



FLORIDA BLUEBERRY



WANT A FUN FIELD TRIP IDEA?

Visit a U-Pick blueberry farm! Students can fill their own buckets of blueberries and learn where their blueberries actually come from.

For more resources, visit these websites:

All About Blueberries
www.blueberrycouncil.org

Blueberry Information
https://edis.ifas.ufl.edu/topic_blueberry

Blueberry Recipes
FDACS.gov/recipes



Florida Farm to School:
FarmToSchoolFL.com

National Farm to School Network:
www.FarmToSchool.org

DEAR TEACHER

This month's Harvest of the Month is the blueberry! The lesson plans and activities provided in this packet were developed to guide your classroom's understanding of the origins and nutritional benefits of the sweet and delicious blueberry. We hope you are able to utilize all of the activities and encourage students to try blueberries with their morning oatmeal, as a snack or in a salad at lunch!

CLASSROOM RECIPE

BLUEBERRY & YOGURT BREAKFAST CUPS

Serves 50

INGREDIENTS:

- 3 1/8 quarts granola
- 6 1/4 quarts low-fat vanilla yogurt
- 4 1/4 pounds blueberries

PREPARATION:

1. Using 1 cup serving cups, put 1/4 cup of granola into each of the cups, then top each with 4 ounces of low-fat vanilla yogurt and 1/4 cup of blueberries.
2. Keep refrigerated until ready to serve.



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FLORIDA BLUEBERRY FACT SHEET

DID YOU KNOW?

- The darker the blueberry, the sweeter the taste.
- Blueberries are grown across central Florida, predominantly in Alachua, Desoto, Hardee, Highlands, Hillsborough, Lake, Manatee, Marion and Polk counties.
- Today, 95% of the world's blueberry crop is grown in North America.
- In 1995, only 139 million pounds of blueberries were consumed, compared to the 735 million pounds consumed in 2015.
- Early seeders of America would use blueberries to make grey paint for their houses by boiling them in milk.
- Blueberries are full of fiber, antioxidants and vitamin C, and have no saturated fat. In 1910, The "Blueberry Queen", Elizabeth Colmand White, and Frederick Coville planted the first cultivated crop of blueberries in New Jersey.



GROWING BLUEBERRIES

- Blueberries grow best in a sunny location in soils that are slightly acidic.
- Blueberry bushes begin to bear fruit within 12 months after planting.
- Some blueberry varieties can grow up to 12 feet tall, but most peak at about 6 feet or smaller with proper pruning.
- Most highbush blueberries are used for fresh market, while lowbush blueberry varieties are better suited for processing.

NUTRITION DATA

NUTRITION FACTS

Serving size: 1 cup
Servings: 1

Amount Per Serving

Calories 84 **Calories from Fat** 0

% Daily Value*

| | |
|-------------------------------|---------------|
| Total Fat 0g | |
| Saturated Fat 0g | 0% |
| Trans Fat 0g | |
| Cholesterol 0mg | 0% |
| Sodium 1mg | |
| Total Carbohydrate 21g | 16% |
| Dietary Fiber 4g | 14% |
| Sugars 15g | |
| Protein 1g | |
| Vitamin A 1% | Vitamin C 19% |
| Calcium 1% | Iron 2% |

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.



LESSON PLANS

Content Areas: Lessons are most applicable for science and environmental science courses but the content includes standards from social studies, art, language arts and *especially* math.

Standards: SC.6.N.1.5, SC.6.N.1.3, SC.7.N.1.5, SC.7.L.17.2, SC.7.L.17.3, SC.8.N.1.5, LAFS.6.SL.1.2, LAFS.6.SL.1.3, LAFS.6.SL.2.4, LAFS.68.RST.1.1, LAFS.68.RST.1.2, LAFS.68.WHST.2.6, LAFS.68.WHST.3.7, MAFS.7.SP.2.4, VA.68.C.2.1, VA.68.C.2.2, VA.68.C.2.3, SS.7.C.2.12, SS.7.C.2.13, and SS.7.C.2.14

Objectives: Students will analyze the history, cultivation and nutritional content of blueberries.
Students will analyze the pH of different soil samples through a pH lab.
Students will investigate properties of matter by creating and cooking their own blueberry dish.

