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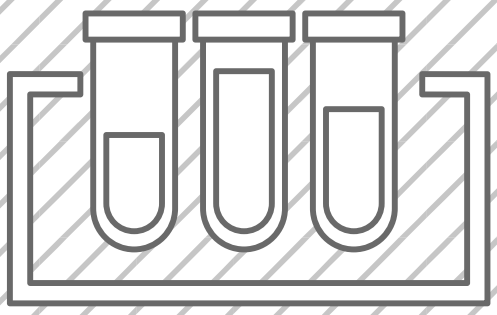
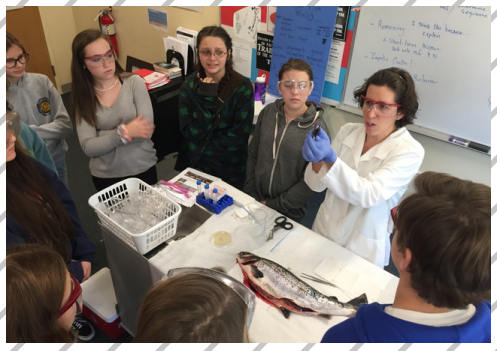
Bioscience Association of Maine presents:

ME BIOSCIENCE DAY

November 13-17, 2023

#mebioscienceday





BIOME
Bioscience Association of Maine

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ME Bioscience Day 2023 Overview

The flight of talented students from Maine is exacerbated by a general public perception that “there are no jobs in Maine”. While some industries in Maine are struggling for a multitude of reasons, the bioscience industry in Maine is thriving and offers significant opportunities for Maine students and the broader workforce.

The exciting, next generation manufacturing and R&D technologies that are the bedrock of the Maine bioscience industry are not always well known by the public at large or acknowledged by Maine media. Maine Bioscience Day is being coordinated with the hope that lasting interactions between industry, researchers, and high schools can be nurtured and to supplant the idea, however misguided, that the “jobs of tomorrow” are not being created in Maine.

What is ME Bioscience Day?

ME Bioscience Day is a statewide event that aims to get middle school students excited about science and inform them of the opportunities they might have working in a science related field in their future. Traditionally, professionals volunteer to visit local middle school classrooms to talk with students about their career in science, their daily tasks, and the opportunities that are available in science based careers.

How will the event be held in 2023?

In 2023, we we will be hosting ME Bioscience Day as a hybrid event with both in-person volunteers and virtual video formats.

Virtual Format & Video Series: We have partnered with University of Maine, Kennebec River Biosciences and Science Dogs of New England to create a series of videos following 3 scientists. Speakers will talk a bit about what life science is, the variety of jobs within the industry, their company, and what their day-to-day jobs look like.

Hands-on Activity: The pre-recoded videos will be followed by a separate hands-on activity video including a lesson plan and materials for the activity.

https://biomaine.org/me-bioscience-day/

2023 Participating Schools

Bristol Consolidated School, Bristol | Cape Elizabeth Middle School, Cape Elizabeth | China Middle School, China | Durham Community School, Durham | Falmouth Middle School, Falmouth | Frank H. Harrison Middle School, Yarmouth | Gardiner Regional Middle School, Gardiner | Gorham Middle School, Gorham | Gray-New Gloucester Middle School, Gray | Great Salt Bay Community School, Damariscotta | Greely Middle School, Cumberland | Greenville Consolidated School, Greenville | James F. Doughty School, Bangor | Jordan-Small Middle School, Raymond | King Middle School, Portland | Lake Region Middle School, Naples | Lamoine Consolidated School, Lamoine | Lawrence Junior High, Fairfield | Lincolnville Central School, Lincolnville | Medomak Middle School, Waldoboro | Middle School of the Kennebunks, Kennebunk | Mt. Ararat Middle School, Topsham | Noble Middle School, Berwick | North Yarmouth Academy, Yarmouth | Oak Hill Middle School, Sabattus | Phillip W. Sugg Middle School, Lisbon | Piscataquis Community Secondary School, Guilford | Presque Isle Middle School, Presque Isle | Saco Middle School, Saco | Sanford Middle School, Sanford | Scarborough Middle School, Scarborough | Skowhegan Area Middle School, Skowhegan | South Bristol School, South Bristol | South Portland Middle School, South Portland | Spruce Mountain Middle School, Jay | Tremont Consolidated School, Bass Harbor | Warsaw Middle School, Pittsfield | Waynflete School, Portland | Wells Junior High, Wells | William S. Cohen School, Bangor | Windham Middle School, Windham | Winslow Elementary School, Winslow | York Middle School, York

