Open wide. What do you see? Teeth, gums, tongue, saliva, oral cavity. Anything else? Oh, yes, hundreds of different types of bacteria are there, too (even though you can’t see them). Yuk! What are they doing in there? Guess what—they’re feasting on your food.

Plaque is a film of leftover food, bacteria, and acid that is produced while bacteria process your food. Gently scrape a fingernail across your teeth. The white stuff you collect is plaque. With daily brushing and flossing, you can get rid of plaque. If you don’t brush away the plaque, the acid the bacteria forms will harm your gums and eat through to tooth enamel. When plaque is not removed each day, it hardens and turns into a yellowish crust called tartar or calculus. Once formed, this must be removed with professional dental cleaning. Red, swollen, or bleeding gums caused by tartar build-up are a problem for about two-thirds of the 15-year-olds in the U.S. This gum inflammation is called gingivitis. If gingivitis is left untreated, the gums pull away from the teeth, creating a pocket which traps food debris that can lead to infection.

Why do we care about gum problems? First of all, they can cause bad breath. More importantly, gum breakdown makes it easier for bacteria and viruses to enter the rest of the body. This route of infection can lead to heart problems, stroke, or babies being born prematurely.

Tooth decay has dropped by 60 percent in the U.S. since the addition of fluoride to community water supplies and toothpaste. How does fluoride work? It helps strengthen teeth and fights off bacteria. Fluoride attracts minerals like calcium and phosphate in your saliva to build tooth enamel and dentin that are more resistant to acid attack. Unfortunately, some communities are still without fluoridated water. Some home filtration units may remove fluoride, and bottled water may not contain proper levels of fluoride. That’s why it is important to brush teeth with toothpaste that contains fluoride.

By age 12, most people have 28 permanent teeth. You probably have your complete set already. Remember to take good care of them. Teenagers like you eat about nine times a day (including snacks). Rinsing your mouth with water after eating is especially important. Don’t forget to brush and floss daily. Your teeth will thank you for it!
they are. Hundreds of different strains of bacteria may be present in the mouth. Public health officials note that among 5-17 year olds, tooth decay is five times more common than asthma. Breakdown of oral tissues allows bacteria and viruses to enter the bloodstream. There are concerns about oral infections spreading to the heart, leading to endocarditis (bacteria on the surface of heart valves). More recently, human and animal studies have linked oral problems with diabetes, stroke, and premature delivery of babies. People with compromised immune systems (those with HIV/AIDS and those receiving chemotherapy) are at greater risk for oral infections.

Scientists are looking at saliva and oral tissues in an increasing array of diagnostic tests, to avoid the need to draw blood or urine samples in the future. Drug testing of athletes for illegal drugs like PCP, steroids, cocaine, alcohol, barbiturates, etc., can all be done with saliva. Testing for environmental toxins (like lead) and appropriate levels of prescription drug treatments can also be done orally.

What is periodontal disease? Gingiva is the scientific name for gums. Most people have heard of gingivitis, an early reversible stage of periodontal disease that responds to improved oral hygiene. When periodontal disease advances, structures supporting teeth can become damaged, causing tooth loss. Accumulation of plaque, tartar, calculus, and the growth of anaerobic bacteria are implicated in advancing periodontal disease. Here are the signs of periodontal disease: gums that bleed with brushing, persistent bad breath, loose teeth, and gums that separate from teeth. Professional evaluation is recommended.

How can we improve our dental health? Brushing daily with a fluoride toothpaste is recommended. Flossing is important for cleaning between teeth and around gums. Flossing should be done at least once a day. Brushing and flossing reduce daily accumulation of plaque and tartar. The recommended frequency of professional cleaning is twice a year (to eliminate this build-up).

For optimal oral health, avoid tobacco and excess alcohol, use mouth-guards and protective devices during sports activities, and focus on good nutritional habits. The American Dental Association suggests limiting snacks between meals. Less harm occurs during mealtime because the amount of saliva produced dilutes the effects of the acids produced by bacteria. Each time you consume a sugary or starch food, acid attack your teeth for twenty minutes. If you multiply that by nine (the average number of times a teen eats every day) you can see the potential for problems when teeth are not properly cleaned.

