

Explore your ideas here - in words or pictures

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*Read about STEM topics other kids find cool  
at the Kids' Corner on our website.*



## *My STEM Stories™*

### *Mushroom Maestros* Featuring Ecovative Design

Can we grow a replacement for  
Styrofoam?



STEM  
Reader:

# Vocabulary

# Traits, Attributes, Characteristics

Term	Definition	Draw a picture or write it in your own words
<b>Biology</b>	Biology is the study of living things.	
<b>Material Science</b>	Material science is the study of how materials are used in science and technology.	
<b>Organisms</b>	Organisms are living things.	
<b>Fungi</b>	Fungi are a kingdom of organisms that can't make food or move and are not green.	
<b>Mushrooms</b>	Mushrooms are the top, fruiting part of a fungus.	
<b>Decomposers</b>	Decomposers are organisms that break down dead or decaying matter.	
<b>Mycology</b>	Mycology is the study of fungi.	
<b>Mycelium</b>	Mycelium are the root-like structures that support and feed the mushrooms.	

Trait

Attribute

Characteristics

# Bio-Inspired and Natural Materials

Biology is the study of living things big and small. It helps us understand what makes us tick and how we interact with the living world around us. As we learn more about the living organisms around us, we can develop beneficial relationships with them and our environment. Sometimes we use living things—plants and animals—directly for food (like corn or wheat), or work (like horses or cows), or just for friendship (like the family pet). Other times we take those living things and turn them into a tool or materials we can use. The fluffy fiber that protects the seeds of the cotton plant can be turned into clothes, and the tall trees in the forest can be used to make all sorts of things, like houses and furniture. Scientists, engineers, and entrepreneurs working in the field of biology often work across traditional technology boundaries to find new and innovative applications for the things they are discovering. In the next few pages we've described several new areas of technology development.

## **Biomaterials:**

Biomaterials are materials that are made out of (formerly) living components, for example plant matter. Mycology is the study of a class of plants called fungi—also known as yeasts, molds, and mushrooms. Mushrooms have mycelium, the vegetation part of the fungus which consists of very strong “root-like” cells called hyphae. By allowing the mycelium to interact with other biodegradable materials new product packaging can be created.

## **Recycling and reusing materials:**

Even materials made from natural products—like plants and animals—take time, energy, and resources to produce. Did you know to make the cotton for one new T-shirt you need 700 gallons of water? That is the same amount of water it would take to fill almost 20 household bathtubs! By recycling and reusing materials you can dramatically cut down on the energy and resources that go into making something, and many scientists, engineers, and entrepreneurs are always looking for new ways to do just that.

**Higher-efficiency composting:**

When food scraps are thrown into the garbage and wind up in landfills, they produce methane gas—a gas that is 21 times more harmful to the environment than carbon dioxide—and are wastes the resources that went into producing the food. Composting is a method to reduce food waste and return some of the remaining nutrients back to the environment. Traditional methods of composting require heat and soil microorganisms to break down plant material, often taking upwards of 12 weeks to reach a point of use in gardens. The Bokashi method uses specific microorganisms to break down organic material and results in reduced decomposition time, the ability to use indoors, reduced or eliminated odor creation, and, since it is anaerobic (does not need oxygen), it can be done in a sealed container.

**Questions:**

i. Why is it important that we get the most out of the materials we use?