ME Bioscience Day 2023 Sponsors

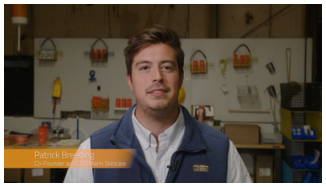
Teacher's Guide to ME Bioscience Day Videos

Part 1: Video Presentations

In lieu of "live" presentations for ME Bioscience Day, we have produced four short video presentations with speakers from four Maine life science institutions:

- Patrick Breeding, Co-Founder and CEO, Marin Skincare
- Caitlin Howell, PhD, Professor of Biomedical Engineering, University of Maine
- Sarah Joyce, Microbiologist, Kennebec River Biosciences
- Lindsay Ware, Owner, Science Dogs of New England

Videos Link: *https://biomaine.org/me-bioscience-day-videos/*



Pre-watching activity (optional)
Tell the students that they will watch a video with professionals from 3 life science organizations in Maine. Have them perform a quick Google search to find these organizations and answer in 1 sentence (for each): "What does each of these organizations do?"

What to do with the presentation videos?
These videos are designed to be played in the classroom on large screen or at home as a remote learning option. We recommend showing all 3 presentations. They can be shown all at once, or you can choose to pause in between and have students share their reflections on what they saw.

Post-watching discussion (optional)
Discuss as a group or in small groups: Who has the coolest job and why? What are 3 new things you learned from these presentations?

Teacher's Guide to ME Bioscience Day Videos

Part 2: Hands-on Activity: Genetic Traits Inventory

In this activity, students take an inventory of their own easily observable genetic traits and compare those inventories with other students in groups. Once the inventories are complete, students make data tables and bar graphs showing the most and least common traits in their group.

Pre-watching activity (optional)

Depending on where your class is and whether you have already covered genetics/ heredity, we recommend having a brief discussion on genetics OR providing reading materials (supplied). Questions to discuss:

1. What are genes?
2. What are genetic traits?
3. Can you think of traits or "things" that are genetically determined/inherited from your parents?
4. What does it mean that a gene is "recessive" or "dominant"?

Genetic Traits Inventory Activity

STEP 1: Distribute "Genetic Traits Inventory" forms (page 6).

STEP 2: Play part 1 of the "Genetic Traits Inventory" video pausing as needed to explain/ discuss any concepts.

STEP 3: Once you get to part 2 of this video ("Taking Inventory of your genetic traits"), students will be observing and recording their own genetic traits on the provided form. We recommend pausing the video after each trait.

STEP 4: Graphing class data. We have provided graph paper for recording class data and an example of what the finished graph might look like.

STEP 5: (OPTIONAL) Graph percentage of people in a group with a given trait. To create a percentage, have students use this formula:
(number of people with the trait/ total number of people in class) *100

Part 3: PTC Paper Taste Test (Optional)

To test for PTC-tasting ability:

STEP 1: Plan for distributing the test papers in advance so it is done in a sanitary fashion. We recommend using a new pair of nitrile gloves and placing the test on a piece of paper/napkin. Please note that the test papers tend to clump together in the tube.

STEP 2: Watch the instructional video

STEP 3: Give each student a piece of PTC paper and instruct them to place the paper on the tip of their tongue to see if they can taste the chemical.

STEP 4: Follow instructions in the instructional video. Students should record their ability to taste the PTC paper on the Genetic Traits Inventory form

Tip: You may want to place small waste containers for PTC paper around the room.

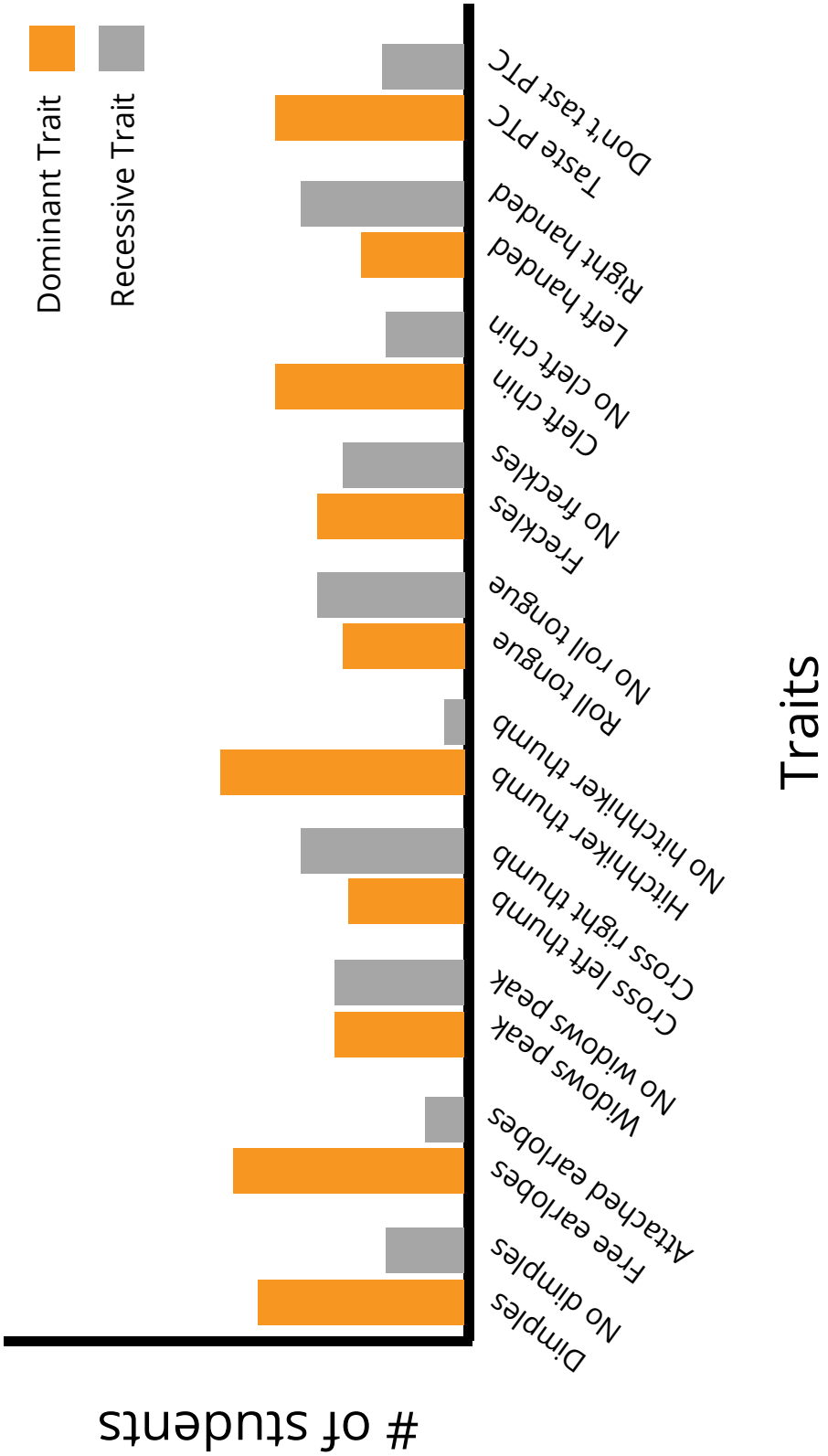
An Inventory of My Traits Survey

What combination of these traits do you have?