Materials:

- Required readings
- pH indicator/litmus paper or a pH meter
- orange juice
- bleach
- vinegar
- tap water
- distilled H₂O
- test tubes and test tube rack
- tweezers
- shovel
- plastic bags
- 250ml beakers for mixing soil and distilled water

Introduction:

Post the following “warm-up” problem to begin the discussion on blueberries:

“In 2001, Florida sold 23 million dollars worth of blueberries. In 2011, Florida sold 69 million dollars worth of blueberries. What was the percentage increase of Florida blueberry sales from 2001 to 2011?”

Answer: $\$69/\$23 = 3.00$ times or a 300% increase

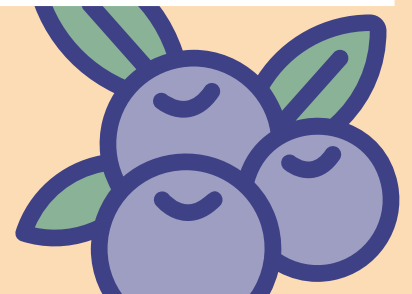
Give students five minutes to answer the warm-up and then review as a class. Next, students will independently read “*Blueberry History and Nutritional Benefits*.” Think-Pair-Share, students will review the facts about blueberries and discuss what they learned. Discuss key points of the reading with students by asking questions such as, “What are some unique qualities of blueberries? Why have blueberries become so popular in recent years?”

Guided Activity:

Activity 1: Pass out the reading “*Innovation, Timing Create Sweet Spot for Florida Blueberries*” and correlated comprehension questions. Students will need approximately one hour to complete the reading and comprehension questions. As a reading extension, have students create a map outlining the migration of blueberry cultivation.

Activity 2: Students will complete a pH lab to determine the pH of different soils across the school campus. Students will ultimately determine the best location for blueberries to be planted at their school based on the pH of the soil. Students will first read the background information on pH titled “*What is pH? - Background Information*.” Next, in partners or small groups, students will follow the lab procedure and answer the post-lab questions.

Independent Activity: Pass out the “*Homework: Understating the Properties of Matter Through Cooking*” materials. This assignment is designed as a homework assignment but could be done as a classroom activity if you have access to a kitchen. For the activity, have students answer questions 1-3 in class. At home, students will complete questions 4-7 after cooking the blueberry dish of their choice. If the school allows, encourage students to bring in their blueberry dish to share with the class and present their findings. Students can also bring in pictures and recipes to share with the class.



BACKGROUND INFORMATION

Blueberries are one of the few fruits that originated in North America. The Native Americans found many uses for blueberries including drying them for winter, making pemmican (a nutrient dense food) and a pudding called “Sautauthig,” using them in cough syrup, to make dyes for clothing and baskets, and as paint.

Elizabeth White and botanist Frederick Coville established an industry for blueberries and created new blueberry varieties. Coville also discovered that blueberries grow best in acidic soils. The consumption of blueberries has increased in the United States ever since. Followed by strawberries, blueberries are the second most commonly eaten berry in the United States.

A one-cup serving of fresh blueberries provides approximately 24% of your daily vitamin C, 5% vitamin of BG and 36% of vitamin K needs. Blueberries score among the top 20 fruits and vegetables that have the most nutrients per calorie. They have only about 80 calories per cup and are packed with antioxidants.

For more information, visit these sources:

- www.indepthinfo.com/blueberries/history.htm
- www.whfoods.com/genpage.php/genpage.php?tname=foodspice&dbid=8
- www.medicaldaily.com/health-benefits-blueberries-5-reasons-eat-more-blueberries-246727
- www.medicalnewstoday.com/articles/287710.php
- www.ars.usda.gov/is/AR/archive/mayll/nal05ll.pdf
- www.blueberrycouncil.org/about-blueberries/history-of-blueberries/

ADDITIONAL READING

- “Blueberries”, poem by Robert Frost 1874-1963
- *Florida’s Blueberry Crop Sees a Sweet Harvest Season*, News Article by the Associated Press: www.wtsp.com/story/news/local/florida/2015/06/15/floridas-blueberry-sweet-harvest-season/71238946/
- “Top 50 Most Delicious Blueberry Recipes”, book by Julie Hatfield



INNOVATION, TIMING CREATE SWEET SPOT FOR FLORIDA BLUEBERRIES



By Laura Reiley, Times Food Critic
©2015 Tampa Bay Times

In the early years of Florida's foray into growing blueberries, there were a lot of naysayers. We were a citrus state, a tomato state, a strawberry state. But the area of blueberries harvested in the state has roughly tripled over the last 10 years, and this year's crop is likely to reach 25 million pounds, with a harvest season that fits fairly tidily in between those of Chile and Georgia. Michigan, the nation's leader in cultivated blueberries, produced 87 million pounds in 2012. In 2013, Chile exported 174 million pounds of blueberries, most of them to the United States.

