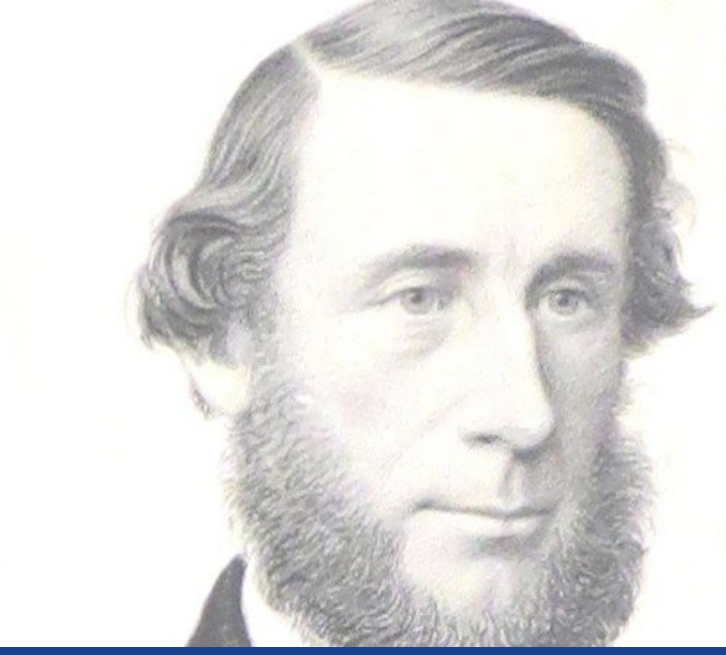

Microbiome Ireland
Interfacing Food & Medicine

Tyndall National Institute
Institiúid Náisiúnta

TYNDALL SCIENCE AT HOME

PURE AIR EXPERIMENT: SCIENCE WITH SOURDOUGH

AGES: 8 - 12

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#Tyndall200

A national celebration to mark the bicentenary of John Tyndall, one of Ireland's most imaginitive and influential scientists.

Take part by conducting this experiment at home. Take photos or make a video, and share it on social media using the hashtag **#Tyndall200**. You can also share photos or a 30-second video using our online entry form. Either way you'll be entered to win a #Tyndall200 prize pack for science lovers!

BACKGROUND

John Tyndall studied how light bounces off tiny particles in the air, a property called diffraction. He wanted to show that light cannot diffract without tiny particles in the air to bounce off. So, he created a “pure air” chamber that filtered all the small particles from the air. He quickly noticed that when he left fish or meat sitting in “pure air” it stayed fresh for a long time, while food left in ordinary air went bad quickly. This experiment suggested that ordinary air contains micro-organisms that are too small to see but powerful enough to breakdown food.

It’s easy to grow your own community of micro-organisms at home by making a sourdough starter. A sourdough starter is what bakers use to make sourdough bread. All you need is some flour, water and help from micro-organisms in the air. Bacteria in the air convert sugars in the flour to lactic acid and acetic acid – these give the sourdough its unique sour taste. Yeasts in the air convert other types of sugars in the flour into ethanol and carbon dioxide. The carbon dioxide creates lots of bubbles in the sourdough starter which will help the bread to rise in the oven.

THE EXPERIMENT

In this experiment, we'll grow two sourdough starters - one indoors and the other outdoors. By comparing their appearance and smell, we'll find out if the micro-organisms in the air inside our homes are different to the micro-organisms in the air outside.

YOU WILL NEED:

- 2 clear plastic or glass jars (recycled jam jars, coffee jars, pasta sauce jars, etc.)
- A tablespoon for measuring
- Kitchen paper
- Elastic bands
- A marker or stickers to make labels

