

Sometimes we start with a question



Our **questions**
can lead us to consider other
phenomena

Our model can generate new questions

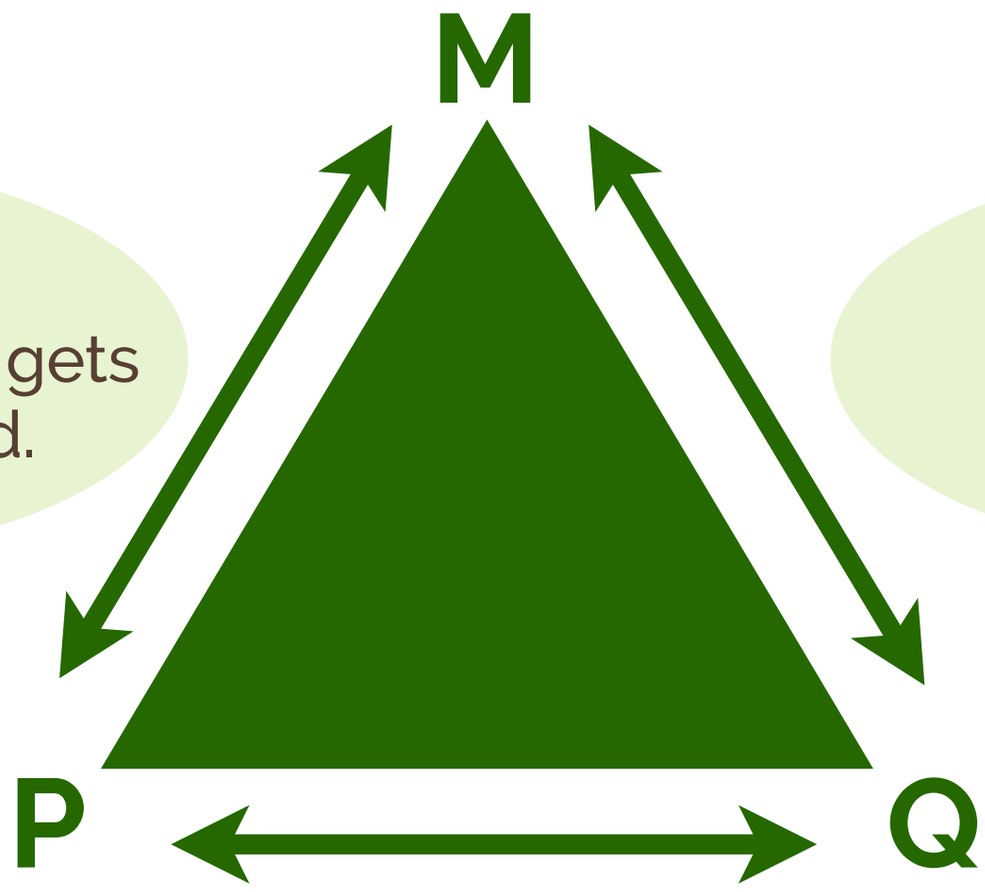


Generating **model ideas** can lead us to new questions

Our **questions** can lead us to consider other phenomena

Our model can get revised

Based on new evidence our **model** gets tested and revised.



Generating **model ideas** can lead us to new questions

Our **questions** can lead us to consider other phenomena

To be clear:

What are models?

A model is a set of ideas or underlying mechanism that can be used to explain some observed patterns.

What is a triangle?

The **PQM triangle** is a **reasoning tool**, and a triangle in our curriculum also refers to several days (or weeks) of instruction focused on a related set of core ideas (e.g Triangle of Natural Selection or Triangle of Matter Cycles)

What teachers have said about mber biology

"I have really enjoyed my MBER experience. It has been challenging but I love the flow of the curriculum and the way it asks kids to think deeper about the content"

"Students are challenged with the different style, but they are willing participants"

"It is a lot more fun, though stressful at times, but good stress".

"The most inspiring moment was probably watching the kids struggle with the finch data. It was exciting to watch them make connections and have genuine conversations specifically about the data"

What students have said about mber biology

"I really like how we had time to try to figure out problems on our own then share ideas with the class."

"We did a lot of our own thinking"

"Being pushed to come to our own conclusions – to learn the material better and give us a deeper understanding."

"It was interesting and explained phenomena I didn't know much about before."

"We weren't just given the answers, we had to actually think about it and discuss ideas."

"I feel like I really understand everything so I won't forget it because it wasn't just memorization. I feel like I can apply it. I wish all my classes were like this!"

Challenges for teachers

"Encouraging students to share their ideas … I see lots of empty papers"

"The time to plan is long as I have to learn how to use new resources"

"Leading the conversation so students generated the model components"

"Preparing work for students going on independent study"

"Time management. I feel so behind all the time and don't feel like I have a good grip on grades"