While this year's season is about a week late to start due to a higher number of overcast winter days, the harvest is expected to be strong, with lots of fruit and prices that hit the sweet spot, making the berries both affordable for consumers and lucrative for growers. Prices for this year's crop have not been set yet, but traditionally consumers pay more at the beginning of the season.

Who is responsible for Florida blueberries' nearly meteoric rise as a crop? That would be scientists at the University of Florida Institute of Food and Agricultural Sciences Plant Innovation Program. It is estimated that 98 percent of the southern highbush blueberries grown in Florida are from cultivars developed at UF.

"I can't overemphasize the importance of the UF breeding program in making this possible," said Alto Straughn, who started farming blueberries more than 30 years ago and now grows 15 to 18 percent of Florida's crop. He says that in the early years of Florida blueberries, farmers had disease problems, pollination problems, soil problems, water quality problems and yield problems.

"The bottom line is the new varieties are better, bigger, tastier and with a better yield," Straughn says of recent UF cultivars like the Emerald or the Jewel. And there are more varieties on the horizon, those that are suitable for machine harvesting.

According to Paul Lyrene, a retired blueberry breeder considered by many to be the father of the Florida blueberry industry, machine-picking blueberries is much more feasible than other Florida crops such as strawberries. And since assembling a harvest labor force is a major concern for many growers, this could contribute further to the growing blueberry industry in the state, but there are costs. Blueberry plants must be pruned to accommodate the harvesting machines, pruning that tends to delay harvest by a week or 10 days. This is a

problem because the early harvest has been one of Florida's main advantages.

Today, fresh blueberries are available to consumers nearly year round, but point of origin varies: Argentina is the first of the season in November; from December to February they are from Chile; Florida usually starts in mid-March and runs through June 1. After March, it moves to Georgia, North Carolina, New Jersey and the Pacific Northwest, where berries are picked until late September.

Many of the big blueberry players are muscling into neighboring "slots," trying to ripen berries earlier and extend the season longer in the other direction as well. UF cultivars have helped some countries effectively manipulate harvest time to maximize market share.

"Fifteen years ago the only fresh blueberries in the world in April came from Florida," said Charlie Poulton, who has grown three acres of blueberries north of Dade City since 2003. He has moved to all U-pick in recent years as larger blueberry growers have squeezed out the "little guy." These days big players like Sunny Ridge, Dole, Driscoll and Wishnatzki Farms have entered the blueberry fray, and while demand has grown along with awareness of the fruit's health benefits, Poulton still insists that most consumers are price sensitive, and will buy whatever is cheaper.

Moving forward, Lyrene sees marketing as the big challenge for Florida blueberry farmers.

"The marketing chain is so maladapted to rewarding the farmer who grows a good-tasting product," Lyrene said. "You have to have a trademarked name, and that depends totally on the imagination and the willingness of someone to do it. Not everybody starts a Microsoft or a Wal-Mart - it takes a particular person. It can be done. Will it be done? Maybe." Still, Straughn is bullish about the future of Florida blueberries.

"The question is, is it going to continue to expand? Yes, it is. It's the best game in town if you consider all the options out there. The potential to make money in blueberries is greater than any other crop in this state."

FAST FACTS

2017 Florida crop cash receipts

(Source: *USDA National Agricultural Statistics Services*)

Oranges: \$1.07 billion

Fresh tomatoes: \$262 million

Strawberries: \$337 million

Blueberries: \$84 million

COMPREHENSION QUESTIONS

Directions: Read the article titled “Innovation, Timing Create A Sweet Spot for Florida Blueberries” and answer the following questions on your own paper.