DAY 1: GETTING STARTED

PREPARE YOUR JARS

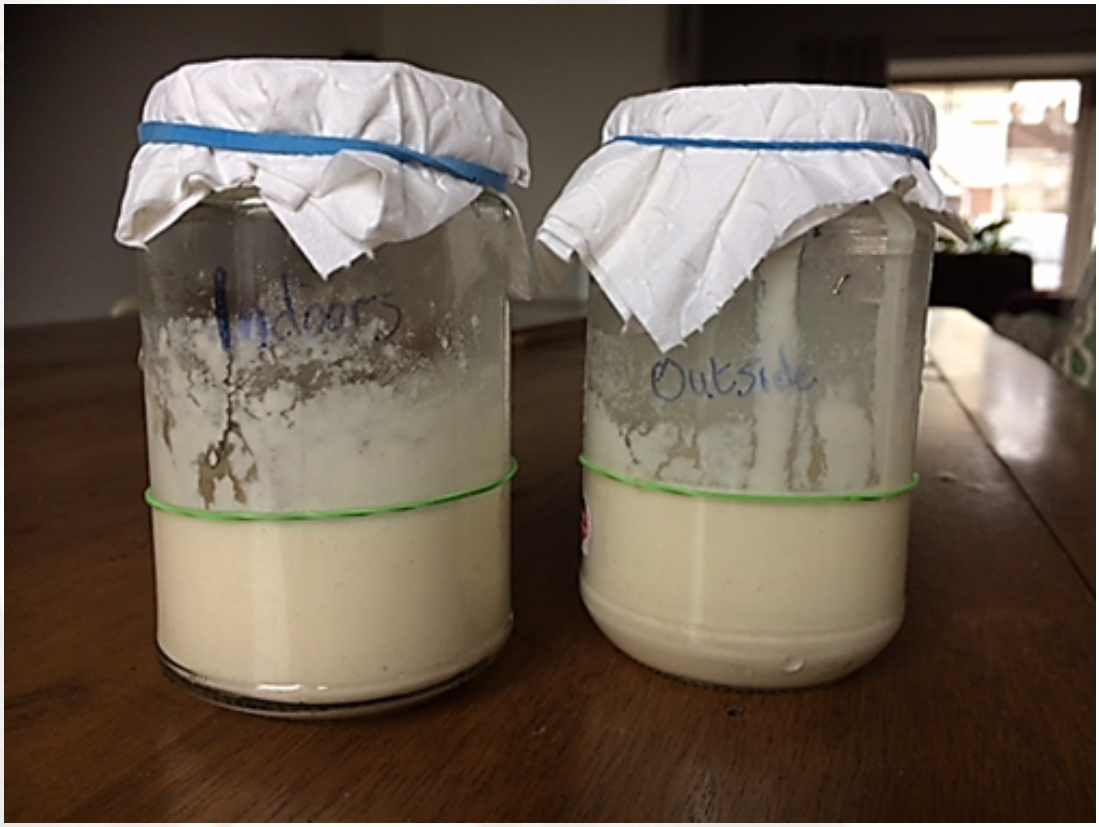
- Before you begin, wash the jars in warm, soapy water and allow them to fully dry.
- So that the jars don't get mixed up, mark one "indoors" and the other "outdoors" with a sticker or marker.

MAKE YOUR SOURDOUGH STARTER

- To create your sourdough starter, you must mix equal amounts of flour and water. The exact quantity is not important, but the ratio of flour to water **must be 1:1**. For example, if you add 4 level tablespoons of flour, you must add 4 tablespoons of water.
- Use a plastic spoon or wooden stirrer to mix the flour and water together in each jar until there are no more lumps.

MAKE YOUR SOURDOUGH STARTER CONTINUED...

- Fold a sheet of kitchen paper in two and place it over the other jar. Use an elastic band to hold it in place. This will prevent dust, dirt or insects falling in but will still allow air inside.
- Put another elastic band around the belly of both jars to mark the height of the sourdough at the beginning of this experiment. This will help you see whether the sourdough grows or not.



LOCATION, LOCATION, LOCATION...

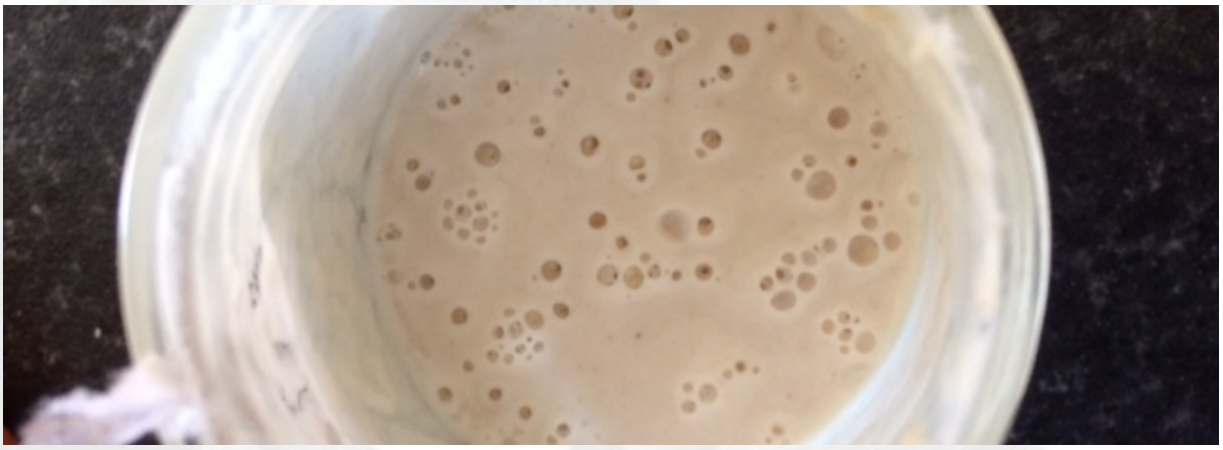
- Place the jar marked “indoors” somewhere in your home – perhaps on your kitchen counter or in a cupboard.
- Place the jar marked “outdoors” somewhere out outside – maybe in your garden, balcony or outside your front door. You’ll want to make sure that the jar is safe from the wind and rain. You could try covering it with a bucket or lunchbox to keep the rain off.

