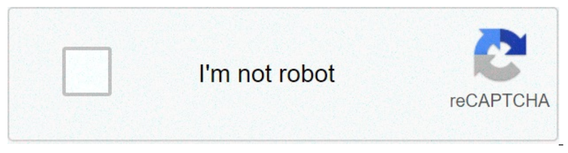

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Kiwi dna extraction lab answers

IntroductionAll living things, bananas and people included, pass on information from one generation to the next using the same basic material, DNA. Within every living organism, most cells contain a complete set of DNA instructions. The information in DNA tells our bodies how to develop, grow, and work. It also controls many of the features that make an organism unique.DNA or deoxyribonucleic acid is found in all living things. Its natural shape is called a double helix and when seen under extremely high-powered microscopes, it looks kind of like a ladder twisted into a spiral shape.These instructions are in segments of DNA called genes. Genes, along with other parts of our DNA that turn genes on and off, hold information for how our body develops and functions. They produce molecules called proteins that do most of the work in the body. Variants of genes, called alleles, are responsible for differences in hair color, eye color, and earlobe shape.All of these instructions fit within tiny packages within our tiny cells, so that is all way too tiny for anyone to ever really see or touch, right? Well, not entirely. Because DNA is in every cell, there is a lot of it in an organism. If you took all of the DNA out of some middle-sized organism (or part of an organism, like a piece of fruit), you could see and even touch DNA. We will use common household products to break apart the cells in a banana and extract out the DNA. While you may know of the double-helix structure of DNA, you can't see that structure with the naked eye. So when seeing it without a high-powered microscope...what does DNA look like?Materials 1/2 peeled ripe banana (you can also use strawberries or other fruit)1/2 cup hot water1 tsp salt1/2 tsp liquid dishwashing soapresealable zip-top bag (quart size)very cold rubbing alcohol (isopropyl alcohol) placed in freezer ahead of timecoffee filternarrow glasswooden stirrerWatch biologist Melissa Wilson Sayres as she shows you step-by-step how to extract DNA from a banana.Extracting DNA in 10 Easy StepsMush the banana in the resealable bag for about a minute until all the lumps are gone and it almost looks like pudding.Fill a cup with the hot water and salt.Pour the saltwater mix into the bag. Close the bag and very gently squeeze and move the saltwater and banana mush together. Do this for 30 to 45 seconds.Add the dishwashing soap into the bag and gently mix the contents. Try to avoid making too much foam.Place the coffee filter in a clear glass cup, securing the top of the filter around the lip of the cup.Pour the mix into the filter and let it sit until all of the liquid drips down into the cup.Remove and discard the used coffee filter.Tilt the glass and slowly add cold alcohol down the side of the cup. You want the alcohol to form a layer on top of the banana mix, staying separated, so be careful not to pour it too fast. Make a layer of alcohol that is 2.5-5cm (1-2in) thick.After the alcohol layer is set up, wait for eight minutes. You may see some bubbles and cloudy material moving around in the alcohol. This is the DNA pieces clumping together.Use the wooden stirrer to start poking the cloudy stuff in the alcohol layer. Spin the stirrer it in place to start gathering the cloudy stuff. When you are done, take a closer look at the stuff on the stirrer. You are looking at DNA!(Teacher & student packet is available.)What Happened?You may understand that mashing a banana can break cells apart and help break apart cell walls, but why was all that other stuff added? And how did we get inside the cells and get the DNA to stick together?Let's think of three of the main items we added to the bananas.Saltwater - The bananas were mashed with saltwater before anything else was added. But this was a special step preparing for the addition of the dish soap. Once the dish soap helps release the DNA, this salt will help the DNA strands to stick to each other in clumps large enough for you to see.Dish soap - Dish soap can help split apart the membranes (the outer "skin") that hold cells together. These membranes are made of a type of molecule called lipids. When you think of lipids, think of fats and oils. Dish soap "cuts through grease" because it actually separates those greasy molecules from each other. Now, the molecules that make the membranes around cells and the nucleus (which holds DNA) are lipids. So when dish