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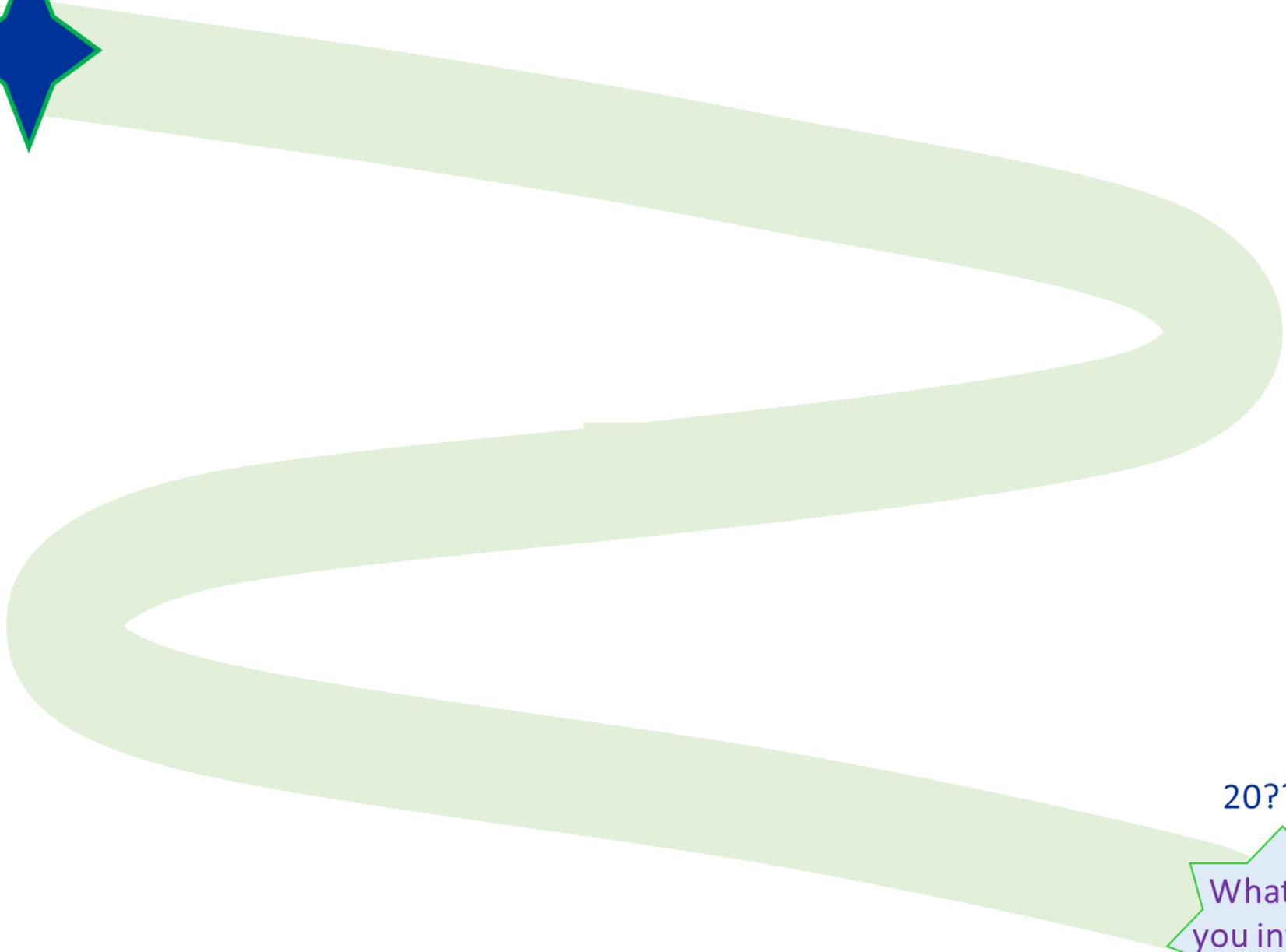
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# Create your own timeline



20?? CE

What will  
you invent?

# Meet Your Entrepreneurs



*Eben Bayer*

Eben Bayer is the CEO and co-founder at Ecovative Design, and he believes that biology can be used to solve a lot of the world's challenges. Eben grew up living and working on a farm and received two degrees (in mechanical engineering and innovative design) from Rensselaer Polytechnic Institute. Eben is interested in many areas of science and advises start-up companies in and around New York.

Gavin McIntyre is the chief scientist and co-founder at Ecovative. Since the company started in 2007, Gavin has led all the material and biological process development.



*Gavin McIntyre*

Gavin received two bachelors of science degrees from Rensselaer Polytechnic Institute—one in mechanical engineering and the other in product design. In addition to inventing new materials, Gavin likes skiing.

Ecovative Design is a world-leading biomaterials company that uses nature to create sustainable materials.

Ecovative Design's mushroom materials are environmentally friendly alternatives to traditional plastic foam packaging, insulation, and other synthetic materials.

These materials are made out of mushrooms, flour, and other plant "garbage" and can be molded into any shape you can imagine! This technology uses mushroom roots (mycelium) to turn waste into strong new materials.

Ecovative Design has been recognized as a Technology Pioneer by the World Economic Forum for its potential beneficial impact on climate change.



# 21<sup>st</sup> Century Context

## Bolt Threads

The founders of Bolt Threads believe that the answers to some of the world's hardest problems can be found in nature. One example of this is spiders! Spiders weave their webs out of silk fibers that have amazing properties—including high strength, high flexibility, and high softness. The team at Bolt Threads is learning how to copy this process but on a manufacturing scale.

First, they studied the proteins in the silk (basically like the silk DNA) and figured out what makes it so strong. Next, they learnt how to grow large amounts of that material in the lab and then in a factory. Finally, they take those silk proteins and turn them into fibers and fabrics.

## Evrnu (pronounced Ever-new)

As a kid, Stacy didn't think that she was good at science. When she went to college at New York City's Fashion

Institute of Technology, though, she discovered this wasn't true. By doing hands-on experiments, Stacy realized that she learned just a little differently than her friends and that she really WAS good at science and chemistry!

After college, she worked with fabric and textiles at companies like DuPont, Target, and Eddie Bauer. While working at these companies, she saw firsthand how much energy it took to make every piece of clothing and how much waste is generated when we throw away old clothes. With that in mind, she began to work on projects around cloth recycling and, in 2014, she and her colleague, Christopher Stanev, founded Evrnu—a company dedicated to recycling cloth waste into *pristine* new thread that can be turned into new fabric and clothing. Doing this *significantly reduces the water and energy* needed to create new clothes and cloth materials.

# Vocabulary Practice