Use of Animals for Medical Testing

Teacher Information

science take-out
just add students™

Summary

Which animals should be used to test the safety and effectiveness of NicoBlock, a fictitious smoking cessation drug? Students compare the human nervous system with the nervous systems of three animals (mice, cats, and baboons). They also explore cost factors and ethical issues involved in animal testing.

Core Concepts

- Nerve cell communication may be altered by drugs that block neurotransmitter receptors.
- The nervous systems of mammals have many similarities in their structure and function.
- Animal testing may be used to test the effects of drugs.
- Some people support, and others oppose, the use of animals for scientific testing.

Time Required

Three 40-minute class periods for the activities

Kit contains

- "Effects of Nicotine and NicoBlock on the Brain" sheet
- Photo sheet for Tests 1,2, and 3
- Small graduated cup
- Stirrer
- White plastic tray
- Tubes of "Liver Enzymes" from human, mouse, cat, and baboon
- Droppers for "Liver Enzymes" from human, mouse, cat, and baboon
- Tube of "Nicotine" (simulated)
- Small scoop
- Tube of "Protein Stain"
- Liver enzyme test sheet
- Protein gel (simulated)
- Sheet of DAPT gene codes

Teacher Provides

- Safety goggles
- Paper towels for cleanup

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 components.

Teacher Notes

- Part 1 may be done during class or may be assigned as pre-lab homework.

- For an excellent animation illustrating gel electrophoresis, see the Gel Electrophoresis Virtual Lab from the Genetics Learning Center at: http://learn.genetics.utah.edu/content/labs/gel/ You will need to explain that gel electrophoresis can be used for both DNA and proteins.

- Information on regulations regarding federal regulations for animal research is available from the Online Ethics Center for Engineering and Research at: www.onlineethics.org/Resources/TeachingTools/20357/19237/resethpages/regan.aspx

- Consider providing opportunities for students to explore the ethics of animal research.
    - Animals In Research: www.nwabr.org/curriculum/animals-research
    - Understanding Animal Research: www.understandinganimalresearch.org.uk/schoolzone

Reusing kits

Kits may be refilled and reused. Allow 20-30 minutes for refilling 10 student 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 bag
• Used Protein gel • Used sheet of DAPT genes	• All labeled droppers • All labeled microtubes • Photo sheet for Tests 1, 2 and 3 • Graduated cup • Stirrer • White tray • Spoon • Liver enzyme test sheet

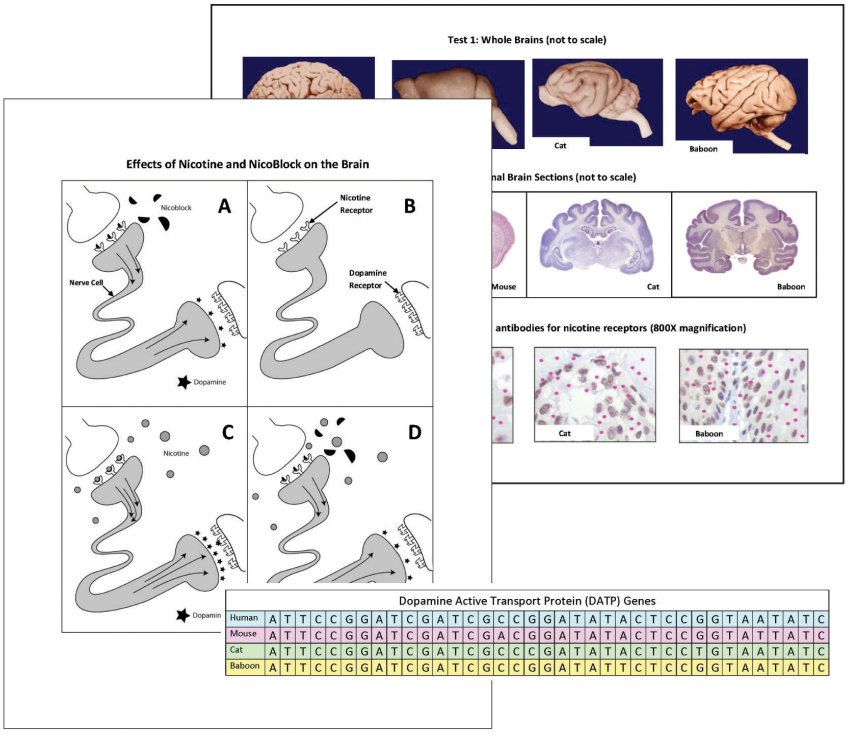
Note: It is <u>not</u> necessary to rinse or wash the droppers after use. Because the droppers are labeled, there is little chance for contamination. Washing the droppers may make the labels difficult to read. Simply ask students to squirt out any extra liquid from the droppers.

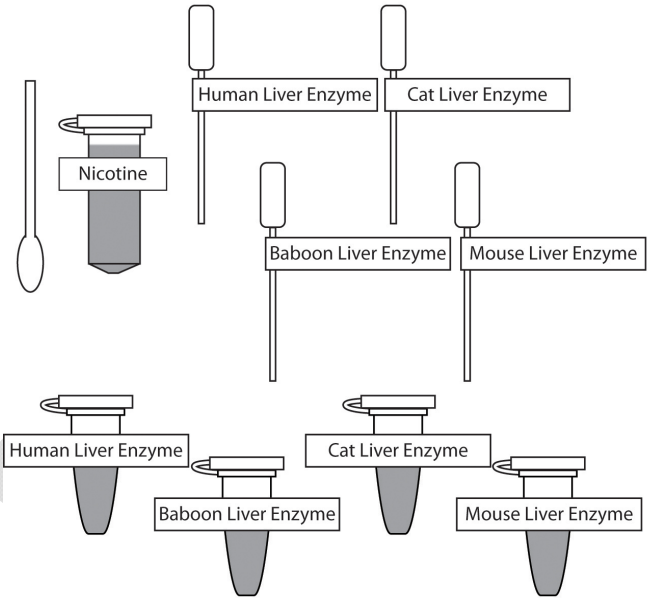
Consider laminating printed parts of the kits that will be reused.