DAY 2: FEEDING & MEASURING

FEED YOUR SOURDOUGH STARTER

Your sourdough starter is a bit like a pet! Because there are living micro-organisms inside the sourdough starter, **you must feed it every day:**

- First **remove** 2 level tablespoonfuls of the sourdough starter and discard it in the waste bin or compost bin.
- So that you don't transfer micro-organisms from one jar to the other, use a **new spoon** for each jar or else wash and dry the spoon between jars.
- To feed your sourdough starters, add 2 level tablespoonfuls of **flour** and 2 level tablespoonfuls of **wate**r to each jar, stirring until smooth. We call this "feeding" the sourdough starter because any micro-organisms inside need nutrients to grow.



BE CURIOUS!

Notice and record and change you see. After **6-8 hours** check on your jars. Do you notice any differences yet? Write down your observations in your experiment notebook:

- Are there any changes in colour, texture or smell?
- Are there any bubbles beginning to form?

MEASURE ANY CHANGES

Has the sourdough expanded or grown bigger in the jar?

- If it **has** grown, use your ruler to measure how high the sourdough has grown above its original height marked by the elastic band. Record it in your experiment notebook.

- If it **hasn't** grown yet, don't get discouraged! It can take a few days for the micro-organisms in your sourdough starter to become very active. Try checking on it a few times every day and be patient!

DAYS 3 - 10: MORE FEEDING & MEASURING!

Repeat the steps from Day 2 **each day.**

- Make sure it's a fair experiment. Treat both your sourdough jars **exactly the same.** The only difference should be that one is kept inside, and one is kept outside.
- It's a good idea to make a schedule and stick to it. You might decide to "feed" your sourdough starters at 12 o'clock every day before you have your lunch and measure them every day at 7 pm every day after you eat your dinner.

WHAT YOU WILL SEE:

Both jars will allow micro-organisms from the air inside. Yeasts will produce carbon dioxide that create bubbles within the sourdough starter. The sourdough starter will expand because of the bubbles, so that the overall height of sourdough in the jar increases.

Because the sourdough jars are kept in different environments, it's likely that different types of micro-organisms will live in each jar. You might notice some differences because of this – maybe they will grow at different rates, smell different, have different amounts of bubbles or be different in colour.

EXPERIMENT NOTEBOOK

SCIENTIST NAME: _____

AGE: _____ EXPERIMENT DATE: _____ TIME: _____

DAY	SOUR DOUGH KEPT **INSIDE**		SOUR DOUGH KEPT **OUTSIDE**		ADDITIONAL **OBSERVATIONS**
	HEIGHT (CM)	OBSERVATIONS (SMELL, TEXTURE, COLOUR, BUBBLES?)	HEIGHT (CM)	OBSERVATIONS (SMELL, TEXTURE, COLOUR, BUBBLES?)	WAS THE WEATHER WARMER OR COOLER? DID YOU MEASURE AT A DIFFERENT TIME OR SKIP A DAY? WAS ANYTHING ELSE DIFFERENT?
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

EXPERIMENT SUMMARY

One thing I learned was: _____

If I was doing this again, I might: _____

ADDITIONAL EXPERIMENTS:

You might have already noticed that temperature effects how well your sourdough grows. Think about how you could design an experiment to test whether sourdough starter grow better in **warm or cool places.**

Your first experiment showed that sourdough needs micro-organisms from the air to ferment and grow. Do you think the sourdough starter would grow if it had **no air at all?** Could you design an experiment to find out?

HEALTH & SAFETY NOTE:

- Because this is a science experiment we advise against baking/eating bread from the sourdough starters you use for your experiment.
- When storing your jars between feedings and measurements, make sure that they won't fall over and break.

John Tyndall (1820 - 1893) was one of Ireland's most successful scientists and educators. Born in Leighlinbridge, County Carlow, he reached the pinnacle of 19th century science. His major scientific interest was the interaction of light with matter, and he is most widely known for the explanation of why the sky is blue. Tyndall National Institute, Ireland's leading ICT research institute, is named in recognition of his work.

Image: Carlow County Museum