STO-161

Is Climate Change Making Us Sick?

Teacher Information

science take·out
just add students™

Summary

Jay wonders if climate change might be to blame for increased problems with his allergies. Students conduct simulated antibody tests to determine if Jay is allergic to tree pollen. They graph and analyze data to determine if there is a correlation between temperature, pollen counts, and allergic symptoms.

Core Concepts

Climate change may alter the environment in ways that lead to human health problems such as allergies and asthma.

Time Required

1-2 forty-minute class periods

Kit contains

- Tube of **Jay's Blood Plasma** (simulated)
- Labeled dropper
- **Allergen-Antibody Test Sheet**
- **Pollen Tape** diagram
- Calendar for minimum temperature
- Transparencies for plotting graphs of temperature, pollen count, and allergy patients

Teacher Provides

- Wet-erase marker for writing on transparencies (such as Vis-à-Vis marker)
- Calculator
- Safety goggles
- Paper towel for clean-up

Warning: Choking Hazard

This Science Take-Out kit contains small parts. Do not allow children under the age of seven to have access to any kit component.

Optional Extension Activity:

Allergies and asthma are just few of the health problems associated with climate change. Use your creativity to make people aware of how climate change might affect their health in the future. Visit **Health Impacts: Climate and Human Health** at https://www.niehs.nih.gov/research/programs/geh/climatechange/health_impacts/index.cfm

Write a story, draw pictures, or use another creative way to show people how climate change may affect other health problems such as:

- Cancer
- Cardiovascular Disease and Stroke
- Effects of Heat
- Foodborne Diseases and Nutrition
- Human Developmental Effects
- Mental Health and Stress-Related Disorders
- Neurological Diseases and Disorders
- Vector-borne and Zoonotic Diseases
- Waterborne Diseases
- Weather-Related Morbidity and Mortality

Supplementary Resources:

- Part 2 of this kit (Climate Change, Pollen and Allergies) is modified from **Impact of meteorological variation on hospital visits of patients with tree pollen allergy**: http://www.biomedcentral.com/1471-2458/11/890

- **A Human Health Perspective on Climate Change:** http://www.niehs.nih.gov/health/materials/a_human_health_perspective_on_climate_change_full_report_508.pdf

- **PBS Learning Media: Climate Change and Human Health**: http://ca.pbslearningmedia.org/resource/envh10.sci.life.eco.cchealth/climate-change-and-human-health/

Reusing *Is Climate Change Making Us Sick?* kits

Kits may be refilled and reused. Allow approximately 30 minutes for refilling 10-15 kits. Teachers will need to instruct students on how to handle clean-up and return of the re-usable kit materials. For example, teachers might provide the following information for students:

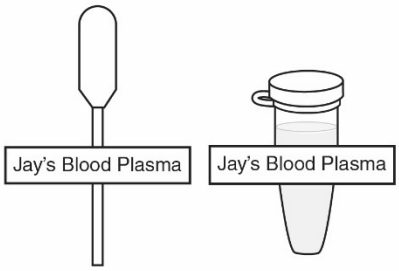
Discard	Return to kit
• Used Antibody Test Sheet • Pollen Tape diagram	• Tube of Jay's Blood Plasma • Dropper* • Calendar

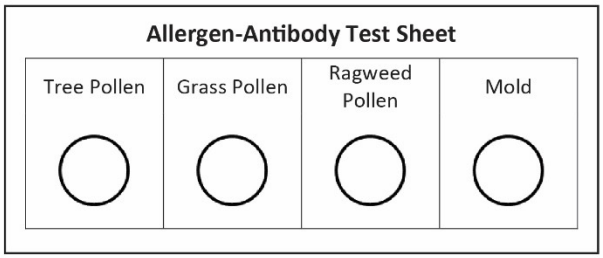
*** Note:** It is <u>not</u> necessary to rinse or wash the droppers after use. Washing the droppers may make the labels difficult to read. Simply ask students to squirt out any extra liquid from the droppers.