What is the anatomy of a tooth? (see last page of TN for diagram) Anatomy of a tooth: root covered by cementum, crown covered by enamel, root canal with pulp tissue (blood vessels connective tissue, nerves; dentin, which makes up most of the tooth, is under enamel)

Get REAL

Students are conducting sensory evaluations, an important aspect of market research. Chemists use special instruments to test toothpastes. For example, gas chromatography provides a picture of the release of different flavor components, and a rheometer measures how a paste performs under stress to determine how easily it will come out of a tube and how well it will stay on a toothbrush. The American Chemical Society notes that each new ingredient requires careful compatibility selection and testing so that toothpastes still retain the good taste, physical properties, and cavity protection that consumers have come to expect. The antibacterial activity of triclosan, for example, can be enhanced or inhibited by added surfactants (substances like detergents that change the surface tension of water or tension on the interface between two liquids).

HYPOTHESES: A discussion of toothpastes and ingredients is a good introduction. Students should develop initial formulas by choosing one dry and one liquid ingredient. Limit dry ingredients to one teaspoon or less. Remind them that different formulas should vary in only one ingredient. Each group should test at least four combinations (calcium carbonate + water, baking soda + water, calcium carbonate + glycerin and baking soda + glycerin).

MATERIALS: Dry ingredients; one cup of dry ingredients equals 36-40 tsp. Secure a food grade of calcium carbonate (CaCO₃) because of tasting. A pharmacist may be willing to donate some in powdered or tablet form; pure tablets can be expensive. Alternatively, calcium supplements like TUMS are a good source of calcium carbonate (but not pure). These tablets can be ground in a coffee grinder, food processor, or with a mortar and pestle (if ground in a food processor, the powder will be fluffy, with no need to compact it for measuring). Each 500 mg tablet will make about one tsp of ground powder. It may be difficult to find the preferred unflavored TUMS tablets, so you may have to use flavored ones. Baking soda is easily available in supermarkets. Liquids: Obtain glycerin at a pharmacy. It is used as a food additive and has a syrupy consistency. If you plan to use flavoring extracts like vanilla or peppermint, add a 1/2 - 1 tsp to a cup of water or glycerin. Otherwise, the flavoring may be too intense. Dilute colorings before adding them to formulas. NOTE: Very minute amounts of these ingredients will be tested. If students accidentally ingest large quantities, consult your local poison control center.

PROCEDURE: For each group, place small amounts of commercial toothpaste on a paper plate. Label these. Students will record descriptions for each brand and rate them on the 1-5 scale. TASTE: Use clean toothpicks for sampling. Do not double dip the same toothpick after it has been placed in the mouth. In their own formulas, students will discover that: calcium carbonate = chalky, baking soda = salty, glycerin = sweet. Flavored calcium carbonate tablets = sweet. SMELL: Many toothpastes have a mint smell. APPEARANCE: Years ago, toothpastes were dry paste. Dental creams were put into collapsible tubes in the 1890s. The pump was introduced in the 1980s. Today's chemical formulations are expected to produce a strip of toothpaste that stands up on the toothbrush and does not drip off. Over time, students will notice that water-based formulas dry out or revert to a dry paste. TEMPERATURE: Pastes might be creamy, stringy, or gritty. Some toothpaste brands have more gritty polishing agents, but these may be abrasive to teeth. Students should place a small amount of each paste on a fingertip to feel texture. POLISHING (Level B): To test the polishing ability/abrasiveness of formulas, draw quarter-sized circles on the shiny side of a piece of aluminum foil. Label the circles. Place a small amount of commercial toothpaste or student formula on a finger and rub in a circular pattern within the marked circle for 15 seconds. Then, wipe off with a damp paper towel and dry. Keep the foil flat on the work surface. More abrasive pastes will dull the foil. Baking soda tends to be more abrasive than pure powdered calcium carbonate, but antacid tablets that are not finely ground into a powder will also be even more abrasive. Formulas with glycerin will glide more easily over the foil than water-based formulas. FOAMING: On a clean plate, place a sample of each formula. Add a drop of vinegar or lemon juice. Commercial pastes tend not to foam much (except when you are brushing with them). Baking soda foams more than calcium carbonate. Both foam more in a water-based mixture than in a glycerin based mixture. This test really measures the pH of the toothpaste. The higher the pH, the more it reacts with vinegar or lemon juice to produce CO₂ bubbles. CLEANING (Level B): To test for stain removal, place a stain (crushed blueberries or blackberry jam) on unglazed tile or plain white fabric (an old sheet). Let stains dry (prepare these in advance). Put a small amount of student formula on a fingertip and gently rub in a straight line on the stain. Next to that, rub another formula in a straight line. Then, rinse with water. Most stains are lessened or removed by the student formulas. NOTE: These purplish red stains will turn blue when they are rubbed because both baking soda (sodium bicarbonate) and calcium carbonate are bases and the fruit stains act as acid-base (pH) indicators.

RESULTS: Have students share and explain observations.

CONCLUSIONS: Groups should decide which toothpastes get the highest ratings. Students develop a marketing plan for their new and improved toothpaste.

Additional Lab-based Activities (teamwork) Acid can destroy hard substances. The purpose of this activity is to suggest what can happen to the hard surface of teeth when acidic foods and bacteria producing acids in the mouth attack teeth. Test what happens by placing an egg in its shell (raw or hardboiled) in white vinegar, cola, or other acidic liquids. Leave overnight. If sufficiently acidic, bubbles form on the shell as it dissolves. The bubbles are carbon dioxide (CO₂). Have a control with only water to show that the bubbles are the result of a chemical reaction, not just air escaping from the egg.
Calcium carbonate (CaCO₃) is the main component of eggshells and is used in making toothpastes. The change in the shell can be determined by gently tapping the egg with a spoon or by touching it. CAUTION: raw eggs can have salmonella. You may want to hard boil the eggs or microwave empty shells. Alternatives to eggs: teeth or clean chicken bones. Dipping an egg in a commercially available fluoride solution or plaque remover (about .05 percent sodium fluoride) for 10 minutes briefly retards initial bubble formation when the egg is dipped in vinegar (about 30 seconds to a minute): then fewer bubbles occur over the next 5-10 minutes. The function of fluoride in the body is protective because fluoride is actually incorporated into the enamel of teeth, re-mineralizing them and making them stronger.

**Testing for oxygen.** See instructions for making elephant toothpaste at: www.carolina.com/chemistry/ This experiment requires 30 percent hydrogen peroxide (strong oxidizer), saturated potassium iodide, and other common ingredients and safety supplies. The presence of oxygen can be demonstrated by lighting a glowing Flint. The chemical equation is reported.

**Investigate toothpaste ingredient labels and the ADA seal.** The purpose of this activity is to compare the ingredients found in different toothpastes with manufacturers’ claims and the actual ADA seal. Collect several boxes from toothpastes. Manufacturers’ websites are generally limited in ingredient information but do promote the advantages of their formulations. Some publicize enhanced anti-tartar formulas, but all toothpastes are anti-tartar because they slow the growth of plaque and calculus above the gumline (problems occur below the gumline). Read the ADA endorsement. If it has the ADA seal, a toothpaste is: not overly abrasive, proven safe, and effective in fighting cavities.

Discuss what qualities consumers want in a toothpaste. Which claims are reliable?
- Fluoride has been proven effective in fighting cavities; the ADA seal recognizes that claim.
- Anti-tartar ingredients (like pyrophosphates, tetrasodium pyrophosphate, gantrex S-70, sodium tri-polysphosphate zinc salts, or methyl vinyl ether/maleic anhydride copolymer) slow the formation of calcified plaque above the gum, but they do not remove it. Some anti-tartar formulas are too abrasive and can cause harm to gums and teeth by wearing away the whiter enamel down to the browner dentin layer.
- Some enzymes enhance the antibacterial properties of saliva (studies on effectiveness are inconclusive).
- Detergents are foaming agents that help spread toothpaste around the mouth. Some have proven antibacterial effects (like Triclosan).
- Xylitol is used as a sweetener in some products (also in chewing gums) because streptococcus microbes and others cannot metabolize it, enhancing protection against cavities.
- Calcium phosphate compounds work to strengthen teeth by re-mineralizing (filling in) tiny holes in the tooth caused by abrasion or gum recession.
- Abrasives for cleaning and polishing like baking soda (sodium bicarbonate) and calcium carbonate baking soda (sodium bicarbonate) have been used as toothpaste for years. Now manufacturers are adding them in less abrasive form. Together with peroxide, these ingredients were supposedly effective in fighting against gum disease and plaque, but an FDA advisory panel has yet to find convincing evidence. It’s possible that this combination could upset the ecological balance of microbes in the mouth.
- Strontium chloride or potassium nitrate is used in toothpastes that reduce sensitivity to heat and cold. Long-term use is not recommended, nor is use by anyone under 12 years of age.
- Humectants (glycerin, sorbitol, propylene glycol, polyethylene glycol) help prevent toothpaste from hardening and may add to sweetness.
- Other inactive ingredients include water, binding and thickening agents (inorganic gums, cellulose, silica), flavorings and preservatives.

