



**Who says all the fun has to happen at The Tech Interactive?
This DIY biotinkering activity can be done with inexpensive
store-bought supplies and things you find around the house!**



Subject: Biodesign
Age: 8+

Key concepts:

Living systems, biomaterials, microbes

Introduction

Ever wanted to grow your own paper or plastic? Or create leather that doesn't use animals? All these can be done at home by collaborating with microbes — tiny microscopic organisms — to grow a custom biomaterial.

What is biomaterial?

Our biomaterial is made by millions of harmless yeast and bacteria that live together in a liquid mixture of tea and sugar. As the microbes grow, a layer of floating cellulose forms on top. You can dry out this layer to create a sturdy and flexible biomaterial that can be used to make things. Biomaterial will grow differently depending on the container and type of microbe food used — what will you grow?

Supplies

You can grow your own biomaterial using just a store-bought bottle of kombucha and common kitchen items! Collect all of the basic supplies on this list to get started.



Heat-safe container



Sugar source (sugar syrup, agave or molasses)



Tea leaves (non-herbal) such as oolong, black or white tea



Growth container



Bottle of kombucha (unflavored)



Clean cloth (coffee filter or cheesecloth)



Rubber band



Non-metal surface

Instructions

1. Boil water in a heat-safe container.
Ask an adult for help!
2. Add sugar and tea leaves to steep. Let the tea cool.
3. Add cooled tea into a clean growth container.
Add a bottle of kombucha.
4. Cover the opening with a clean cloth and a rubber band.
5. Leave to grow for at least a week or until the amount of biomaterial you want has grown.
Try not to move it!
6. Wash your hands and remove the biomaterial. Lay out on a non-metal surface until dry.
7. Peel the dry biomaterial from the surface and make some awesome things!

+ Want to make more?

Repeat the steps above, but for step 3 use tea from your growth container instead of a bottle of kombucha!

Starter recipe

Container	Tea	Sugar	Water
1 quart	1 bag (2 tsp. loose leaf)	3 tsp.	3 cups

Expert tips

Our scientists have done some testing of common ingredients. Here is what we have learned so far:

How fast will biomaterial grow in different teas?

- White tea: slow
- Oolong tea: medium
- Black tea: fast

How will dried biomaterial feel if different sugars are used?

- Sugar syrup: thin and papery
- Agave: plastic-like
- Molasses: thick and leathery

Keep experimenting!

These supplies and ingredients are just a starting point, so get creative and experiment for yourself! Explore your pantry to find different types of teas, sugars, containers and drying surfaces. How do these things change your biomaterial?

How to use biomaterial

Keep in mind what you want to make with the dried biomaterial when planning how to grow it. What size or material properties might work best? For example, do you want to fold some origami or braid it into a bracelet? You could make a gift tag, sew a wallet or create stained glass art. Up to you!



Share your results!

Keep us posted about your biomaterial projects, experiments, discoveries and creations on social media with #BioTinkeringLab and #MakingWithMicrobes



Further explorations

- How large a piece can you grow? What interesting shapes?
- Can you change the color of your growing biomaterial with dyes?
- What different textures can you find or make to embed into your drying biomaterial?
- How might you integrate other materials into your growing biomaterials?
- Can you coat your biomaterial with something to make it waterproof?

BioTips

- The microbial cellulose that biomaterial is made of is similar to what helps plants stand upright!
- Your microbes cannot eat artificial sugars like Splenda.
- Do not grow biomaterial in metal containers. They will corrode.
- Avoid herbal or flavored teas.