soap is added, the cell membrane and the nuclei are broken apart, releasing the DNA.Alcohol - The DNA clumps are soluble (can be dissolved) in some liquids, but not in alcohol. So adding alcohol helps the clumps of DNA to form. Credits Banana and Strawberry image by Ralph Daily via Wikimedia Commons. Strawberries Zip-closure sandwich bag DNA extracting solution (mix about 1 tablespoon of dish detergent and 1 teaspoon of salt into 1 cup of water) Plastic cup Gauze, cheesecloth or coffee filter Rubber band Test tube (or smaller cup) Dropper or spoon Denatured alcohol eg. methylated spirits or rubbing alcohol (put in the freezer for best results) Place a strawberry in a zip-closure bag and remove most of the air before you seal the bag. Mash the strawberry through the bag in your hand. Do not hit against the table as this may damage the DNA. Add 2 tablespoons of the DNA extracting solution. Continue mixing and mashing the bag in your hand. Place the piece of gauze or cheesecloth over the opening of the cup, securing it with a rubber band. Carefully pour the strawberry mixture into the cup making sure to catch the solids with the gauze. Take a dropper or spoonful of the liquid out of the cup and place in the test tube or smaller cup. Add a dropper or spoonful of the alcohol to the test tube. Take care not to tilt or tip the test tube; do not mix the two liquids. Observe the line between the strawberry mixture and the alcohol. You will notice a white thread-like cloud appearing at this line. This is strawberry DNA. The DNA will clump together and float to the top of the alcohol layer. Take a photo of your findings and share your scientific success with your friends and family! This unit covers the differences between sexual and asexual reproduction, the structure of DNA and its role in making proteins, mutations and their effects and how characteristics are inherited. Bring Science HomeA genetically geared activity from Science BuddiesAdvertisement Key concepts DNA Genome Genes Extraction Laboratory techniques Introduction Have you ever wondered how scientists extract DNA from an organism? All living organisms have DNA, which is short for deoxyribonucleic acid; it is basically the blueprint for everything that happens inside an organism's cells. Overall, DNA tells an organism how to develop and function, and is so important that this complex compound is found in virtually every one of its cells. In this activity you'll make your own DNA extraction kit from household chemicals and use it to separate DNA from strawberries. Background Whether you're a human, rat, tomato or bacterium, each of your cells will have DNA inside of it (with some rare exceptions, such as mature red blood cells in humans). Each cell has an entire copy of the same set of instructions, and this set is called the genome. Scientists study DNA for many reasons: They can figure out how the instructions stored in DNA help your body to function properly. They can use DNA to make new medicines or genetically modify crops to be resistant to insects. They can solve who is a suspect of a crime, and can even use ancient DNA to reconstruct evolutionary histories! To get the DNA from a cell, scientists typically rely on one of many DNA extraction kits available from biotechnology companies. During a DNA extraction, a detergent will cause the cell to pop open, or lyse, so that the DNA is released into solution. Then alcohol added to the solution causes the DNA to precipitate out. In this activity, strawberries will be used because each strawberry cell has eight copies of the genome, giving them a lot of DNA per cell. (Most organisms only have one genome copy per cell.) Materials Rubbing alcohol Measuring cup Measuring spoons Salt Water Dishwashing liquid (for hand-washing dishes) Glass or small bowl Cheesecloth Funnel Tall drinking glass Three strawberries Resealable plastic sandwich bag Small glass jar (such as a spice or baby food jar) Bamboo skewer, available at most grocery stores. (If you use a baby food or short spice jar, you could substitute a toothpick for the skewer.) Preparation Chill the rubbing alcohol in the freezer. (You'll need it later.) Mix one half teaspoon of salt, one third cup of water and one tablespoon of dishwashing liquid in a glass or small bowl. Set the mixture aside. This is your extraction liquid. Why do you think there is detergent in the extraction liquid? Completely line the funnel with cheesecloth. Insert the funnel tube into the tall drinking glass (not the