**Toothpaste ingredients affect mouth functions.** This experiment shows how toothpastes affect other parts of the mouth. First, take a taste of orange juice. Then, rinse your mouth with water and brush teeth with toothpaste (improvise with cotton swabs in the classroom). An ingredient like sodium lauryl sulfate (a detergent) can affect taste. Take another sip of orange juice. Is there a difference? Yes, but why? The chemical affects our sweet-sensing taste buds, enhancing our perception of bitterness. Does everyone notice a difference? Some people are less sensitive to bitter tastes, due to lack of a specific gene.

**Check It Out**

**Level A:** 1) 16, 2) 20, 3) answers will vary. 4) 24
**Level B:** **GRAPH 1:** 1) 16, 2) 20, 3) answers will vary, 4) 24, 5) about 4
**GRAPH 2:** 1) 34.9 percent, 2) 29.3 or about 30 percent reduction, 3) 19.6 percent, 4) snuff (students should look at proportional change)

The duration and frequency of spit tobacco use increases the prevalence of oral lesions that may progress to oral cancer. Smoking and consumption of alcohol are other risk factors. Research on healthy young men shows that most lesions of the mouth lining (leukoplakia) that develop from smokeless tobacco use will disappear in about six weeks after quitting.

**Untangle the WEB**

(A more!)

A wealth of information about oral health is available online.

The ADA recommends tongue brushing. These sites contain more background info.
http://www.ada.org/public/faq/cleaning.html
http://www.adha.org/oralhealth/index.html

The www.healthyteeth.org site is appealing for elementary students. About 35 percent of tooth surfaces are not cleaned without flossing. Check out the pictures in the braces section. The teacher’s guide includes flossing demonstration and video on sealants.

The www.perio.org site provides excellent background on gingivitis and periodontal disease, along with graphics. Some materials are in Spanish.

The www.nidcr.nih.gov/news/pubs/sealants/main.htm site has extensive information on sealants. Bacteria don’t usually grow if sealed off.

Visit www.howstuffworks.com/category-teeth.htm for information, plus Dr. Gordon’s dental pages.


The www.adha.org/kidstuff/ site is appropriate for elementary students.
Be sure to try www.petdental.com for details about oral health for pets.

Your mouth and your oral mucosa and saliva can provide a window into what is happening in your body. Did you know that the scrapings from the buccal mucosa (from inside the cheek) are used to test whether athletes are abusing illegal drugs? Anything in the bloodstream of your body will show up in these cells. Suppose someone is going to a smoking cessation class and sweats they have not had a cigarette. Guess what? Doctors can test the participant’s spit for cigarette by-products. Scraping a few cheek mucosa cells or testing spit is easier than drawing blood.

Tobacco and excessive use of alcohol increase the risk of oral cancer. Excess exposure to sunlight is a risk factor for lip cancer. White oral lesions are called leukoplakia. Not all of these become cancerous, but all oral cancers start this way. Reddish lesions called erythroplakia are even more likely to turn cancerous.

BioSTARS is published by the AAALAS Foundation: You and Your Big Mouth, Spring 2001
Our mouth helps keep us alive as we eat and drink. It keeps us in touch with others as we talk and smile. Did you know that your mouth is also busy protecting you?

The lining of the mouth (oral mucosa) might seem soft and delicate, but it can tolerate extremes of temperature. The lining has two layers, the epithelium and connective tissues. Epithelial cells provide a barrier to bacteria. With a microscope, you would see why. The cells are square-shaped and give off sticky molecules that hold them close together. Under the epithelium is a sturdier layer of connective tissue that contains blood vessels and nerves. When you have gum disease, the connective tissue and epithelium are damaged. Bacteria can enter into your bloodstream more easily if your mucosa is damaged. Fortunately, you have saliva, which helps you recover from problems like a pizza burn on the roof of your mouth. Saliva helps heal wounds as your body repairs and builds cells. Saliva neutralizes acids from foods that may cause cavities. It can even kill many microorganisms.

Oral cancer has been linked with smoking and frequent use of smokeless tobacco. In the initial stages, a pre-cancerous lesion will appear. If the lesion does not heal within two weeks, medical attention is necessary. Make a healthy choice – don’t use tobacco. You can see that a healthy mouth is directly related to your general health. Avoid problems by visiting a dental professional twice a year.

Oral cancer is a deadly disease. More than 30,000 Americans will get oral cancer this year, and only half of them will survive beyond five years. Early detection can increase survival rates.

What are scientists doing to fight cancer? Dr. Joel Schwartz and Dr. Xinbin Gu, of the Howard University College of Dentistry, are searching for ways to detect oral cancer in its early stages. Here’s the story of their research.

In humans, chemicals or viruses can cause cancer. Scientists may study a substance to find out if is is linked with cancer. Drs. Schwartz and Gu are investigating a chemical called DMBA, so they have set up testing conditions for their research. Epithelial cells grown in a lab dish with DMBA turn cancerous, multiplying out of control. Observing cells grown in vitro gives us better understanding. However, that environment is not the same as a complex, living organism. Researchers need a model with a mouth, bloodstream, and an immune system. Hamsters are good models because their oral structures are similar to ours in many ways.

Researchers painted a 0.5 percent solution of DMBA inside the young hamsters’ mouths to find out what would happen. They repeated this three times a week for 16 weeks. The animals developed oral cancer. Drs. Schwartz and Gu observed changes. They are searching for biochemical markers that will uncover details about when and why the lesions became cancerous. The researchers hope to learn more about early detection of oral cancer.

How will this help humans? Once scientists identify these markers for cancer growth, they can screen humans for similar markers. In vitro and animal models may lead to better understanding and treatment of this disease. Dr. Schwartz is also studying applications of vitamin E to fight oral cancer. These Howard University researchers are working with scientists at the University of Wisconsin on new technology called fluorescent imaging. Cancer cells grow and divide faster than surrounding cells, giving off different amounts of energy. This energy can be detected by a fluorescent glow. Cancerous growths smaller than one mm in size can be spotted with these special hand-held cameras. That will make early detection of cancer much easier!

Yes, today’s lab discoveries have the potential to save lives in tomorrow’s world.

Helping Humans, Helping Animals

Visit this site to take a close up look at the differences between a healthy and an unhealthy dog’s mouth. You can even follow step-by-step procedures for cleaning a cat’s teeth. www.thepetcenter.com/

While thinking about pets’ diets, students should consider their own eating habits and oral health. The ADA recommends a well balanced diet that includes the major food groups: fruits and vegetables; meat, poultry, and fish; milk, cheese, and yogurt; bread, cereals, and grains. For small teenagers should focus on nutritious foods like cheese, raw veggies and fruit, or yogurt. Many foods include the sugars and starches that bacteria thrive on, so it’s important to limit between-meal snacks. Rinsing mouth with water and cleaning teeth after food consumption is helpful. Students might be curious about chewing gum. Sugarless gum has some benefit because it stimulates saliva production, which helps clean teeth. Chewing gum that contains sugar does not have the same benefits. Some brands of chewing gum may contain ingredients that re-mineralize teeth.

Level A: Encourage creativity as students develop models using common materials (cardboard, styrofoam packing pellets, modeling clay, etc.). Lightweight wire could be used to fashion braces for these models.

- Brushing and flossing. Students can discuss proper techniques and the need for extra vigilance while wearing braces.
- Straightening teeth. Adults comprise 20 percent of orthodontist visits for braces, but the best time for orthodontic work is during the younger years. Braces help to align the bite and alleviate tooth crowding as growing jaws adjust to larger, permanent teeth. Braces are usually worn for 2-3 years. Some dental appliances are removable, but most are fixed (e.g., brackets directly glued to front teeth and metal bands attached to molars). An arched wire runs along the top teeth and a second along the bottom teeth. These are tightened over time. A stainless steel archwire is used to connect the bands and brackets in each arch (one for upper and one for lower teeth). Sometimes, rubber bands are used to align the upper jaw (the maxilla) with the lower jaw (mandible).
- Mouthguards. The Academy of General Dentistry reports that mouthguards prevent more than 200,000 injuries annually. Soccer and basketball players are at higher risk than football players. The Academy recommends that players participating in basketball, softball, wrestling, soccer, lacrosse, rugby, in-line skating, and the martial arts wear mouthguards.

Level B. The American Dental Association, The National Institutes of Health, and The National Hepatitis Foundation have all taken a position against tongue piercing. In an editorial in the Journal of the American Dental Association, Lawrence Meksin advises dentists to exercise caution in expressing strong opposition to oral piercing. Too strong a position may alienate those who might benefit from dental counseling about the associated health risks. In addition, over-emphasizing the pain of this procedure may be counterproductive because some teens consider this a challenge. Help students become better informed as they discuss these practices among peers. They should also be aware of local or state health department regulations for those who do body piercing. It is NOT recommended that students search the web for “oral piercing.” This may lead to sites for body piercing parlors that describe piercing of body parts that are inappropriate in the school setting.

General information: www.pediatricdentalcare.com/parent/ www.chicagodentalsociety.org/

This site is for teachers only, as it references some sensitive topics: www.safepiercing.com

Delving Deeper

Dental technicians make dentures, crown, and bridges. Their work is described at: http://stats.bls.gov/oco/ocos238.htm
Also check out: www.umsl.edu/services/govdocs/ooh9899/167.htm
This profession requires an artistic flair. An apprenticeship (but not necessarily college) may prepare students to be dental technicians.

Cool Careers

Howard University’s College of Dentistry is the fifth oldest in the country. The dental school prepares students for a variety of careers in the dental profession. In addition to completing their studies as registered dental hygienists, Ms. Frazier-Kelley, Dr. Grant-Mills, and Ms. Neely pursued
master's and doctoral level studies in counseling, education, community health, and dentistry to advance to their knowledge. These educators note that the field of dental hygiene provides more than dental cleaning services. Other work includes oral health assessment, nutrition counseling, smoking cessation counseling, research, education, administration, commercial efforts, and patient advocacy.

Dr. Grant-Mill's experiences illustrate how far we have come in improving dental health awareness and practices. Previous generations were expected to lose their teeth from decay or gum disease. In 1970, one of every two adults lost all of their teeth, with grimmer statistics in poor communities or in places without fluoridated water. Tooth loss can affect speech and chewing ability (even with replacement dentures). By 1997, one in four adults aged 65 to 74 years had all their teeth extracted. Hawaii has the lowest incidence of adult tooth loss (13.9 percent), and West Virginia has the highest (47 percent). Even today, some children in poor communities do not have toothbrushes.

**MINDBENDER**

Talk with students about their own innovative ideas for new dental technologies. All those listed are available, but not all dentists use them. New technologies can be expensive. Before widespread adoption, these technologies must be shown to be as effective or more effective than current methods. New materials for filling cavities and replacement teeth look very natural. Replacement teeth may be screwed into the jaw. One new idea is the development of an anti-cavity agent to prevent the attachment of micro-organisms on teeth. Students may want to ask their dentists about these technologies. Students can research how dentistry has evolved over the years. One good source is: wwwddfdestinymiles.com/dentalfun.html (see Travers books, listed in references)

Find more details on new technologies at: www.dentistryonline.com/cons/newtech2/default.html

- Drill-free dentistry. A high-speed air blaster with aluminum oxide powder can gently blast away the smallest pockets of decay (like a miniature sand blaster).
- Dental lasers. A focused low-power laser (like bar code readers) can cut away diseased gum tissue. Some claim faster healing, less pain, and lower risk of infection. Others say that the $15,000-$50,000 cost is not a balanced investment. Lasers in use today are less successful when used on hard surfaces like teeth.
- Intra-oral camera. Now you can see for yourself if a tooth or filling is cracked. Get an up-close and personal view on your computer monitor. You can even print a picture. Half of today's dentists have this equipment.
- Tooth implants with titanium screws have become more widely available in the past 20 years, but they require surgery. Case studies suggest that an implanted tooth will last 10 years. Research investigating which genes control the development of teeth is underway. Scientists have grown mice teeth in a dish. Why would we want to learn how to grow human teeth in a dish? The body rejects many foreign substances, so the closer an implant is to the body's natural parts, the less likely is that a rejection will occur. Researchers might learn how to grow a whole new set of teeth. More info at: http://abnews.go.com/sections/science/DailyNews/dentures000831

Research on dental fears. Peter Milgrom, DDS, Director of the University of Washington Dental Fears Research Clinic, has reported that these fears peak around middle age, with one-fifth of the public having such pronounced fears that they avoid going to the dentist. Most fears stem from childhood experiences. Such fears can be overcome with advanced awareness and the use of relaxation techniques.

**Ask a Scientist**

Encourage students to submit their own questions about dental care and oral health.

**Dental Humor**

- How did the dentist break a mirror? Acci-DENTAL-ly
- What did the dentist say to the computer? This won't hurt a BYTE.
- What do dentists like best about amusement parks? MOLAR Coasters.

**Glossary**

- **Amalgam** - filling material for teeth made of mercury (50 percent), silver, tin, copper, and zinc.
- **Bite** - how the upper and lower teeth fit together.
- **Cavity** - a hole in a tooth caused by decay.
- **Caries** - scientific name for decay, caused by acid produced by bacteria in plaque and food debris.
- **Flossing** - cleaning between teeth and under gums with a thread-like strip.
- **Fluoride** - a natural mineral that prevents tooth decay.
- **Gums** - mucous membranes covering the roots of teeth and surrounding bones (also called gingival).
- **Gingivitis** - inflammation in gums that makes them swollen, red, and easily susceptible to bleeding.
- **Oral cavity** - mouth.
- **Oral hygiene** - cleaning the mouth with brushing, flossing, and rinsing.
- **Oral mucosa** - pinkish-red tissue lining the mouth; over the roots of teeth it forms the gums.
- **Plaque** - a thin film of food debris, mucus, and bacteria and their toxic acids; plaque coats teeth and contributes to decay and gum disease.
- **Saliva** - the scientific name for spit, a watery, tasteless fluid of water and enzymes secreted by the salivary glands which becomes mixed with undigested food and bacteria; saliva helps move food through the mouth.
- **Sealants** - plastic coatings placed on biting surfaces of teeth to keep out food and bacteria, preventing decay.
- **Scaling** - professional removal of plaque, tartar, and stains from tooth surfaces.
- **Tartar** - a hardened yellow or white crust formed on teeth if plaque is not removed regularly.

**Reproducible Quiz**

Decide whether each statement is TRUE or FALSE. If it is false, change the wording to make it a true statement.

1. After tartar forms, it can easily be removed with home dental care.
2. Fluoride hardens tooth enamel and dentin, making teeth more resistant to acid attack and decay.
3. Very few teenagers have problems with red, swollen, or bleeding gums that result from tartar build up.
4. Replace your toothbrush every year.
5. By 12 years of age, most people have 28 permanent teeth.
6. If you have periodontal disease, the connective tissue of the gums may collapse, forming pockets next to the teeth.
7. Saliva moistens foods to aid in swallowing and digestion, but it has no other important functions.
8. Gum disease and tooth loss are problems for many older pets.
9. Sealants are placed on the sides of teeth to keep out food and bacteria, preventing decay.
10. Brushing your teeth twice a day is sufficient to keep them healthy.
For Marie Frazier-Kelley and Donna Grant-Mills, childhood experiences were instrumental in capturing their interest in dentistry. Today these leaders train dental hygienists at Howard University in Washington, D.C.

As a young girl, Marie didn't have a clue about good oral health habits. When she started school, she was embarrassed about the appearance of her stained teeth. Luckily, there was a dental hygienist at her school. After her first teeth cleaning, Marie felt like a completely different person. From then on, she took care of her teeth faithfully. After finishing high school, Ms. Frazier-Kelley decided to follow in the footsteps of her friend, the registered dental hygienist (RDH). She knew that was the perfect career choice for her.

When Donna Grant-Mills was young, many people in her community could not afford to go to a dentist for regular check-ups. Donna grew up thinking that it was normal for people to lose all their teeth as they got older. As a teenager, her summer job in a new dental clinic changed her mind. She was amazed to learn that teeth could last a lifetime. That led to her decision to become a registered dental hygienist. After serving her community (helping people keep their teeth), she took on a new challenge. She attended dental school and graduated to become Dr. Grant-Mills. Through her teaching at Howard University, she continues to help others learn about dental care and good oral health.

The next time you get your teeth cleaned, ask your dental hygienist or dentist to tell you how their careers in oral health got started.

New technologies will change dental office visits. But, new technologies won't help if people don't get to the dentist in the first place. Your task is to come up with an advertisement that highlights the benefits of new dental technologies.

Focus on these ideas or invent your own:

● Removal of decayed areas without a metal drill.
● Using lasers to cut away diseased gum tissue.
● Looking inside the mouth with a pen-sized camera and projecting the image on a computer screen.
● Replacement of a knocked out tooth with one grown in a lab.
● Computer Assisted Design (CAD) systems for making replacement teeth that are a perfect fit.

Develop print and audio materials for your ad. Share these with the class.

Answers to quiz
1. False. Plaque can be removed through daily brushing, but hardened tartar requires professional dental cleaning.
2. True
3. False. About 60 percent of 15-year-olds have some of these problems
4. False. Change more frequently, like every 3-4 months.
5. True. Only wisdom teeth erupt later in most people.
6. True. These pockets can trap food and bacteria, worsening gum health.
7. False. Saliva has multiple functions, including helping to heal wounds through cell repair and regeneration. Saliva also neutralizes acids in foods.
8. True
9. False. Sealants are places on biting surfaces, where food and bacteria lodge in the pits and crevices.
10. False. Brushing needs to be done with fluoride toothpaste, flossing is needed, and a healthy diet is important to maintain the integrity of teeth.

The next time you get your teeth cleaned, ask your dental hygienist or dentist to tell you how their careers in oral health got started.

Instructional Resources
American Dental Association. Look for oral health topics from A-Z. [www.ada.org](http://www.ada.org)
American Dental Hygienists’Association. Look for kidstuff and career information. [www.adha.org](http://www.adha.org)
Academy of General Dentistry. Consumer information and dental fact sheets. [www.agd.org](http://www.agd.org)
Look for the spectrum series for cutting edge research.
National Spit Tobacco Education Program. Free major league baseball-based educational materials on spit tobacco, including videos, posters, pictures of players, and games. [www.nstep.org](http://www.nstep.org)
Variety of educational resources and advocacy materials at: [www.oralhealthamerica.org](http://www.oralhealthamerica.org)
Go to the National Oral Health Information Clearinghouse to find free materials, including information on spit tobacco and oral cancer. [www.nohic.nidcr.nih.gov/](http://www.nohic.nidcr.nih.gov/)
Tobacco Free Kids has info on smoking, contests, an online quiz, and the ABC’s of how tobacco use affects the body. [http://tobaccofreekids.org](http://tobaccofreekids.org)
Excellent visuals. [www.microbelibrary.org](http://www.microbelibrary.org) (keyword: dental)

Watch for release of NEW dental health curriculum "Open Wide and Trek Inside" (for gr. 1-2) [www.science-education.nih.gov](http://www.science-education.nih.gov)

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Use these words to label the drawing.

Periodontal ligaments
Blood vessels
Enamel
Root
Crown
Pulp cavity
Dentin
Bone
Cementum
Nerves
Gum

Enlarge and reproduce the tooth diagram.