1.	I have dimples	☐ Yes	☐ No
2.	I have detached earlobes	☐ Yes	☐ No
3.	The hairline on my forehead is straight	☐ Yes	☐ No
4.	I cross my left thumb over my right when i clasp my hands together	☐ Yes	☐ No
5.	I can bend my thumbs backwards	☐ Yes	☐ No
6.	I can roll my tongue	☐ Yes	☐ No
7.	I have freckles	☐ Yes	☐ No
8.	I have a cleft chin	☐ Yes	☐ No
9.	I am left-handed	☐ Yes	☐ No
10.	(Optional) I can taste PTC	☐ Yes	☐ No

Class Traits Double Bar Graph

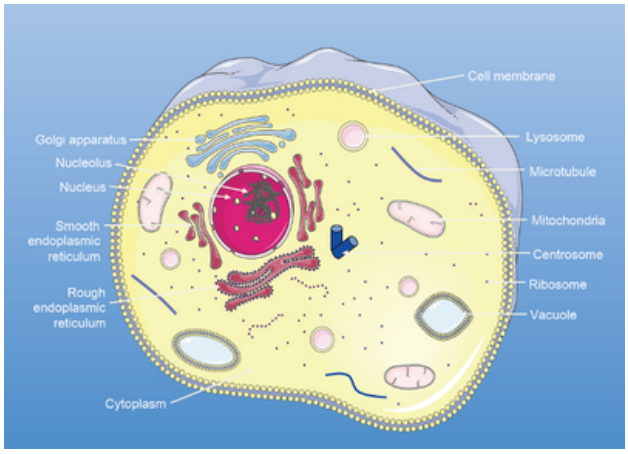
Example



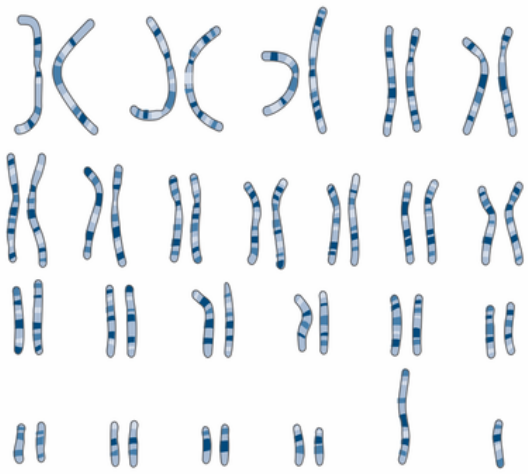
Genetics, Traits, and Taste
A BioME ME Bioscience Day Activity

Introduction to Cells and DNA

Every living thing is made up of building blocks called cells. In animals, our tissues and organs are each made of specialized cells that can carry out the functions needed in that particular tissue or organ. For example, bone cells are strong and rigid to form the structure in our skeletons, cells in the pancreas can make and secrete the hormone insulin, and skin cells provide a protective and waterproof barrier. Each of these cells has a slightly different shape (or, **morphology**), and the proteins it makes help it carry out its specialized jobs and functions. To make these **proteins** the cell will turn on certain genes that it needs. These genes are coded for our in **DNA, or deoxyribonucleic acid**, which is identical in each cell of our body and is stored in the nucleus at the center of the cell. The DNA is grouped in segments called **genes**, and the study of these genes and how they cause different traits in living organisms is called **genetics**. DNA is wound up into tight coils called **chromosomes**, inside our nucleus. Humans have 46 chromosomes: one set of 23 chromosomes from our mother and one set of 23 chromosomes from our father. 22 of these chromosomes are in pairs, plus we inherit a sex chromosome (X or Y) from each parent. Therefore, we have two copies of each gene from the paired chromosomes, or two variations called **alleles**. Often, only one of these alleles will be expressed, giving us a **genetic trait**.



A prototypical animal cell (from Servier Medical Art):



*A set of Chromosomes, visualized in a **karyotype** (from Servier Medical Art). Note there are two copies of each chromosome*

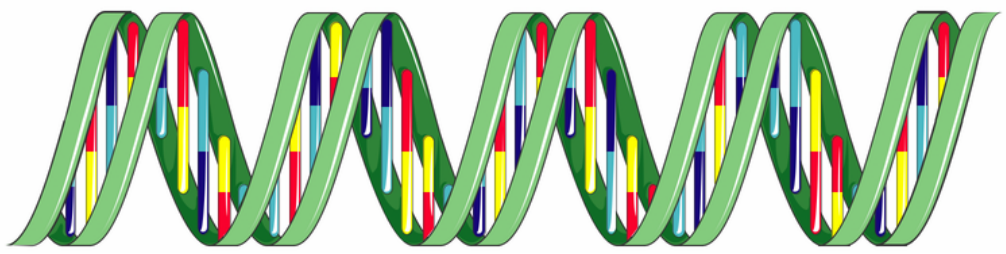
Genetics, Traits, and Taste
A BioME ME Bioscience Day Activity

Gene Expression

For each organism, the DNA in the nucleus of our cells is slightly different. Dogs need to make tails and have a good sense of smell, worms need moist skin and to wriggle on the ground, and butterflies need wings and colorful patterns. Their DNA helps give them these important and individual traits. Even within one organism, such as dogs, the DNA can be different and lead to many different types of dogs with big ears short legs, long fur, or strong jaws. The same is true for humans. Each of us is special and unique in part because of our individual DNA, and partly because of our environment as we grow up.

DNA is shaped like a twisted ladder, or double-helix, and is comprised of 4 nitrogenous bases called Adenine (A), Thymine (T), Cytosine (C) and Guanine (G). The repeating pattern of these nucleic acids acts like a code, which cellular machinery can decipher into amino acids – or the building blocks of proteins. This process of decoding DNA into proteins is called **gene expression**. Basically, our cells read the letters in the DNA and determine which protein needs to be made for that cell to function properly.

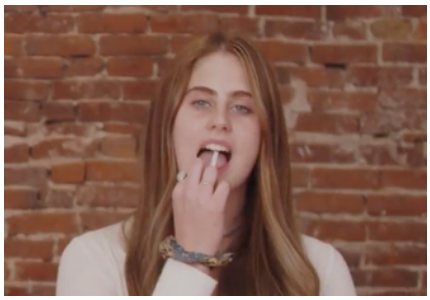
DNA structure: the green backbone is made of sugar (deoxyribose) and phosphates. The colored bars indicate the 4 nitrogen-containing "base pairs". A pairs with T and C pairs with G as the rungs of the ladder.



Sometimes, DNA has mutations, which can lead to problems in gene expression and may cause health problems. Other times, these mutations can lead to a beneficial trait in the offspring, which may be carried on through many generations of reproduction.

Comparing Inherited Human Traits
A BioME ME Bioscience Day Activity

Trait Profile - PTC Tasting



Does not taste PTC

Tastes PTC

For some people the chemical phenylthiocarbamide (PTC) tastes very bitter. For others, it is tasteless.

The ability to taste PTC shows dominant inheritance and is controlled by a gene on chromosomes 7. This gene codes for part of the bitter taste receptor in tongue cells. One of its five alleles (forms) causes a lack of ability to sense bitter tastes; the other four alleles produce intermediate to fully sensitive taste abilities. Approximately 75% of people can taste PTC while the remaining 25% cannot.

PTC-like chemicals are found in the Brassica family of vegetables, such as cabbage, brussel sprouts, and broccoli. People who can taste PTC often do not enjoy eating these vegetables, since they taste bitter to them. Non-tasters tend not to notice bitter tastes and therefore may be more likely to become addicted to nicotine (which is bitter).

PTC-tasting ability has also provided information related to human evolution. Populations in Sub-Sahara Africa, and people who are descended from this area, contain at least five forms of the gene. Some of these forms confer a PTC-tasting ability that is intermediate between taster and non-taster. However, with only a few exceptions, only two forms – taster and non- taster – are found in populations outside of Africa and their descendents. This is consistent with the out-of-Africa hypothesis of modern human origins.

Some scientists think that tasters have fewer cavities, suggesting that there might be a substance in the saliva of tasters that inhibits the bacteria that cause cavities to form. Others think that PTC tasting may be in some way connected with thyroid function. PTC tasting was a chance discovery in 1931.

Source: http://gslc.genetics.utah.edu/

Genetics, Traits, and Taste
Additional Resources

Additional Genetics Resources

DNA Day Activities (NIH): *https://www.genome.gov/dna-day/get-activity-ideas*

Further Reading re PTC and Taste Traits

Genetics and PTC: *https://learn.genetics.utah.edu/content/basics/ptc/*
Genetics of taste (full activity):
https://gsoutreach.gs.washington.edu/files/genetics_of_taste.pdf