glass with the extraction liquid in it). Remove and discard the green tops from the strawberries. Procedure Put the strawberries into a resealable plastic sandwich bag and push out all of the extra air. Seal the bag tightly. With your fingers, squeeze and smash the strawberries for two minutes. How do the smashed strawberries look? Add three tablespoons of the extraction liquid you prepared to the strawberries in the bag. Push out all of the extra air and reseal the bag. How do you think the detergent and salt will affect the strawberry cells? Squeeze the strawberry mixture with your fingers for one minute. How do the smashed strawberries look now? Pour the strawberry mixture from the bag into the funnel. Let it drip through the cheesecloth and into the tall glass until there is very little liquid left in the funnel (only wet pulp remains). How does the filtered strawberry liquid look? Pour the filtered strawberry liquid from the tall glass into the small glass jar so that the jar is one quarter full. Measure out one half cup of cold rubbing alcohol. Tilt the jar and very slowly pour the alcohol down its side. Pour until the alcohol has formed approximately a one-inch-deep layer on top of the strawberry liquid. You may not need all of the one half cup of alcohol to form the one-inch layer. Do not let the strawberry liquid and alcohol mix. Study the mixture inside of the jar. The strawberry DNA will appear as gooey clear/white stringy stuff. Do you see anything in the jar that might be strawberry DNA? If so, where in the jar is it? Dip the bamboo skewer into the jar where the strawberry liquid and alcohol layers meet and then pull up the skewer. Did you see anything stick to the skewer that might be DNA? Can you spool any DNA onto the skewer? Extra: You can try using this DNA extraction activity on lots of other things. Grab some oatmeal or kiwis from the kitchen and try it again! Which foods give you the most DNA? Extra: If you have access to a milligram scale (called a balance), you can measure how much DNA you get (called a yield). Just weigh your clean bamboo skewer and then weigh the skewer again after you have used it to fish out as much DNA as you could from your strawberry DNA extraction. Subtract the initial weight of the skewer from its weight with the DNA to get your final yield of DNA. What was the weight of your DNA yield? Extra: Try to tweak different variables in this activity to see how you could change your strawberry DNA yield. For example, you could try starting with different amounts of strawberries, using different detergents or different DNA sources (such as oatmeal or kiwis). Which conditions give you the best DNA yield? Observations and results Were you able to see DNA in the small jar when you added the cold rubbing alcohol? Was the DNA mostly in the layer with the alcohol and between the layers of alcohol and strawberry liquid? When you added the salt and detergent mixture to the smashed strawberries, the detergent helped lyse (pop open) the strawberry cells, releasing the DNA into solution, whereas the salt helped create an environment where the different DNA strands could gather and clump, making it easier for you to see them. (When you added the salt and detergent mixture, you probably mostly just saw more bubbles form in the bag because of the detergent.) After you added the cold rubbing alcohol to the filtered strawberry liquid, the alcohol should have precipitated the DNA out of the liquid while the rest of the liquid remained in solution. You should have seen the white/clear gooey DNA strands in the alcohol layer as well as between the two layers. A single strand of DNA is extremely tiny, too tiny to see with the naked eye, but because the DNA clumped in this activity you were able to see just how much of it three strawberries have when all of their octoploid cells are combined! ("Octoploid" means they have eight genomes.) More to explore Do-It-Yourself Strawberry DNA, from the Tech Museum of Innovation, Stanford School of Medicine About Genetics, from the Tech Museum of Innovation, Stanford School of Medicine DNA Extraction Virtual Lab, from Learn Genetics, the University of Utah Do-It-Yourself DNA, from Science Buddies This activity brought to you in partnership with Science Buddies Discover world-changing science. Explore our digital archive back to 1845, including articles by more than 150 Nobel Prize winners.Subscribe Now! DNA Extraction Labby The DNA Extraction Lab has to be one of the best and easiest