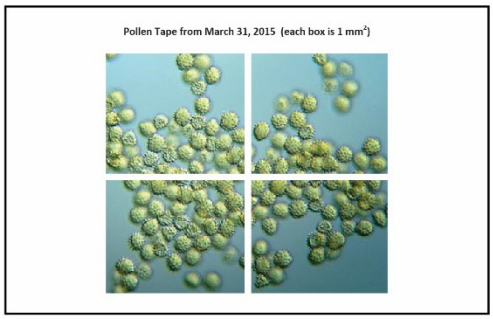
Refills for the *Is Climate Change Making Us Sick?* kits are available at www.sciencetakeout.com. The 10 Kit Refill Pack includes the following materials:

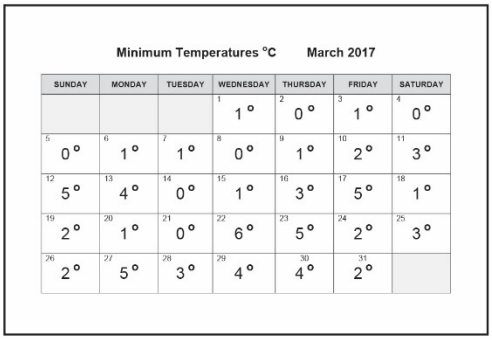
- 10 mL of Jay's Blood Plasma (simulated)
- 10 Antibody Test Sheets
- 10 Pollen tape diagrams
- 10 of each transparency graph: temperature, pollen count, and allergy patients

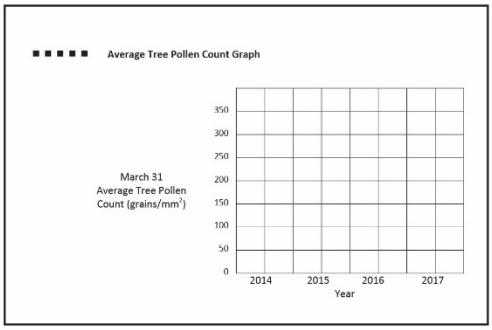
Kit Contents Quick Guide

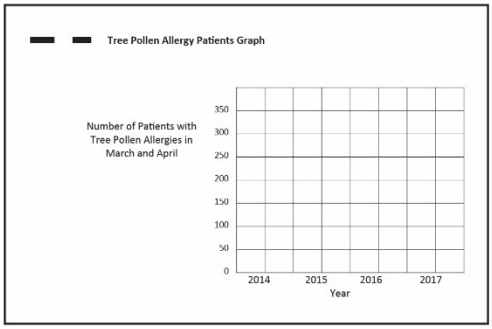


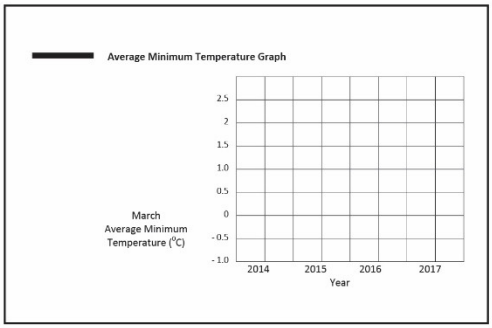












Read these instructions before using Science Take-Out kits

Parental or Adult Supervision Required

This kit should be used only under the supervision of an adult who is committed to ensuring that the safety precautions below, and in the specific laboratory activity, are followed.

Safety Goggles and Gloves Strongly Recommended

We encourage students to adopt safe lab practices, and wear safety goggles and gloves when performing laboratory activities involving chemicals. Safety goggles and gloves are not provided in Science Take-Out kits. They may be purchased from a local hardware store or pharmacy.

Warning: Choking and Chemical Hazard

Science Take-Out kits contain small parts that could pose a choking hazard and chemicals that could be hazardous if ingested. Do not allow children under the age of seven to have access to any kit components. Safety Data Sheets (SDS) provide specific safety information regarding the chemical contents of the kits. SDS information for each kit is provided in the accompanying teacher instructions.

Chemicals Used in Science Take-Out Kits

Every effort has been made to reduce the use of hazardous chemicals in Science Take-Out kits. Most kits contain common household chemicals or chemicals that pose little or no risk.

General Safety Precautions

1. Work in a clean, uncluttered area. Cover the work area to protect the work surface.
2. Read and follow all instructions carefully.
3. Pay particular attention to following the specific safety precautions included in the kit activity instructions.
4. Goggles and gloves should be worn while performing experiments using chemicals.
5. Do not use the contents of this kit for any other purpose beyond those described in the kit instructions.
6. Do not leave experiment parts or kits where they could be used inappropriately by others.
7. Never taste or ingest any chemicals provided in the kit - they may be toxic.
8. Do not eat, drink, or apply make-up or contact lenses while performing experiments.
9. Wash your hands before and after performing experiments.
10. Chemicals used in Science Take-Out experiments may stain or damage skin, clothing or work surfaces. If spills occur, wash the area immediately and thoroughly.
11. At the end of the experiment, return ALL kit components to the kit plastic bag. Dispose of the plastic bag and contents in your regular household trash.

No blood or body fluids from humans or animals are used in Science Take-Out kits. Chemical mixtures are substituted as simulations of these substances.

Is Climate Change Making Us Sick?

Teacher Answer Key

Part 1: An Allergy Attack

Jay has allergic asthma. His airways are very sensitive to allergens such as pollen and mold. Once these allergens get into Jay's body, the muscles around his airways tighten and become inflamed, and over time his airways are flooded with thick mucus. This can result in an asthma attack that makes it very difficult for Jay to breathe.

Jay suspects that he is allergic to tree pollen because he has more severe asthma attacks in March and April when trees flower and release their pollen. Over the last 5 years, his asthma has gotten much worse. His allergy symptoms start earlier, are more severe, and last longer.

Jay saw a TV program that talked about how **climate change** is affecting human health. He wonders if climate change might lead to increased tree pollen production that might explain why his allergies are getting worse.

> **Climate change** is the long-term shift in the weather patterns in a region or globally. This includes global warming (a rise in the Earth's surface temperature) and changes in weather patterns such as in precipitation, cloud cover, or storms.

1. Do you think that climate change is associated with Jay's increasing problems with allergies and asthma? Explain why or why not.

Jay goes to the hospital near his house whenever he has an asthma attack. Since 2014, this hospital has been counting the number of patients with tree pollen allergies who visit the hospital during the months of March and April. A patient is counted as being allergic to tree pollen if tests reveal that his or her blood plasma contains antibodies to tree pollen.

2. Should Jay be counted as a patient who is allergic to tree pollen? Use the **Allergen-Antibody Test Sheet** to test Jay's blood plasma to determine if he is allergic to tree pollen.

    - Each circle on the Allergen-Antibody Test Sheet is coated with one type of allergen—tree pollen, grass pollen, ragweed pollen, or mold.
    - Use the dropper to put one drop of Jay's blood plasma in each of the circles on the Allergen-Antibody Test Sheet.
    - If Jay's blood plasma contains antibodies that react with one of the allergens, the circle will turn pink.

3. Should Jay be counted as a patient who is allergic to tree pollen?

4. What other allergens might be causing Jay's allergic asthma attack?

Part 2: Is the number of patients with tree pollen allergies increasing?

In the area where Jay lives, trees flower and release their pollen during March and April. Beginning in 2014, researchers at the hospital counted the number of patients with tree pollen allergies who visited the hospital in March and April. The data they collected is shown in the table below.

Year	Number of Patients with Tree Pollen Allergies in March and April
2014	75
2015	100
2016	125
2017	220

1. Use the clear plastic **Tree Pollen Allergy Patients Graph** in your lab kit.

2. Use a marker to make a LINE GRAPH for the number of patients with tree pollen allergies on the **Tree Pollen Allergy Patients Graph**. Plot the points and connect them with a dashed (▬ ▬ ▬) line to plot the data.

3. Describe the trend or pattern you observe in the Tree Pollen Allergy Patients graph.

Part 2: Is the amount of pollen in the air increasing?

Scientists from the Society for Pollen Research used pollen-trapping tape to collect daily pollen samples from the air near the hospital. They collected the pollen to do a tree pollen count.

1. Use the **Pollen Tape** photo in your lab kit. This photo shows a piece of the pollen tape from March 31, 2015 with four 1 mm^2 sections marked off with boxes.

2. Count the number of tree pollen grains in <u>each</u> of the four boxes and record the number below. *You may write on the pollen tape to make it easier to count accurately. Count pollen grains that are in good focus **and** pollen grains that are blurry. Only count pollen grains on the edges if it looks like more than half of the pollen grain is visible.*

pollen grains per mm^2	pollen grains per mm^2
pollen grains per mm^2	pollen grains per mm^2

3. Calculate the <u>average</u> daily tree pollen count for March 31, 2015. Record the average daily tree pollen count in the table below.

Year	**March 31 Average Tree Pollen Count (grains per mm^2)**
2014	10
2015	
2016	70
2017	300

4. Use the clear plastic **Average Tree Pollen Count Graph** in your lab kit.

5. Use a marker to make a LINE GRAPH for the March 31 Average tree pollen count data on the **Average Tree Pollen Count Graph**. Plot the points and connect them with a dotted (▪▪▪▪▪▪▪▪▪▪▪▪) line to plot the data.

6. Describe the trend or pattern you observe in the Average Tree Pollen Count graph.

Part 3: Is the average temperature for March increasing?

Jay contacted the local weather information service and obtained the average minimum temperature (°C) for his town in March for the years 2014 through 2016. The minimum temperature is the coldest temperature of the day. Jay also obtained a calendar with the minimum temperatures for each day in March 2017.