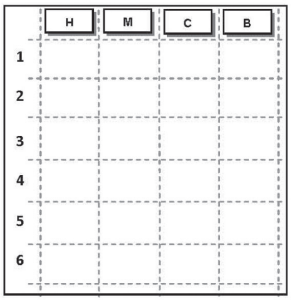
Refills for *Use of Animals for Medical Testing* kits are available at www.sciencetakeout.com. The **10 Kit Refill Pack** includes the following materials:

- Instructions and Quick Guide for refilling kit
- 4 graduated transfer pipets (for teacher use—refilling tubes of liquids)
- 10 ml of "Liver Enzymes" from human, mouse, cat, and baboon
- "Nicotine" (simulated) to fill 10 tubes
- "Protein Stain" to fill 10 tubes
- 10 Protein gels (simulated)
- 10 sheets of DAPT gene codes from human, mouse, cat, and baboon
- 1 white plastic scoop (for teacher use – for refilling "Protein Stain")
- 1 funnel (for teacher use – for refilling "Protein Stain")

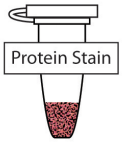
Kit Contents Quick Guide

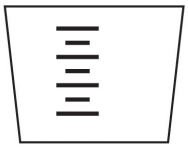






Simulated Protein Gel





Graduated Measuring Cup

Liver Enzyme Test Sheet	Human	Mouse	Cat	Baboon
	○	○	○	○

White Plastic Tray

Stirrer

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. Material Safety Data Sheets (MSDS) provide specific safety information regarding the chemical contents of the kits. MSDS 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, 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.

Use of Animals for Medical Testing:

A team of scientists has developed a new medicine called **NicoBlock**. They hope that NicoBlock will be safe and effective for use as a smoking cessation medication. It is designed to interfere with the brain pleasure mechanisms that lead smokers to crave nicotine and continue smoking.

Introduction: NicoBlock, a Smoking Cessation Medicine

1. Read the paragraphs below. For each paragraph, write the letter of the diagram from the diagram sheet entitled **Effects of Nicotine and NicoBlock** that best illustrates the information.

_____ When someone smokes tobacco, nicotine is inhaled and travels through the bloodstream from the lungs to the brain. Nicotine then attaches to the nicotine **receptors** in the brain and triggers brain cells to release a **neurotransmitter** (chemical messenger) called dopamine. The release of dopamine in the brain results in a feeling of pleasure.

_____ The effect of nicotine only lasts for a short time. When someone quits smoking, there is no nicotine to trigger the release of dopamine needed for a feeling of pleasure.

_____ **NicoBlock** is designed to interfere with the brain mechanisms that cause smokers to crave nicotine and continue smoking. NicoBlock attaches to nicotine receptors and triggers the production of small amounts of dopamine, a neurotransmitter that leads to a pleasure sensation.

_____ Once **NicoBlock** attaches to the nicotine receptors, it remains in and blocks the receptors. Because the nicotine receptors are blocked by NicoBlock the brain cell receptors cannot bind to nicotine any more. Therefore, if someone smokes while using NicoBlock, nicotine cannot trigger the release of dopamine.

Before any new medication can be tested with humans, scientists need to conduct preliminary tests on animals to demonstrate that the medication is likely to be safe and effective for human use. For animal testing, researchers need to select animal species that are likely to react to **NicoBlock** in a way that is similar to humans.

Your Task:

You will work as a researcher to gather structural evidences and molecular evidences to determine which type of mammal (mice, cats, or baboons) is most likely to react to **NicoBlock** in a way that is similar to humans.




Mammals are warm-blooded vertebrates that:

- nourish their young with milk secreted by mammary glands
- have most or all of the skin usually covered with hair

Humans are mammals.

To make recording data for this lab activity easier, tear off the data table on the last page of these instructions. Record your data from the following tests on this data table.

Data Table: Comparison of Mammalian Species (Humans, Mice, Cats, and Baboons)

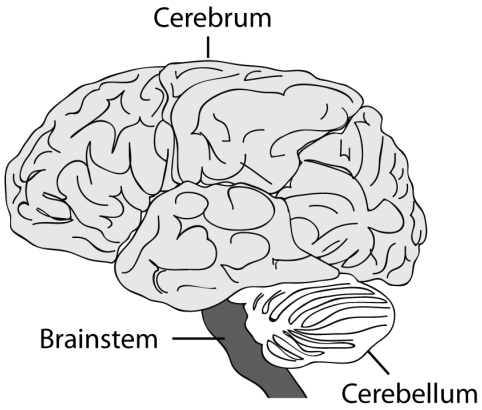
Species	Structural Evidences		Molecular Evidences			
	Test 1 Whole Brain (structures present and relative size)	Test 2 Brain Section Folds (many, few, none)	Test 3 Nicotine Receptors (present or absent)	Test 4 Nicotine Detoxifying Enzymes (present or absent)	Test 5 Proteins in Brain Fluid (locations of bands)	Test 6 Differences in DNA base sequence for DATP gene
Human 	Cerebellum Brainstem Large cerebrum	Many	Present	Present	Bands at 1, 3, 4, and 6	
Mouse 						
Cat 						
Baboon 						

Part 1: Structural Evidences—Comparing the Parts of the Brain

Test 1 – Structural Characteristics of Whole Brains

Specimens of whole brains for humans and the three species (mouse, cat and baboon) were photographed from various angles. Use the **Whole Brains** photographs in your kit to complete the following:

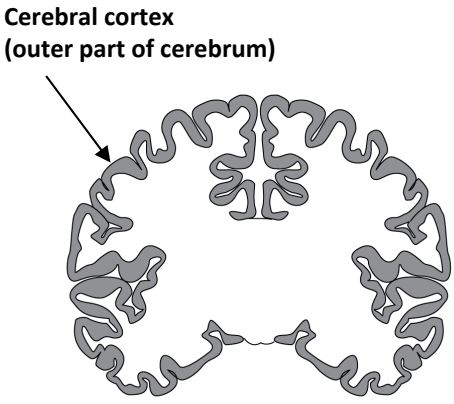
1. Compare the structures of the whole brain from a human with the whole brains from a mouse, a cat, and a baboon. Use the diagram on the right as a guide when making your comparisons. Consider the presence or absence of different brain sections and their relative sizes.
   - **Cerebrum**—Controls conscious sensation, voluntary movement, memory, and decision-making
   - **Cerebellum**—Controls balance and posture
   - **Brainstem**—Controls breathing and heart rate



2. Record your observations of the structures on the **Data Table: Comparison of Mammalian Species (Humans, Mice, Cats and Baboons)**.

Test 2 – Structural Characteristics of Stained Brain Sections

The folds or indentations on the cerebral cortex (outer part of the cerebrum) increase the surface area for interactions between neurons. Midcoronal brain sections were prepared by cutting and then staining thin slices from the same regions of the brains. Use the **Midcoronal Brain Sections** photographs in your kit to complete the following:



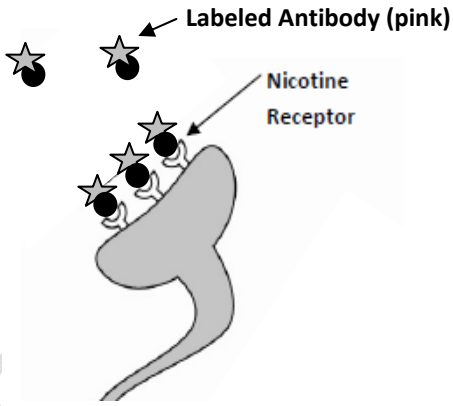
1. Compare the <u>number of folds</u> (many, few, or none) in the human cerebral cortex the number of folds in the cerebral cortex of the mouse, cat, and baboon.

2. Record your observations of the number of folds on the Data Table.

Part 2: Molecular Evidences—Comparing the Molecules in the Brain

Test 3 – Observation of Antibodies Attached to Nicotine Receptors

Human brain neurons have nicotine receptors. Antibody tests can be done to determine whether the brain neurons of mice, cats, and baboons have nicotine receptors on their surfaces. If nicotine receptors are present on neurons, the pink labeled antibodies will attach to the receptors and produce pink spots.



1. Observe the photos that show brain tissues treated with labeled antibodies. The brain tissues will have pink spots to indicate where the antibodies attach to nicotine receptors.

2. Record your observations (nicotine receptor present or not present) on the Data Table.

Test 4 –Testing for Nicotine Detoxification Enzymes

Nicotine is a toxin (poison). The human liver contains enzymes that detoxify (break down) nicotine so that it can be excreted with urine. You will test mice, cats, and baboons to see which species also contain enzymes that detoxify nicotine.

1. Obtain tubes of liver enzymes from humans, mice, cats, and baboons.

2. Use the matching labeled pipettes to place 3 drops of liver enzymes from humans, mice, cats, and baboons on the appropriate circles on the Liver Enzyme Test Sheet.

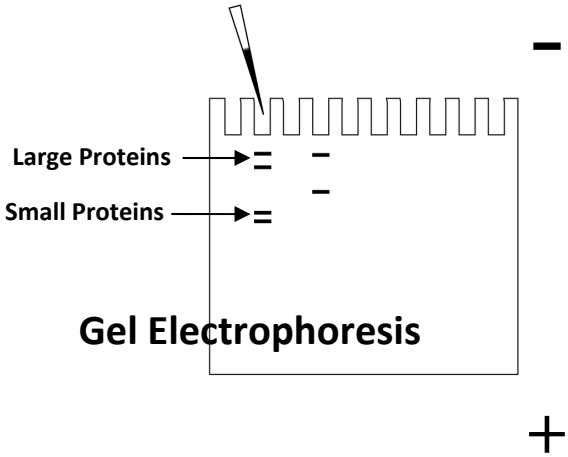
3. Use the small wooden scoop to add 1 tiny scoop of powdered nicotine to each of the circles. If the enzyme is present, a fizzing reaction will happen. *Note: This is simulated (not real) nicotine.*

4. Compare the liver enzyme activity in the human liver enzymes and in the liver enzymes from mice, cats, and baboons.

5. Record your observations of the enzyme activity on the data table.

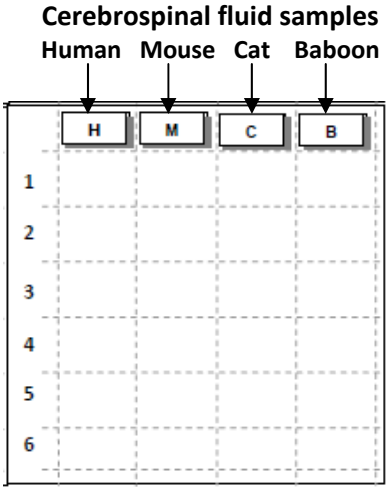
Test 5 – Comparing Proteins in Brain Fluid

Cerebrospinal fluid (the fluid that bathes the brain) contains a many different kinds of proteins. Scientists placed small amounts of cerebrospinal fluid from humans, mice, cats, and baboons into the wells of a gel.



The scientists used **gel electrophoresis** to separate the proteins based on their size. The gel was placed in an electrical field of an electrophoresis chamber. The electrical field caused the proteins in the cerebrospinal fluid samples to move different distances on the gel. **Small proteins move further than large proteins.**

The proteins in the gel are colorless. To see the proteins, you will need to add a stain to the gel. The stain will turn the proteins a bright pink color.



1. Place the protein electrophoresis gel (**simulated with a paper "gel"** that looks like the one in the diagram on the right) into the white tray.

2. Prepare the protein stain by measuring 10 ml of water in the small cup. Add the entire tube of protein stain to the water in the cup. Stir thoroughly with the stirrer.

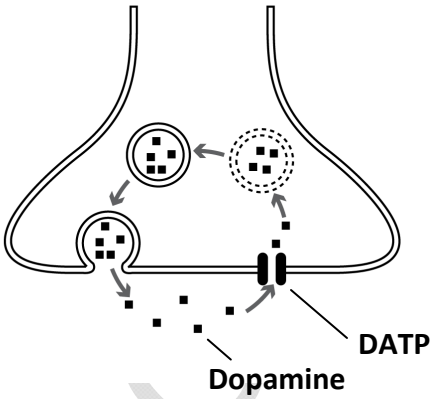
3. Pour all of the protein stain solution onto the white tray that contains the gel. Make sure the liquid completely covers the gel.

4. Compare the <u>locations</u> of the pink bands on the gel (indicated by the numbers 1–6 on the side of the gel) for humans, mice, cats, and baboons.

5. Record your observations of the protein bands on the data table.

Test 6 – Comparing the DNA (Gene) Code for Dopamine Active Transport Protein

Once dopamine triggers a sensation of pleasure, special proteins on the surface of nerve cells, called Dopamine Active Transport Proteins (DATP), begin active transport of dopamine back into the nerve cells so that it can be stored for reuse. The **DATP gene** carries coded information that is used by neurons to make dopamine active transport proteins.



1. The sequence of DNA bases shown on blue "DATP Gene" sheet represent small parts of the DATP gene from a human. The letters represent DNA bases in the DATP gene.

Dopamine Active Transport Protein (DATP) Genes																																			
Human	A	T	T	C	C	G	G	A	T	C	G	A	T	C	G	C	C	G	G	A	T	A	T	A	C	T	C	C	G	G	T	A	A	T	A	T	C
Mouse	A	T	T	C	C	G	G	A	T	C	G	A	T	C	G	A	C	G	G	A	T	A	T	A	C	T	C	C	G	G	T	A	T	T	A	T	C
Cat	A	T	T	C	C	G	G	A	T	C	G	A	T	C	G	C	C	C	G	A	T	A	T	A	C	T	C	C	T	G	T	A	A	T	A	T	C
Baboon	A	T	T	C	C	G	G	A	T	C	G	A	T	C	G	C	C	G	G	A	T	A	T	T	C	T	C	C	G	G	T	A	A	T	A	T	C

2. Circle the DNA bases on the mouse (pink), cat (green), and baboon (yellow) gene sequences (order of A, T, G, and C's) that are <u>different</u> from the human base sequence.

3. Count and record the <u>number of differences</u> in the DNA base sequences on the data table.

Part 4: Analysis of Results

1. Using all of the structural and molecular evidences in your data table, which mammal (mouse, cat, or baboon) would you select for animal testing to determine whether **NicoBlock** would be safe and effective for use by humans? _____

2. Explain your choice by citing four specific evidences from the data that you recorded on the data table.

3. Which kind of evidence – structural or molecular – is most important when making decisions about the selection of animals for use in animal testing? Explain why.

4. List four characteristics (structural or molecular) which humans, mice, cats, and baboons all have in common.

5. Explain how the data you collected provides evidence that humans, mice, cats, and baboons evolved from a common ancestor.

6. Do you think it would be possible to use the other two mammals for testing **NicoBlock**? Explain why or why not.

Part 5: Costs for Research Animals

Obtaining and caring for animals used for medical testing can be expensive! Scientists need to weigh the **benefits** of using species that are most similar to humans with the **costs** involved for purchasing and caring for research animals.

Scientists are also aware that their experiments will be more **reliable** if they use a large number of research animals.

	Mouse 	**Cat** 	**Baboon** 
Cost to purchase one animal	$5.00	$50.00	$500.00
Cost to maintain one animal for one year including cages, food, and veterinary care.	$45.00	$200.00	$500.00
Total cost for purchase and care for one animal/year			
Number of animals that could be used if the researcher had a $10,000 budget for animals used in animal testing			

1. Complete the last two rows on the chart above. Show your work (how you arrived at the answer).

2. Which species would you select for the **NicoBlock** testing if you were concerned about the cost of testing and the reliability of testing? Explain your answer using information from your data table and the information in the chart above.

Part 6: Ethical Issues

1. Read the information below. As you read, underline the statements that support the use of animal testing in one color. Use a different color to underline the statements that oppose the use of animal testing.

Use of Animals for Medical Testing?

The use of animals for medical testing is a controversial subject, with a great deal of passion, emotion and ideas on both sides regarding the ethics of this practice. Some people support all types of animal testing. Other people oppose all types of animal testing. Other people support animal testing only under some circumstances while they oppose its use for other circumstances.

Generally, the scientific community is strongly in favor of animal testing. The medical breakthroughs that have occurred as a result of animal testing are considered the main reason to continue the practice, with the aim of reducing human suffering and saving human lives. Ultimately, supporters believe that the end result of saved human lives justifies the use animal testing.

There are a number of arguments against animal testing. Unlike human test subjects, animals cannot consent to the tests. Animal testing may expose animals to pain, suffering and potential deadly circumstances. While researchers work to minimize these risks, they may not be completely prevented.

There is no clear right or wrong answer to the controversy of animal testing that seems to please everyone. But, as a result of controversy about animal testing, regulations and laws have been established to require proper animal care in animal testing facilities. This is a positive step for both animal testing supporters and those who argue against it.

2. State two reasons for supporting animal testing.

3. State two reasons for opposing animal testing.

4. State one action that has been taken to reduce people's concern about the use of animals for drug testing.

5. Before the United States Food and Drug Administration (FDA) approves a drug for use by humans, it must be tested first on rodents (such as mice or rats) and then on non-rodents (such as cats, monkeys, baboons, or chimpanzees). Why do you think the FDA requires tests on non-rodents?

Data Table: Comparison of Mammalian Species (Humans, Mice, Cats, and Baboons)

Species	Structural Evidences		Molecular Evidences			
	Test 1 **Whole Brain** **(structures present and relative size)**	**Test 2** **Brain Section Folds** **(many, few, none)**	**Test 3** **Nicotine Receptors** **(present or absent)**	**Test 4** **Nicotine Detoxifying Enzymes** **(present or absent)**	**Test 5** **Proteins in Brain Fluid** **(locations of bands)**	**Test 6** **Differences in DNA base sequence for DATP gene**
Human 	**Cerebellum** **Brainstem** **Large cerebrum**	**Many**	**Present**	**Present**	**Bands at** **1, 3, 4, and 6**	[redacted]
Mouse 						
Cat 						
Baboon 						

MATERIAL SAFETY DATA SHEET

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name (as printed on the label): "Protein Stain" (simulated)

Product identity: ARM & HAMMER® Super Washing Soda

Manufacturer: Church & Dwight Company, Inc.,
469 North Harrison Street
Princeton, New Jersey 08543-5297
Phone (609) 683-5900

Telephone number for information: (585)764-5400
Preparation date of this MSDS: 9/14/12
Medical emergency phone number (Chemtrec): (800) 424-9300

2. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Ingredient	% By Weight	CAS Number
Sodium Carbonate	≥ 85%	497-19-8
Water	≤ 15%	
7732-18-5		

Exempt from OSHA and WHMIS as a packaged consumer household product.

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
Avoid eye and skin contact.

Potential Health Effects:
EYES: will cause severe irritation. SKIN: May cause irritation.
NGESTION and INHALATION: May be harmful if swallowed or inhaled

HMIS Rating:	Health 2	Fire 0	Reactivity 0

4. FIRST AID MEASURES

EYES: Check for and remove contact lenses. Immediately flush eyes with clean flowing water, low pressure and lukewarm if possible, occasionally lifting upper and lower eyelids. Get medical attention immediately.

SKIN: Wash affected area with soap or mild detergent and large amounts of water. Seek medical attention if irritation develops.

INHALATION: Remove from area of exposure. Treat symptomatically. Seek medical attention if irritation develops or if person has difficulty breathing.

INGESTION: Do not induce vomiting. If patient is conscious and can swallow, give two glasses of water to drink. **Do not attempt to give anything orally to an unconscious person**. Seek medical attention.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES FLAMMABLE LIMITS

FLASHPOINT: Not flammable LFL: Not applicable

METHOD USED: Not applicable UFL: Not applicable

EXTINGUISHING MEDIA: None combustible material. Use extinguishing media appropriate for surrounding fire.

FIRE-FIGHTING INSTRUCTIONS: Carbon dioxide and irritating dusts may be generated by thermal decomposition. Wear a self-contained breathing apparatus (SCBA) and full protective equipment (Bunker Gear).

UNUSUAL FIRE AND EXPLOSION HAZARDS: None known.

6. SPILL OR LEAK PROCEDURES

Scoop up into clean, dry waste container. Avoid stirring up dusts. Neutralize residue with dilute muriatic acid and flush residue to sewer or waste water system. Wash area with large amounts of water. Prevent eye and skin contact and inhalation of dusts by wearing appropriate protective equipment (See Section 8).

7. HANDLING AND STORAGE

Store in cool, dry areas and away from incompatible substances (acids). Super Washing Soda will react with acids to yield carbon dioxide gas which can accumulate in confined spaces. Do not enter confined spaces until they have been well ventilated and carbon dioxide levels have been determined to be safe.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

RECOMMENDED EXPOSURE LIMIT: 10 mg/m^3 as a nuisance dust (ACGIH).
RESPIRATORY PROTECTION: Wear a NIOSH approved dust respirator if dust level exceeds recommended exposure limit. Respiratory protection is recommended for any level of dust generation.
PROTECTIVE GLOVES: General purpose for handling dry material.
EYE PROTECTION: Safety glasses with side shields or chemical safety goggles, if excessive dust is generated. Do not wear contact lenses.
OTHER PROTECTIVE CLOTHING OR EQUIPMENT: Full cover clothing. Local eye wash is recommended.

ENGINEERING CONTROLS: Use local exhaust if total dust level exceeds 10 mg/m^3.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: White granular powder
ODOR: None
PHYSICAL STATE: Solid
pH AS IS: Not applicable
pH (1% SOLN. w/v): 11.4
VAPOR PRESSURE: Not applicable
VAPOR DENSITY: Not applicable
BOILING POINT: Not applicable
FREEZING/MELTING POINT: Not applicable
SOLUBILITY IN WATER: Readily soluble in water. 7.1% @ 20°C
SPECIFIC GRAVITY (Water = 1): 2.25
APPARENT DENSITY (g/cc): Approximately 1.1 at 20°C.
% VOLATILE: Not applicable
VOLATILE ORGANIC COMPOUNDS: Not applicable
MOLECULAR WEIGHT: 124

10. STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable
CONDITIONS TO AVOID: Loses all water of hydration at temperatures above 228°F.
INCOMPATIBILITY WITH OTHER MATERIALS: Reacts with acids to form carbon dioxide. May yield corrosive caustic soda if mixed with lime dust and water.
HAZARDOUS DECOMPOSITION PRODUCTS: Yields sodium oxide if exposed to temperatures above 1564°F. HAZARDOUS POLYMERIZATION: Will not occur.

11. TOXICOLOGICAL INFORMATION

EYE EFFECTS: A severe eye irritant.
SKIN EFFECTS: A moderate skin irritant. May produce various severities of irritation on prolonged, repeated or occluded contact.
ACUTE ORAL EFFECTS: Although low in toxicity (LD_{50} ~ 3000 - 4000 mg/kg), may cause corrosion of gastric mucosa and gastrointestinal disturbances such as heaves, vomiting, abdominal pain.
INHALATION EFFECTS: Dusts either inhaled or aspirated during ingestion may cause mucous membrane and upper respiratory irritation.

12. ECOLOGICAL INFORMATION No data

13. DISPOSAL CONSIDERATIONS Can be disposed of in the trash or down the sink.

14. TRANSPORTATION INFORMATION

D.O.T. SHIPPING NAME: Not regulated
TECHNICAL SHIPPING NAME: ARM & HAMMER® Super Washing Soda Detergent Booster
D.O.T. HAZARD CLASS: None
U.N./N.A. NUMBER: None
HAZARDOUS SUBSTANCE/RQ: None
D.O.T. LABEL: None
D.O.T. PLACARD: None

15. REGULATORY INFORMATION

The components of this material are reported in the U.S. EPA TSCA Inventory and appear on the Canadian DSL.
This material is not listed as a carcinogen or potential carcinogen by NTP Annual Report, IARC Group I or II, OSHA 29 CFR Part 1910 Subpart Z, or ACG1H Appendix A.

16. ADDITIONAL INFORMATION

The information provided in this Material Safety Data Sheet represents data from the manufacturer and/or vendor and is accurate to the best of our knowledge. By providing this information, Science Take-Out LLC makes no guarantee or warranty, expressed or implied, concerning the safe use, storage, handling, precautions, and/or disposal of the products covered or the accuracy of the information contained in this fact sheet. It is the responsibility of the user to comply with local, state, and federal laws and regulations concerning the safe use, storage, handling, precautions, and/or disposal of products covered in this fact sheet.

MATERIAL SAFETY DATA SHEET

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name (as printed on the label): "Nicotine" (simulated)

Product identity: Sodium Bicarbonate (Baking Soda)

Manufacturer: Church & Dwight Co., Inc.
469 N. Harrison Street
Princeton, NJ 08543
Telephone number for information: (609)683-5900
Manufacturer's Issue date of this MSDS: 9/17/02

Medical emergency phone number (Chemtrec): (800) 424-9300

2. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Ingredient: Sodium bicarbonate % by Weight: 100%
CAS Number: 144-55-8
Not hazardous under OSHA Standard 29 CFR 1910.1200.
Not a WHMIS controlled substance.

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

White crystalline powder; no odor. Not a fire hazard.
No significant health or environmental effects associated with this material.
HMIS Rating Health 0, Fire 0, Reactivity 0

Potential Health Effects
EYE: Not an eye irritant. SKIN CONTACT: Not a skin irritant.
INGESTION: Material is practically non-toxic. Small amounts (1-2 tablespoonfuls) swallowed during normal handling operations are not likely to cause injury as long as the stomach is not overly full; swallowing larger amounts may cause injury.
INHALATION: None known.
SUBCHRONIC EFFECTS/CARCINOGENICITY: Based on published studies on its effects in animals and humans, sodium bicarbonate is not teratogenic or genotoxic. Only known subchronic effect is that of a marked systemic alkalosis. The material is not listed as a carcinogen or potential carcinogen by IARC, NTP, OSHA, or ACGIH.

4. FIRST AID MEASURES

EYES: Check for and remove contacts. Flood eyes with clean flowing water, low pressure and luke warm (not hot) if possible, occasionally lifting eyelids.

INGESTION: If large amounts of this material are swallowed, do not induce vomiting. Administer water if person is conscious. Never give anything by mouth to an unconscious person.

NOTE TO PHYSICIAN: Large doses may produce systemic alkalosis and expansion in extracellular fluid volume with edema.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES: FLASHPOINT: Not combustible METHOD USED: N/A
FLAMMABLE LIMITS: LFL: Not applicable UFL: Not applicable
EXTINGUISHING MEDIA: Non-combustible material. Use extinguishing media appropriate for surrounding fire.
FIRE-FIGHTING INSTRUCTIONS: Carbon Dioxide may be generated making necessary the use of a self-contained breathing apparatus (SCBA) and full protective equipment (Bunker Gear). Carbon dioxide is an asphyxiant at levels over 5% w/w. Sodium oxide, another thermal decomposition product existing at temperatures above 1564□F is a respiratory, eye, and skin irritant. Avoid inhalation, eye and skin contact with sodium oxide dusts.
UNUSUAL FIRE AND EXPLOSION HAZARDS: None known.

6. ACCIDENTAL RELEASE MEASURES

Scoop up into dry, clean containers. Wash away uncontaminated residue with water.

7. HANDLING AND STORAGE

Store in cool, dry areas and away from incompatible substances (see Section 10). Sodium Bicarbonate reacts with acids to yield carbon dioxide gas which can accumulate in confined spaces. Do not enter confined spaces until they have been well ventilated and carbon dioxide and oxygen levels have been determined to be safe.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

RESPIRATORY PROTECTION: Dust mask required if total dust level exceeds 10 mg/m3.
PROTECTIVE GLOVES: General purpose for handling dry product. Impervious gloves when working with solutions.
EYE PROTECTION: Safety glasses when handling bulk material or when dusts are generated.
OTHER PROTECTIVE CLOTHING OR EQUIPMENT: Full cover clothing. Apron where splashing may occur when working with solutions.

PROTECTIVE WORK/HYGIENIC PRACTICES: No special requirements with respect to chemical exposure beyond those provided above.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: White crystalline powder. ODOR: None.
PHYSICAL STATE: Solid pH AS IS: Not Applicable
pH (1% SOLN. w/v): 8.2 VAPOR PRESSURE: Not applicable.
VAPOR DENSITY: Not applicable. BOILING POINT: Not applicable.
FREEZING/MELTING POINT: Not applicable.
SOLUBILITY IN WATER: 8.6 g/100 ml @ 20□C.
BULK DENSITY (g/cc): 62 lb/Ft3 % VOLATILE: Not applicable.
VOLATILE ORGANIC COMPOUNDS: Not applicable. MOLECULAR WEIGHT: 84.02

10. STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable.
CONDITIONS TO AVOID: Temperatures above 65□C (150□F).
INCOMPATIBILITY WITH OTHER MATERIALS: Reacts with acids to yield carbon dioxide. Also may yield free caustic in presence of lime dust (CaO) and moisture (i.e., water, perspiration).
HAZARDOUS DECOMPOSITION PRODUCTS: Heating above 100□C may cause dangerous levels of carbon dioxide gas to be present in confined spaces. Yields sodium oxide if exposed to temperatures above 850□C. Avoid inhalation, eye and skin contact with sodium oxide.
HAZARDOUS POLYMERIZATION: Not applicable.

11. TOXICOLOGICAL INFORMATION

EYE EFFECTS: The material was minimally irritating to unwashed eyes and practically non-irritating to washed eyes (rabbits).
SKIN EFFECTS: Not a skin irritant or dermally toxic. Not a contact sensitizer.
ACUTE ORAL EFFECTS: Acute Oral-rat LD50 = 7.3 g/kg
ACUTE INHALATION: LC50 (rat) > 4.74 mg/l

12. ECOTOXICOLOGICAL INFORMATION

AQUATIC TOXICITY: Daphnids: EC50 = 4100 mg/l; Bluegill: LC50 = 7100 mg/l
Rainbow Trout: LC50 = 7700 mg/l

13. DISPOSAL CONSIDERATIONS

Bury in a secured landfill in accordance with all local, state and federal environmental regulations. Empty containers may be incinerated or discarded as general trash.

14. TRANSPORTATION INFORMATION

D.O.T. SHIPPING NAME: Not regulated D.O.T. HAZARD CLASS: None
TECHNICAL SHIPPING NAME: Sodium Bicarbonate
U.N./N.A. NUMBER: None HAZARDOUS SUBSTANCE/RQ: None
D.O.T. LABEL: None

15. REGULATORY INFORMATION

CLEAN AIR ACT SECTION 611: Material neither contains nor is it manufactured with ozone depleting substances (ODS).

FEDERAL WATER POLLUTION CONTROL ACT (40 CFR 401.15): Material contains no intentionally added or detectable (contaminant) levels of EPA priority toxic pollutants.

FOOD AND DRUG ADMINISTRATION: Generally Recognized As Safe (GRAS) direct food additive (21 CFR 184.1736).

US DEPARTMENT OF AGRICULTURE: List of Proprietary Substances - Permitted Use Codes 3A, J1, A1, G1, and L1.
CERCLA REPORTABLE QUANTITY: None

OSHA: Not hazardous under 29 CFR 1910.1200
RCRA: Not a hazardous material or a hazardous waste by listing or characteristic.

SARA TITLE III: Section 302, Extremely Hazardous Substances: None
Section 311/312, Hazardous Categories: Non-hazardous
Section 313, Toxic Chemicals: None

Sodium Bicarbonate is reported in the EPA TSCA Inventory List.

This material is listed on the Canadian DSL.

This material is not listed as carcinogen or potential carcinogen by NTP, IARC, OSHA, ACGIH or NIOSH.

This material is neither a volatile organic compound nor does it contain VOCs.
NATIONAL STOCKING NUMBER: 6810002646618, Contract No. DLA 40086C1831
NSF STANDARD 60: Corrosion and Scale Control in Potable Water. Max use 200 mg/l.
EUROPEAN INVENTORY (EINECS): 205-633-8
JAPANESE INVENTORY (MITI): 1-164
AUSTRALIAN INVENTORY (AICS): Carbonic acid, monosodium salt.

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MATERIAL SAFETY DATA SHEET

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name (as printed on the label): "Human Liver Enzyme", "Baboon Liver Enzyme", "Cat Liver Enzyme", "Mouse Liver Enzyme"

Product identity: Vinegar (dilute acetic acid)

Distributor: Wegman's Food Markets, Inc.
Rochester, NY 14603

Telephone number for information: (585)764-5400
Date of this MSDS: 9/14/12
Medical emergency phone number (Chemtrec): (800) 424-9300

2. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Ingredient: Vinegar Chemical Name: Acetic Acid
CAS Number: 64-19-7 Formula: CH_3COOH
Synonyms: Ethanoic Acid
Principle Hazardous Components: Acetic Acid (CAS#64-19-7) 4-6%
TLV and PEL units: ACGIH-TLV 10ppm(TWA), STEL 15ppm
OSHA-PEL 10ppm(TWA)

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
Do not ingest. Avoid skin and eye contact. Avoid exposure to vapor or mists.

Potential Health Effects

EYES: May cause irritation.
SKIN: May cause irritation.
INGESTION: May cause gastrointestinal discomfort.
INHALATION: May cause irritation to respiratory tract.

4. FIRST AID MEASURES

Emergency and First Aid Procedures:

EYES - Flush with water for at least 15 minutes, raising and lowering eyelids occasionally. Get medical attention if irritation persists.

SKIN - Thoroughly wash exposed area for at least 15 minutes. Remove contaminated clothing. Launder contaminated clothing before reuse. Get medical attention if irritation persists.

INGESTION - Do not induce vomiting. If swallowed, if conscious, give plenty of water immediately and call a physician or poison control center. Never give anything by mouth to an unconscious person.

INHALATION - Remove to fresh air. Give oxygen if breathing is difficult; give artificial respiration if breathing has stopped. Keep person warm, quiet, and get medical attention.

5. FIRE FIGHTING MEASURES

Flash Point (Method Used):109F (cc)

NFPA Rating:
Health: 2
Fire: 2
Reactivity: 1

Extinguisher Media: Use dry chemical, CO2 or appropriate foam.

Flammable Limits in Air % by Volume: 5.4%LEL 16.0%UEL

Autoignition Temperature: No data available

Special Firefighting Procedures: Firefighters should wear full protective equipment and NIOSH approved self-contained breathing apparatus.

Unusual Fire and Explosion Hazards: No data available

6. SPILL OR LEAK PROCEDURES

Steps to be Taken in Case Material is Released or Spilled:

Ventilate area of spill.
Eliminate all sources of ignition.
Remove all non-essential personnel from area.
Clean-up personnel should wear proper protective equipment and clothing.
Absorb material with suitable absorbent and containerize for disposal.

7. HANDLING AND STORAGE

Store above 62 degrees F, away from direct heat, ignition sources and oxidizers.
Other Precautions: Do not reuse container. Residue may make empty containers dangerous.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Respiratory Protection: A NIOSH/MSHA chemical cartridge respirator should be worn if PEL or TLV is exceeded.

Ventilation: Local Exhaust: Preferred Mechanical(General): Acceptable
Special: No Other: No

Protective Gloves: Natural rubber, Neoprene, PVC or equivalent.
Eye Protection: Splash proof chemical safety goggles should be worn.
Other Protective Clothing or Equipment: Lab coat, apron, eye wash, safety shower.

Requirements with respect to specific equipment and applications are the responsibility of the user.

9. PHYSICAL AND CHEMICAL PROPERTIES

Molecular Weight: 60.05 Melting Point: 16.7C
Boiling Point: 118.1C Vapor Pressure: 11.4 at 20C
Vapor Density (Air=1): 2.07 Specific Gravity (H_2O=1): 1.049
Percent Volatile by Volume: 100 Evaporation Rate (BuAc=1): 0.97
Solubility in Water: Miscible
Appearance and Odor: Clear colorless liquid with pungent odor.

10. STABILITY AND REACTIVITY

Stability: Stable Conditions to Avoid: Heat, ignition sources, metals
Incompatibility (Materials to Avoid): Oxidizers, strong alkalis, metals, amines, cyanides, sulfides, chromic acid, nitric acid, hydrogen peroxide, carbonates.
Hazardous Decomposition Products: COx
Hazardous Polymerization: Will not occur

11. TOXICOLOGICAL INFORMATION

Toxicity Data: aihl-mus LC50: 5620 ppm/1H orl-rat LD50: 3530 mg/kg
skin-rbt LD50: 1060 mg/kg

Effects of Overexposure: Acute: See section 3
Chronic: Mutation and reproductive effects data cited. Not listed as causing cancer by IARC, NTP, or OSHA.
Conditions Aggravated by Overexposure: Respiratory conditions
Target Organs: Eyes, skin, and respiratory tract.
Primary Route(s) of Entry: Inhalation, ingestion or skin contact.

12. ECOLOGICAL INFORMATION EPA Waste Numbers: D002 D001

13. DISPOSAL CONSIDERATIONS

Waste Disposal Methods: Dispose in accordance with all applicable Federal, State and Local regulations. Always contact a permitted waste disposer (TSD) to assure compliance.

14. TRANSPORTATION INFORMATION D.O.T. SHIPPING NAME: Not regulated

15. REGULATORY INFORMATION

EPA TSCA Status: On the TSCA Inventory List.
Hazard Category for SARA Section 311/312 Reporting: Acute
SARA EHS Section 302 TPQ(lbs.): No
SARA Section 313 Chemicals Name List: No Chemical Category: No
CERCLA Section 103 RQ(lbs.): 5,000 RCRA Section 261.33: No

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