1. What would be an appropriate substitute for the word “Innovation” in the title of the article?
2. What state institution is responsible for creating varieties of blueberries for commercial consumption?
3. Name two other states AND two other countries that compete with Florida in the blueberry market.
4. What must be done before certain varieties of blueberries can be harvested by a machine?
5. What is one advantage that Florida has over other blueberry producers in the United States, such as Georgia and Michigan?
6. What are two challenges that Florida blueberry producers will face in the coming years?
7. This year’s Florida blueberry production is estimated to be 25 million pounds, three times greater than ten years ago. Approximately how many pounds of blueberries were produced ten years ago? Show your work!

What is pH?

Part 1: What does pH stand for? by Charlene Rennick

Have you ever wondered why the “p” in “pH” is a lower-case letter while the “H” is capitalized? What does it mean? The “p” stands for potential and the “H” stands for Hydrogen. Okay, so that makes it as clear as mud. What is potential Hydrogen? A scientific explanation would state that pH refers to the plant’s ability to attract hydrogen ions. A less scientific explanation says pH is the acid/alkaline balance.

Translated into a language those of us without a PhD can understand, pH level refers to the amount of acid and alkaline contained inside of both the water and the growing medium or soil. If the environment is too acidic, that means the plant will not attract enough hydrogen, while an environment that is too alkaline will attract too much hydrogen. An environment that continually fluctuates from one extreme on the pH scale to the other is unhealthy for the plant.

Hydrogen is one of four elements any living plant needs to survive. Without hydrogen, the plant would wilt and not be able to take in nutrients. Because the plant contains hydrogen, it continues to absorb hydrogen through the water via a process called osmosis. This hydrogen-osmosis cycle is what keeps the nutrients traveling from the water into the plant. Once a plant has died due to lack of water, there is no amount of water that can be added to it that will cause the plant to be revived.

The level of pH is measured on a scale of 0 to 14 with 0 representing the highest concentration of acid and 14 representative of the most alkaline. Seven is the magic figure for pH because it means that there is a balance of acid and alkaline in the solution and is often referred to as pH neutral. It is usually sufficient to say that a pH neutral environment is perfect for most plants, but some vegetation requires water or a growing medium that is more acidic than alkaline in order to flourish or have the right color of blossoms, while other plants prefer the opposite. Testing strips for pH can be purchased to determine exactly what the acid/alkaline balance is in your water, growing medium or soil. This makes it easy to adjust the level for home gardeners or for mixing nutrients for your own hydroponic garden.

Part 2: Acids, Bases and pH by G. Carboni

There are millions of chemical substances in the world. Some of them have acidic properties, others, basic properties. *Acids* are substances which free hydrogen ions (H^+), when they are mixed with water. *Bases* are substances which free hydroxide ions (OH^-) when they are mixed with water. (This freeing of ions is called dissociation in both cases). Free hydroxide ions react with the hydrogen ions producing water molecules: $H^+ + OH^- = H_2O$. In this way, bases diminish the concentration of hydrogen ions. A solution rich in hydrogen ions is acidic, a solution poor in hydrogen ions is basic. Some acids dissociate only in part and they are called *weak acids*; others dissociate completely, freeing large amounts of hydrogen ions, and they are called *strong acids*. In the same way, the bases can be stronger or weaker. Diluted acids and bases are less concentrated and less aggressive in their actions. The acidic or basic degree of substances is measured in pH units. The scale used spans from 0 to 14. Substances with pH lower than 7 are considered acids, those with pH equal to 7 are considered neutral, and those with pH higher than 7 are considered bases. Substances with low pH are very acidic, while those with high pH are highly basic. Concentrated acidic and basic substances are very corrosive and dangerous.

There are substances which have the property of changing their color when they come in contact with an acidic or basic environment. These substances are called pH indicators. Usually, they are used as dissolved substances, as for instance phenolphthalein and bromothymol blue. Often, to measure the pH, special papers which have been soaked with indicators are used. These papers change color when they are immersed in acidic or basic liquids. This is the case of the well-known litmus paper. More recently, it has become possible to measure the pH with electrical instruments like the pH meter.

Part 2 (continued):

Litmus paper

Litmus is a substance obtained from certain lichens. It has the property of changing its color to red with acidic substances and to blue with basic ones. On the packet of the litmus paper, there is a color scale which indicates the color assumed by the paper as a function of the pH (figure 1).

Using Litmus paper

Using Litmus paper is simple. First of all, it is necessary to immerse an end of it in the liquid you wish to examine and to remove it immediately. The pH of the liquid is determined by comparing the color of the paper to the scale of colors which is printed on its packet (figure 1).

The pH meter is an electronic instrument supplied with a special bulb which is sensitive to the hydrogen ions which are present in the solution being tested. The signal produced by the bulb is amplified and sent to a liquid-crystal or an analog meter display. In the market, it is easy to find pH meters which cost about 30 dollars. These instruments are much more precise and convenient to use than the indicating papers.

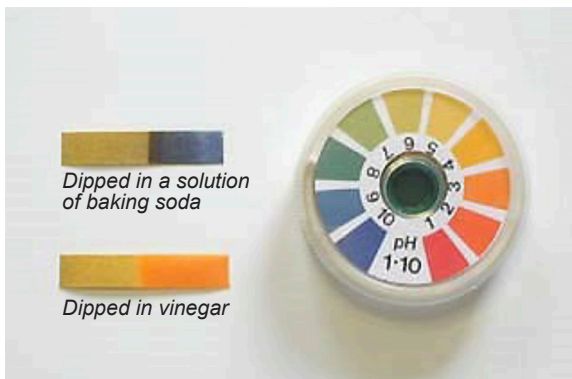
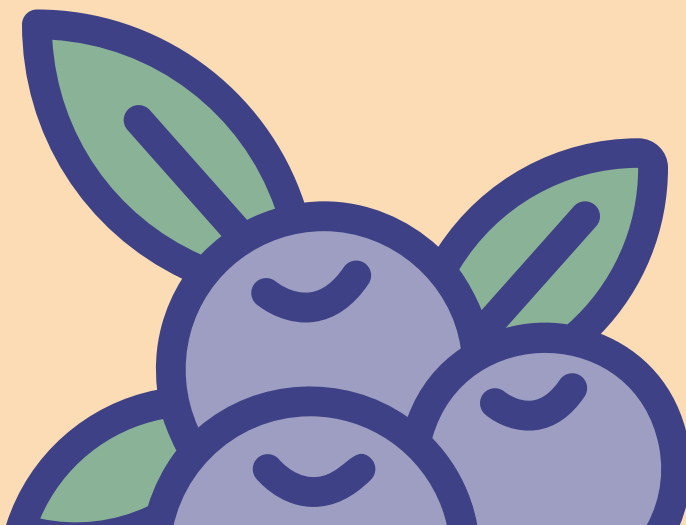


Figure 1 - Litmus Paper

Setting the pH meter

Before using it, the instrument has to be checked and possibly adjusted. For this purpose, the electrode of the meter is immersed in suitable buffer solutions with known pH. Usually, these solutions are supplied with the meter when you buy it, but they can also be bought separately or prepared for the purpose. If the meter doesn't give the exact value, it can be adjusted by means of two potentiometers: one for the shift and the other for the gain. Usually, to adjust the instrument it is enough to use a buffer solution with pH = 7 and to adjust the shift trimmer only.

Source: www.funsci.com/fun3_en/acids/acids.htm#4



Measuring pH to Plant Florida Blueberries

Objective:

Students will review the definition of pH, why it is important, how to determine the pH of certain products, and measure the pH of soil samples collected from areas around the school to determine the best area to plant blueberries at their school.

Materials Needed:

Required readings, pH indicator such as, litmus paper and/or pH meter, orange juice, bleach, vinegar, tap water, distilled H₂O, test tubes and test tube rack, tweezers, shovel, plastic bags and 250ml beakers for mixing soil and distilled water to measure pH of soil.



Background Information:

A liquid may be an acid, base or neutral. The degree of acidity or alkalinity can be measured using the pH scale. The scale is divided into three areas: acidic (readings below 7), neutral (reading of 7) and basic (readings above 7). Distilled water has a pH of 7 but when it mixes with air the suspended materials will either raise or lower its pH. Acid rain is an example of this type of reaction causing rain water to typically have a slightly acidic pH. Universal indicator paper changes depending on the pH of the solution being tested. Many cleaning and cooking solutions around your home are either acids with a low pH, or bases with a high pH.

Blueberries require a soil pH of 4.0-5.5. In more alkaline soils (higher soil pH values), levels of microelements such as iron and zinc can become deficient in the plant tissues. Symptoms of these deficiencies will appear on new growth and plants will start to lose vigor. Soils can be acidified by mixing a small amount of granulated sulfur or lime into the soil several months before planting. The application of most fertilizers will gradually lower the soil pH. A soil test is needed to measure the soil pH and can indicate whether or not soil acidification prior to the growing season is necessary.

Blueberries require a well-drained soil profile of at least 18 inches in depth. Blueberries should be planted on raised beds if water drainage is poor (standing water is present within 18 inches of the soil surface for prolonged periods during the rainy season). If blueberry roots are exposed to water-saturated soil for more than a few days damage from root rot may become severe. Generally, blueberries will grow well where azaleas, camellias and other "acid-loving" plants are proven performers.

Measuring pH to Plant Florida Blueberries

Directions:

Use the pH testing materials and the chart below to record the pH of the different materials.

| Solution | pH Level | Acid | Base | Neutral |
|------------------------------------|----------|------|------|---------|
| Orange Juice | | | | |
| Bleach | | | | |
| Vinegar | | | | |
| Tap Water | | | | |
| Distilled Water (H ₂ O) | | | | |
| Soil Sample Location: | | | | |
| Soil Sample Location: | | | | |
| Soil Sample Location: | | | | |
| Soil Sample Location: | | | | |
| Soil Sample Location: | | | | |
| Soil Sample Location: | | | | |

Post-lab Questions:

1. Was there a difference between the pH of tap water and distilled water?
2. If there was a difference between the pH of tap water and distilled water, what might account for the difference in pH?
3. Which soil sample had the lowest pH and what might account for the lower pH?
4. Which soil sample had the highest pH and what might account for the highest pH?
5. Based on the pH of your soil samples, which area has the most suitable soils for growing blueberries and why?

Understanding the Properties of Matter Through Cooking

Background Information:

One of the best ways to observe the properties of matter is in our own kitchen. In this assignment, with the guidance of an adult, you will bake, blend, freeze, mix and/or cook a food item using blueberries as your key ingredient. Once you have created your culinary masterpiece, reflect on your accomplishment and its relation to the properties of matter by answering the following questions on a separate sheet of paper:

1. What is the name of your blueberry culinary concoction?
2. On a separate sheet of paper, list all the ingredients needed and the amount of each. Also, list both the U.S. and metric measurements for each ingredient. For example, list both ounces (oz), grams (g) and/or milliliters (mL).
1 ounce=30 grams 1 ounce (liquid)=30mL 1 cup=240mL 1 teaspoon=5 mL 1 tablespoon=15 mL
3. Also on your separate sheet of paper, list all the steps in preparing your dish. If it is baked or cooked in the oven, list the temperature in both degrees Fahrenheit and degrees Celsius.
 $^{\circ}\text{C}=0.55(^{\circ}\text{F}-32)$ $^{\circ}\text{F}=(^{\circ}\text{C} \times 1.8) + 32$
4. What types of mixtures occurred in the process of creating your item? Did your item begin as a heterogeneous mixture and finish as a homogeneous mix? What were the solvents, if any?
5. What physical changes occurred during the process? Did evaporation, boiling, condensation, melting, freezing, or even sublimation occur at any time during the process?
6. Name five indicators that a chemical change has occurred. Did any chemical changes occur in creating your recipe?
7. Did your item turn out as planned? What would you do differently next time? What was the most difficult part in the cooking process? Was it delicious?



COMPREHENSION QUESTIONS - ANSWER KEY

1. Breakthrough, change, and invention are all suitable substitutes for innovation.
2. The University of Florida's Institute of Food and Agricultural Sciences Plant Innovation Program.
3. Michigan and Georgia, Chile and Argentina.
4. They must be pruned.
5. Florida blueberries are harvested and available for sale before other states.
6. Competition from other countries and producing a quality blueberry at a low price.
7. $25 \text{ million pounds} / 3 = 8.3 \text{ million pounds}$ or 8,300,000 pounds.

ADDITIONAL RESOURCES

Explore these WeatherSTEM lessons



weatherstem.com/resources



For more resources, please visit:

FarmToSchoolFL.com