1. Use the information on the March 2017 calendar in your lab kit to calculate the average minimum temperature (°C) for March 2017. Round to the nearest tenth of a degree. Record your calculation in the data table below.

Year	March Average Minimum Temperature (°C)
2014	- 0.8
2015	0.1
2016	1.2
2017	

2. Use the clear plastic **Average Minimum Temperature Graph** in your lab kit.

3. Use a marker to plot a LINE GRAPH for the data for average minimum temperature in March on the **Average Minimum Temperature Graph**. Plot the points and connect them with a solid (▬▬▬) line to plot the data. *Note: The 0 on scale is not on the bottom line. The numbers below the 0 are negative numbers.*

4. Describe the trend or pattern you observe in the Average Minimum Temperature graph.

Part 4: Putting it All Together

1. Put <u>all three</u> graphs on top of each other so that the axes line up.

> **Correlation** indicates that two or more variables change together. A positive correlation indicates that the variables increase or decrease together. A negative correlation indicates that one variable increases as the other decreases.

2. Based on the <u>three</u> graphs, what conclusions can you draw about the <u>correlation</u> between average minimum temperature, tree pollen counts, and hospital patients with tree pollen allergy symptoms?

> A correlation between variables does not automatically mean that the change in one variable is the **cause** of the change in the other variable. Correlation does not imply **causation**. There may be an unknown factor that influences both variables similarly. For example, there is a correlation between ice cream eating and swimming pool use. But, you could <u>not</u> say that eating ice cream causes swimming pool use.

3. What additional evidence is needed before scientists can be confident that climate change <u>causes</u> an increase in allergy symptoms?

Section 1 Chemical Product and Company Information

Science Take-Out
80 Office Park Way
Pittsford, NY 14534
(585)764-5400

CHEMTREC 24 Hour Emergency
Phone Number (800) 424-9300
For laboratory use only. Not for drug, food or household use

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Product	Buffer Solution pH10
Synonyms	"Jay's Blood Plasma" (simulated)

Section 2 Hazards Identification

This substance or mixture has not been classified at this time according to the Globally Harmonized System (GHS) of Classification and Labeling of Chemicals.

Signal word: WARNING
Pictograms: None required
Target organs: None known

GHS Classification:
Skin irritation (Category 3)
Eye irritation (Category 2B)

GHS Label information: **Hazard statement(s):**
H316: Causes mild skin irritation.
H320: Causes eye irritation.

Precautionary statement(s):

P264: Wash hands thoroughly after handling.

P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P332+P313: If skin irritation occurs: Get medical attention.

P337+P313: If eye irritation persists: Get medical attention.

Ca Prop 65 - This product does not contain any chemicals known to the State of California to cause cancer, birth defects, or any other reproductive harm.

Section 3 Composition / Information on Ingredients

Chemical Name	CAS #	%	EINECS
Water	7732-18-5	99.08%	231-791-2
Potassium chloride	7447-40-7	0.40%	231-211-8
Boric acid	10043-35-3	0.33%	233-139-2
Sodium hydroxide	1310-73-2	0.19%	215-185-5

Section 4 First Aid Measures

INGESTION: Call physician or Poison Control Center immediately. Induce vomiting only if advised by appropriate medical personnel. Never give anything by mouth to an unconscious person.

INHALATION: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

EYE CONTACT: Check for and remove contact lenses. Flush thoroughly with water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get immediate medical attention.

SKIN ABSORPTION: Remove contaminated clothing. Flush thoroughly with mild soap and water. If irritation occurs, get medical attention.

Section 5 Fire Fighting Measures

Suitable Extinguishing Media: Use any media suitable for extinguishing supporting fire.

Protective Actions for Fire-fighters: In fire conditions, wear a NIOSH/MSHA-approved self-contained breathing apparatus and full protective gear. Use water spray to keep fire-exposed containers cool.

Specific Hazards: During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Section 6 Accidental Release Measures

Personal Precautions: Evacuate personnel to safe area. Use proper personal protective equipment as indicated in Section 8. Provide adequate ventilation.

Environmental Precautions: Avoid runoff into storm sewers and ditches which lead to waterways.

Containment and Cleanup: Absorb with inert dry material, sweep or vacuum up and place in a suitable container for proper disposal. Wash spill area with soap and water.

Section 7 Handling and Storage

Precautions for Safe Handling: Read label on container before using. Do not wear contact lenses when working with chemicals. Keep out of reach of children. Avoid contact with eyes, skin and clothing. Do not inhale vapors, spray or mist. Use with adequate ventilation. Avoid ingestion. Wash thoroughly after handling. Remove and wash clothing before reuse.

Conditions for Safe Storage: Store in a cool, well-ventilated area away from incompatible substances.

Section 8 Exposure controls / Personal Protection

Exposure Limits:

Chemical Name	ACGIH (TLV)	OSHA (PEL)	NIOSH (REL)
Potassium chloride	None established	None established	None established

Engineering controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower and fire extinguishing material. Personnel should wear safety glasses, goggles, or faceshield, lab coat or apron, appropriate protective gloves. Use adequate ventilation to keep airborne concentrations low.

Respiratory protection: None should be needed in normal laboratory handling at room temperatures. If misty conditions prevail, work in fume hood or wear a NIOSH/MSHA approved respirator.

Section 9 Physical and Chemical Properties

Appearance: Clear, colorless liquid.
Odor: No odor.
Odor threshold: Data not available.
pH: 10.0
Melting/Freezing point: Approx. 0°C (32°F) (water)
Boiling point: Approx. 100°C (212°F) (water)
Flash point: Data not available

Evaporation rate (Water = 1): <1
Flammability (solid/gas): Data not available.
Explosion limits: Lower/Upper: Data not available
Vapor pressure (mm Hg): 14 (water)
Vapor density (Air = 1): 0.7 (water)
Relative density (Specific gravity): Approx. 1.0 (water)
Solubility(ies): Complete in water.

Partition coefficient: Data not available
Auto-ignition temp.: Data not available
Decomposition temp.: Data not available
Viscosity: Data not available.
Molecular formula: Mixture
Molecular weight: Mixture

Section 10 Stability and Reactivity

Chemical stability: Stable
Hazardous polymerization: Will not occur.

Conditions to avoid: Excessive temperatures which cause evaporation.
Incompatibilities with other materials: Acids, alkalies, and air will change the buffer's ability.
Hazardous decomposition products: Boron oxide and chlorine gas.

Section 11 Toxicological Information

Acute toxicity: Data not available
Serious eye damage/irritation: Data not available
Germ cell mutagenicity: Data not available
Skin corrosion/irritation: Data not available
Respiratory or skin sensitization: Data not available
Carcinogenity: Data not available

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity: Data not available
Aspiration hazard: Data not available
STOT-single exposure: Data not available
STOT-repeated exposure: Data not available

Potential health effects:
Inhalation: May be harmful if inhaled.
Ingestion: May be harmful if swallowed.
Skin: May cause mild irritation.
Eyes: May cause mild irritation.

Signs and symptoms of exposure: To the best of our knowledge the chemical, physical and toxicological properties have not been thoroughly investigated. Specific data is not available. Exercise appropriate procedures to minimize potential hazards.
Additional information: RTECS #: Data not available

Section 12 Ecological Information

Toxicity to fish: No data available
Toxicity to daphnia and other aquatic invertebrates: No data available
Toxicity to algae: No data available
Persistence and degradability: No data available
Mobility in soil: No data available
Bioaccumulative potential: No data available
PBT and vPvB assessment: No data available
Other adverse effects: An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Section 13 Disposal Considerations

These disposal guidelines are intended for the disposal of catalog-size quantities only. Federal regulations may apply to empty container. State and/or local regulations may be different. Dispose of in accordance with all local, state and federal regulations or contract with a licensed chemical disposal agency.

Section 14 Transport Information

UN/NA number: Not applicable
Hazard class: Not applicable
Exceptions: Not applicable
Shipping name: Not Regulated
Packing group: Not applicable
2012 ERG Guide # Not applicable
Reportable Quantity: No
Marine pollutant: No

Section 15 Regulatory Information

A chemical is considered to be listed if the CAS number for the anhydrous form is on the Inventory list.

Component	TSCA	CERLCA (RQ)	RCRA code	DSL	NDSL	WHMIS Classification
Potassium Chloride	Listed	Not Listed	Not Listed	Listed	Not Listed	Uncontrolled Product
Sodium hydroxide	Listed	1,000 lbs (454 kg)	D002	Listed	Not Listed	E

Section 16 Additional Information

The information contained herein is furnished without warranty of any kind. Employers should use this information only as a supplement to other information gathered by them and must make independent determinations of suitability and completeness of information from all sources to assure proper use of these materials and the safety and health of employees.
NTP: National Toxicology Program, IARC: International Agency for Research on Cancer, OSHA: Occupational Safety and Health Administration, STOT: Specific Target Organ Toxicity, SE: Single Exposure, RE: Repeated Exposure, ERG: Emergency Response Guidebook.

Revision Date: July 20, 2018 Supercedes: