Quick Start Guide to Presenting a Discovery Cart

Working a Discovery Cart allows our guests to receive information in a fun and interactive setting while learning from a future health care professional!

Please welcome our guests by engaging them using a question. Below you will find a suggested format for engaging visitors at your cart for about 3-5 minutes.

Feel free to tell them more about your experience in school, studying science, and working hard to become a doctor, nurse, or physician's assistant.

**Recommendations: The 5 E's**

**Engage** - Engage your audience by asking a question.

**Extract** - Find out what your audience already knows! Quiz them with questions to make your cart more interactive.

**Experiment** - Use the models and/or experiments to teach your audience something new.

**Explain** - Meet your audience at their level of knowledge. Explain science in a way that is interesting and exciting to them. (For example: You would explain the circulatory system very different to a 7 year-old child than to your professor.)

**Ending Idea** - Make sure your audience walks away with at least one take home point that will encourage them to make more healthy life choices.

Refer to the next page for an Overview of the Respiratory Discovery Cart
### Engage
**Lung Questions to Ask**
- Do you know anyone who smokes?
- Is smoking healthy for you?
- What might happen if you smoke too much?

### Extract
**Quiz to Promote Interaction**
1. What happens when you take a breath of air?  
   A: As the lungs expand, air flows in the mouth/nose through the trachea into the bronchioles into the alveoli where gas exchange occurs.
2. What gas do you need when you inhale?  
   A: Oxygen
3. What gas do you get rid of when you exhale?  
   A: Carbon Dioxide
4. What happens to your lungs when you smoke?  
   A: The lungs turn black. Tar and smoke get caught in the lungs and destroy the alveoli that are essential for gas exchange.
5. How many lungs do you have? Which one is bigger?  
   A: Humans have 2 lungs. The right lung has 3 lobes and the left lung has two lobes. The right lung is bigger because the left lung has to make room for the heart.
6. Do you know how your diaphragm works?  
   A: It is a muscle that contracts during inhalation and relaxes during exhalation.

### Experiment & Explain
**Teaching Tools**
1. **Pig Lungs**  
   Explain differences between a healthy lung and a diseased/smoker’s lung. Demonstrate with pig lung specimens.
2. **Respiratory System Model**  
   Explain how the lung and diaphragm work together. Demonstrate with the balloon/diaphragm model.
3. **Smokey’s Café**  
   Explain the number of chemicals and toxins found in a cigarette. Demonstrate what smokers ingest but would never eat using Smokey’s Café Lesson Plan.
4. **Tainted Blood**  
   Explain how smoking causes damage in the bloodstream. Demonstrate with the Tainted Blood display.
5. **Jar of Tar**  
   Explain the effects of tar on the lungs. Demonstrate with Jar of Tar container.
6. **Mr. Gross Mouth**  
   Explain what happens to your mouth with the use of tobacco. Demonstrate with Mr. Gross Mouth model.
7. **Emphysema Activity**  
   Explain asthma, chronic bronchitis, and emphysema. Demonstrate effects of tobacco use with straws. Demonstrate tissue changes that occur during asthma and chronic bronchitis with Bronchus Model.

### Ending Ideas
**Take Home Points**
Use the **Self-Prescription Questions** and **Facts about Respiration** on the next page.
# Self-Prescription Questions

Why is it bad for your health to smoke cigarettes or chew tobacco?  
How does gas exchange occur in the lung?

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## Facts about Respiration

- Your lungs contain almost 1500 miles of airways and over 300 million alveoli.
- Every minute you breathe in 13 pints of air.
- The right lung is larger than the left lung because the left lung needs to make room for the heart.
- Plants take in carbon dioxide and release oxygen. Plants are our partners in breathing. We breathe in air, use the oxygen in it, and release carbon dioxide.
- Cigarette smoke contains over 7,000 chemicals, 250 of which are known to be harmful to lungs including hydrogen cyanide, carbon monoxide and ammonia.
- Smoking is directly responsible for approximately 90 percent of lung cancer deaths and approximately 80-90 percent of COPD (emphysema and chronic bronchitis) deaths.
- In 2005, an estimated 45.1 million, or 2.1% of adults were current smokers.
- Approximately 90% of smokers begin smoking before the age of 21.
- Smoking is the leading cause of cancer and death from cancer. It is directly linked to cancer of the lung, esophagus, larynx, mouth throat, kidney, bladder, pancreas, stomach and cervix.
- There is no safe tobacco product, and there is no safe level of exposure to tobacco smoke.
- Children’s lungs keep growing as they grow—second hand smoke can stunt this growth and has been linked to the development of asthma.
- New studies show that exposure to third hand smoke (particles left from smoke on clothing, skin and surfaces) decrease a child’s IQ.

For more information about healthy lung habits, visit:

National Lung Association  
[www.lungusa.org](http://www.lungusa.org)

National Lung Health Education Program  
[www.nhelp.org](http://www.nhelp.org)
Experiment & Explain
Section 1: Pig Lungs

Overview
• Explain differences between a healthy lung and a diseased/smoker’s lung.
• Demonstrate with pig lung specimens.
  NOTES:
  o Wear gloves when handling the lungs for protection from the chemicals used to preserve the specimens.
  o Pick-up and hold the lungs by the plastic pipe/tip.
  o Do not allow guests to handle the specimens.
• Demonstrate with lung stand and inflators.

Notes about specimens:
• The pigs were slaughtered for food (not for demonstration purposes) and rather than discarding, they are used for educational purposes. The Museum orders specimens from a catalog.
• The black lung simulates the lungs of a person who has been exposed to standard amounts of air pollutants and has smoked a pack of cigarettes per day for about 20 years.

The “healthy lung” is red because of the preservative. The lung would normally be a pink or gray color, like the color seen on the trachea.

The “smoker’s lung” is black because at the time of slaughter, the lungs were hooked-up to a respirator and infused with carbon.
Lung Stand and Inflators

- PVC stands and inflator that you can hook up to display the lungs and demonstrate inhaling and exhaling—Do this slowly so they don’t explode on you or your visitors!
- You can use just the stands to display them and not take pumps but be aware that the lungs will begin to dry out after a short period of time so be sure to put them back into the preservative from time to time.

Show the rings of cartilage on the trachea. The rings are present to keep the trachea open so that air exchange can occur continuously. If there was no cartilage, it would be like trying to breathe into a paper bag—when you exhale into the bag it fills up with air; when you inhale into the bag, the bag collapses inward. Without the rings of cartilage to keep the trachea open this would happen to us.
Experiment & Explain
Section 2: Respiratory System Model

Overview
- Explain how the lung and diaphragm work together.
- Demonstrate with the balloon/diaphragm model.

The lungs and the diaphragm work together to make us breathe. As you can see with this model:
  - When GENTLY pulling down on the diaphragm, see the lungs fill air. The diaphragm is moving downward to allow the lungs to expand and fill with air.
  - When pushing up on the diaphragm, it forces the air out of the lungs.

The reason why some drug overdoses are fatal is due to muscle movement in the body that ceases and therefore the diaphragm (a muscle) and the heart (a muscle) stop working.
Overview

- Explain the number of chemicals and toxins found in a cigarette.
- Demonstrate what smokers ingest but would never eat using Smokey's Café Lesson Plan packet provided on the cart.

Tobacco smoke contains over 4,000 different chemicals. At least 250 are known carcinogens, which means they can cause cancer. A few of them are:

- Ammonia - common household cleaner
- Arsenic - in rat poison
- Lead
- Mercury

NOTE TO VOLUNTEER: Refer to the silk scarf on the cart for more carcinogens.

Effect of Smoking on Health

According to the National Cancer Institute:

- Cigar smoke, like cigarette smoke, contains toxic and cancer-causing chemicals that are harmful to both smokers and nonsmokers.
- Of the more than 7,000 chemicals in tobacco smoke, at least 250 are known to be harmful, including hydrogen cyanide, carbon monoxide, and ammonia.
- There is no safe tobacco product, and there is no safe level of exposure to tobacco smoke.
- The more you smoke, the greater your risk of disease.
- Cigar smoking causes oral cavity cancers (cancers of the lip, tongue, mouth, and throat) and cancers of the larynx (voice box), esophagus, and lung.
- All cigar and cigarette smokers, whether or not they inhale, directly expose their lips, mouth, tongue, throat, and larynx to tobacco smoke and its toxic and cancer-causing chemicals.
• Smoking harms nearly every organ of the body and diminishes a person’s overall health. Millions of Americans have health problems caused by smoking.

• Smoking is a leading cause of cancer and death from cancer. It causes cancers of the lung, esophagus, larynx, mouth, throat, kidney, bladder, pancreas, stomach, and cervix, as well as acute myeloid leukemia.

• Smoking also causes heart disease, stroke, aortic aneurysm (a balloon-like bulge in an artery in the chest), chronic obstructive pulmonary disease (COPD) (chronic bronchitis and emphysema), asthma, hip fractures, and cataracts. Smokers are at higher risk of developing pneumonia and other airway infections.

• For more information and resources, visit: www.smokefree.gov

• For an INTERACTIVE DIAGRAM of how smoking affects different parts of the body, go to: http://www.smokefree.gov/healthConsequences/default.aspx#.USflf2jR20s

EFFECT OF SMOKING ON TASTE
Sources: Discovery Health; MedicineNet.com; MedLine Plus; WebMD

• Smoking dulls senses such as smell and taste that together impact our ability to taste food and in turn can affect whether we enjoy the right kinds of food for good health.

• Taste sensitivity depends mainly on chemical sensors in taste buds of the tongue that help us distinguish among the different types of flavor: sweet, sour, salty, bitter, and umami. This is why smokers may tend to salt their food more – because they cannot taste as well so it takes more for them to be able to taste. But too much salt in your diet can negatively affect your health. (See next section “Effect of Salt Intake on Blood Pressure”)

• Taste relies heavily on olfaction, or the sense of smell, which is why you may notice food doesn’t taste as good when you have a cold.

• Smoking affects chemoreceptors both on the tongue and in the nasal passages, which “attacks” the ability to taste.

• Smoking can even affect the shape of taste buds. Some studies have found that taste buds on smokers’ tongues are flatter than taste buds of nonsmokers. Quitting smoking can help restore taste buds and improve sense of taste.

NOTE TO VOLUNTEER: Refer visitors to Nutrition Discovery Cart for additional information about healthy eating.
Smokey’s Café

Materials needed for demonstration:
- Nail polish
- Bug spray
- Paint thinner
- Lighter
- Cigarette
- Indoor fogger
- Rubber rat
- Worksheet copies (if using a classroom)

Synopsis:
This lesson is designed to introduce you to the idea that when people smoke, they ingest harmful chemicals that they would never choose to put in their bodies.

There are several harmful chemicals in tobacco smoke, many of which are shown to cause cancer.

NOTE TO VOLUNTEER: For complete instructions, refer to pages 3 and 4 of the packet provided on the cart. Since this lesson is being adapted for use with the cart and not as a classroom activity, simply engage visitors in a verbal dialogue as you go through the lesson and skip writing terms on the board.
Experiment & Explain
Section 4: Tainted Blood

This information is also included in the Circulatory Discovery Cart Guide, Section 7

Overview:
• Explain how smoking causes damage in the bloodstream.
• Demonstrate with Tainted Blood Display.

Tainted Blood Display

This unique model looks like a cigarette on the outside but the inside is a representation of an artery where carbon monoxide is keeping oxygen from flowing to the body’s organs and muscles. The display also shows plaque buildup caused by smoking and poisons from cigarette smoke traveling through the bloodstream.

Refer to the tent card that explains the model in detail and provides additional information about smoking hazards.
Experiment & Explain
Section 5: Jar of Tar

Overview
• Explain the effects of tar on the lungs.
• Demonstrate with Jar of Tar container.

Jar of Tar
The Jar of Tar provided on the cart shows the amount of tar that builds up in the respiratory system after one year of smoking a pack of cigarettes per day.
Experiment & Explain
Section 6: Mr. Gross Mouth

Overview
- Explain what happens to your mouth with the use of tobacco products.
- Demonstrate with Mr. Gross Mouth model.

Effects of tobacco use on your mouth:
(marijuana, cigarettes, chewing, pipes/cigars)
- Tooth Loss
- Gingivitis
- Cancer of Gums, Tongue and Palate
- Cavities
Experiment & Explain
Section 7: Emphysema Activity

Overview
• Explain asthma, chronic bronchitis, and emphysema.
• Demonstrate the effects of tobacco use with straws.
• Demonstrate tissue changes that occur during asthma and chronic bronchitis using 4-piece Bronchus Model.

Asthma
➢ Asthma is the most common lung disease in children and is reversible most of the time.
➢ Inflammation in the lungs occurs after someone's immune system makes an abnormal response to an allergen (dust, pollen, smoke, etc.). They episodically have inflammation when exposed to the allergen, leading to constriction of the bronchi, increased mucus. This sounds like wheezing and feels like being constantly out of air.
➢ It is dangerous when kids tire themselves out trying to get enough oxygen or breathe so fast that they actually change the pH of their blood.

Chronic Bronchitis
➢ Chronic bronchitis is most commonly caused by smoking from overproduction of mucus in bronchi, stopping air from getting to alveoli.
➢ Smoking also leads to inflammation in the lungs, which results in fibrosis (scarring) in the lung tissue.
➢ Someone with chronic bronchitis has a cough most days, feels short of breath, and may even be cyanotic (blue).

Emphysema
➢ Emphysema is most commonly caused by smoking.
➢ Chemicals within smoke cause immune system cells like neutrophils and macrophages to migrate to lung tissue. They mistakenly think there is something to attack and release protein destroying enzymes. As a result, some lung tissue is broken down.
Over time the destruction can progress so far that it leads to trouble breathing, pockets of air that cannot move out and over inflation of the lung tissue.

The build-up of tar and other damage to the lungs from smoking may result in emphysema. This makes breathing difficult because the elasticity of the alveoli (tiny air sacs in the lungs) are decreased, and exhaling (deflating of the alveoli/lung) takes longer, resulting in a feeling of shortness of breath. {Can be demonstrated with the black pig lung from Section 1}

Those with emphysema are usually on oxygen support and possibly in a wheelchair. They are not physically disabled; it’s just that it is so difficult for them to breathe something as simple as walking a short distance will get them “winded.”

Cocktail Straws - Emphysema Activity
Ask the visitor to breathe normally, but only through a straw with their nose pinched. This simulates what it’s like for someone with asthma to breathe 24/7.

NOTE TO VOLUNTEER: Throw away all used straws; kids usually like to keep trying the activity and then they start complaining of a headache and we don't want anyone to pass out!
NOTE TO VOLUNTEER: During your demonstration, you can use the model and/or poster provided on the cart that highlights similar information as the diagram below.

**The Respiratory System**

- 1. Sinus Areas
- 2. Nose
- 3A. Mouth
- 3B. Tongue
- 4. Adenoids
- 5. Tonsils
- 6. Throat
- 7. Epiglottis
- 8. Voice Box
- 9. Esophagus
- 10. Windpipe
- 11. Lymph Node
- 12. Ribs
- 13A. Right Main Bronchial Tube
- 13B. Left Main Bronchial Tube
- 14. Three Lobes Of The Right Lung
- 15. Two Lobes Of The Left Lung
- 16. Pleura
- 17. Bronchial Cilia
- 18. Diaphragm
- 20A. Alveolus (Air Sac)
- 20B. Pulmonary Vein
- 20C. Capillaries
- 20D. Pulmonary Artery

Mucus

Cells
The diagram of the respiratory system (pictured on the previous page) shows the intricate structures needed for breathing. Breathing is the process by which oxygen in the air is brought into the lungs and into close contact with the blood, which absorbs it and carries it to all parts of the body. At the same time the blood gives up waste matter (carbon dioxide), which is carried out of the lungs when air is breathed out.

1. The **SINUSES** (frontal, maxillary, and sphenoidal) are hollow spaces in the bones of the head. Small openings connect them to the nose. The functions they serve include helping to regulate the temperature and humidity of air breathed in, as well as to lighten the bone structure of the head and to give resonance to the voice.

2. The **NOSE** (nasal cavity) is the preferred entrance for outside air into the respiratory system. The hairs that line the wall are part of the air-cleaning system.

3. Air also enter through the **MOUTH** (oral cavity), especially in people who have a mouth-breathing habit or whose nasal passages may be temporarily obstructed, as by a cold or during heavy exercise.

4. The **ADENOIDS** are lymph tissue at the top of the throat. When they enlarge and interfere with breathing, they may be removed. The lymph system, consisting of nodes (knots of cells) and connecting vessels, carries fluid throughout the body. This system helps to resist body infection by filtering out foreign matter, including germs, and producing cells (lymphocytes) to fight them.

5. The **TONSILS** are lymph nodes in the wall of the throat (pharynx) that often become infected. They are part of the germ-fighting system of the body.

6. The **THROAT** (pharynx) collects incoming air from the nose and mouth and passes it downward to the windpipe (trachea).

7. The **EPIGLOTTIS** is a flap of tissue that guards the entrance to the windpipe (trachea), closing when anything is swallowed that should go into the esophagus and stomach.

8. The **VOICE BOX** (larynx) contains the vocal chords. It is the place where moving air being breathed in and out creates voice sounds.

9. The **ESOPHAGUS** is the passage leading from the mouth and throat to the stomach.

10. The **WINDPIPE** (trachea) is the passage leading from the throat (pharynx) to the lungs.
11. The **LYMPH NODES** of the lungs are found against the walls of the bronchial tubes and windpipe.

12. The **RIBS** are bones supporting and protecting the chest cavity. They move to a limited degree, helping the lungs to expand and contract.

13. The windpipe divides into the two main **BRONCHIAL TUBES**, one for each lung, which subdivide into each lobe of the lungs. These, in turn, subdivide further.

14. The right lung is divided into three **LOBES**, or sections. Each lobe is like a balloon filled with sponge-like tissue. Air moves in and out through one opening -- a branch of the bronchial tube.

15. The left lung is divided into two **LOBES**.

16. The **PLEURA** are the two membranes, actually one continuous one folded on itself, that surround each lobe of the lungs and separate the lungs from the chest wall.

17. The bronchial tubes are lines with **CILIA** (like very small hairs) that have a wave-like motion. This motion carried **MUCUS** (sticky phlegm or liquid) upward and out into the throat, where it is either coughed up or swallowed. The mucus catches and holds much of the dust, germs, and other unwanted matter that has invaded the lungs. You get rid of this matter when you cough, sneeze, clear your throat or swallow.

18. The **DIAPHRAGM** is the strong wall of muscle that separates the chest cavity from the abdominal cavity. By moving downward, it creates suction in the chest to draw in air and expand the lungs.

19. The smallest subdivisions of the bronchial tubes are called **BRONCHIOLES**, at the end of which are the air sacs or alveoli (plural of alveolus).

20. The **ALVEOLI** are the very small air sacs that are the destination of air breathed in. The **CAPILLARIES** are blood vessels that are imbedded in the walls of the alveoli. Blood passes through the capillaries, brought to them by the **PULMONARY ARTERY** and taken away by the **PULMONARY VEIN**. While in the capillaries the blood gives off carbon dioxide through the capillary wall into the alveoli and takes up oxygen from the air in the alveoli.