hands on science activities to implement! I was very nervous to do my first in class "experiment" with students. I feared a total classroom management breakdown. Surprisingly, it went much better than expected! Materials:Strawberries/kiwiExtract your own DNAby A method sheet that discusses how to extract your own DNA from cheek cells. Highly engaging and suitable as a starter activity for any biology topic involving nucleic acids. Much more interesting than the usual extraction of DNA from Kiwi fruit or onions!Subjects: Background: The long, thick fibers of DNA store the information for the functioning of the chemistry of life. DNA is present in every cell of plants and animals. The DNA found in strawberry cells can be extracted using common, everyday materials. Strawberries are soft and easy to pulverize. Strawberries have large genomes; they are octoploid, which means they have eight of each type of chromosome in each cell. Thus, strawberries are an exceptional fruit to use in DNA extraction labs and strawberries yield more DNA than any other fruit (i.e. banana, kiwi, etc.). We will use an extraction buffer containing salt, to break up protein chains that bind around the nucleic acids, and dish soap which helps to dissolve the phospholipid bilayers of the cell membrane and organelles. This extraction buffer will help provide us access to the DNA inside the cells. DNA is not soluble in alcohol. The colder the alcohol, the less soluble the DNA will be in it. Thus make sure to keep the alcohol in the freezer or on ice. Materials: heavy duty quart ziploc bag Strawberry Table salt Shampoo (look for sodium lauryl sulfate as a first ingredient) Water Cheesecloth or similar loose woven fabric Funnel 50mL vial / test tube or similar container 500 mL beaker or mason jar glass rod, popsicle stick, wooden skewer or toothpick chilled (refrigerated or briefly frozen) isopropyl alcohol Warning: Isopropyl alcohol is a skin irritant, and inhaling or consuming it can make you sick. Use in a well ventilated space. Alcohols are also flammable and the vapors can ignite. Keep away from open flame. Procedure: Gather all materials. Prepare the DNA extraction buffer. In 500 mL beaker add 400mL (1 ¾ cups) water 50mL (3 Tablespoons + 1 teaspoon) shampoo 5mL (2 teaspoons) table salt Slowly invert the bottle to mix the extraction buffer. Place one strawberry in a Ziploc bag. Smash/grind up the strawberry using your fist and fingers for 2 minutes. Careful not to break the bag! Why? The physical smashing breaks the plant's cell walls and allows the cytoplasm to leak out. Add 10mL (2 teaspoons) of extraction buffer (salt and soap solution) to the bag. Kneed/mush the strawberry in the bag again for 1 minute. Why the detergent? The soap breaks down the lipids (fats) in the phospholipid bi-layers of the cell membrane and nuclear membrane. This releases the contents from the cell and the chromosomes containing DNA from the nucleus. Assemble your filtration apparatus as shown to the right. Pour the strawberry slurry into the filtration apparatus and let it drip directly into your test tube. Why? Filtering strains all the large cellular junk out of the mix. The DNA, still tightly wound, is so small it slips through with the liquid and into the test tube. Caution! From this stage onward, you must be careful not to agitate the mixture. Gently Slowly pour 20mL (1 Tablespoon + 1 teaspoon) cold alcohol down the inside wall of the test tube to form a separate, clear layer on top of the cloudy strawberry mixture below (You should see small wisps of gel-like material forming above the boundary.) OBSERVE Why? The polar/non-polar boundary layer causes the DNA to precipitate. The tiny bits of wispy junk floating in the alcohol just above the boundary layer is DNA. Dip the glass rod or wooden stick into the tube where the strawberry extract and alcohol layers come into contact with each other. OBSERVE If the procedure worked really well (it often doesn't) you will get long strands of DNA forming, sometimes more than an inch long! Using the bamboo skewer or toothpick, gently wind up the precipitated DNA. As you gently lift the skewer or toothpick out of the container after winding, it will carry long strands of a mucus-like substance that looks like "boogers." That's concentrated DNA, just like they do it on CSI ;-) If it didn't work perfectly, don't despair. Most people see the wispy stuff, but you have to get a bit lucky to get the long strands to form References and Resources: Video: Video: