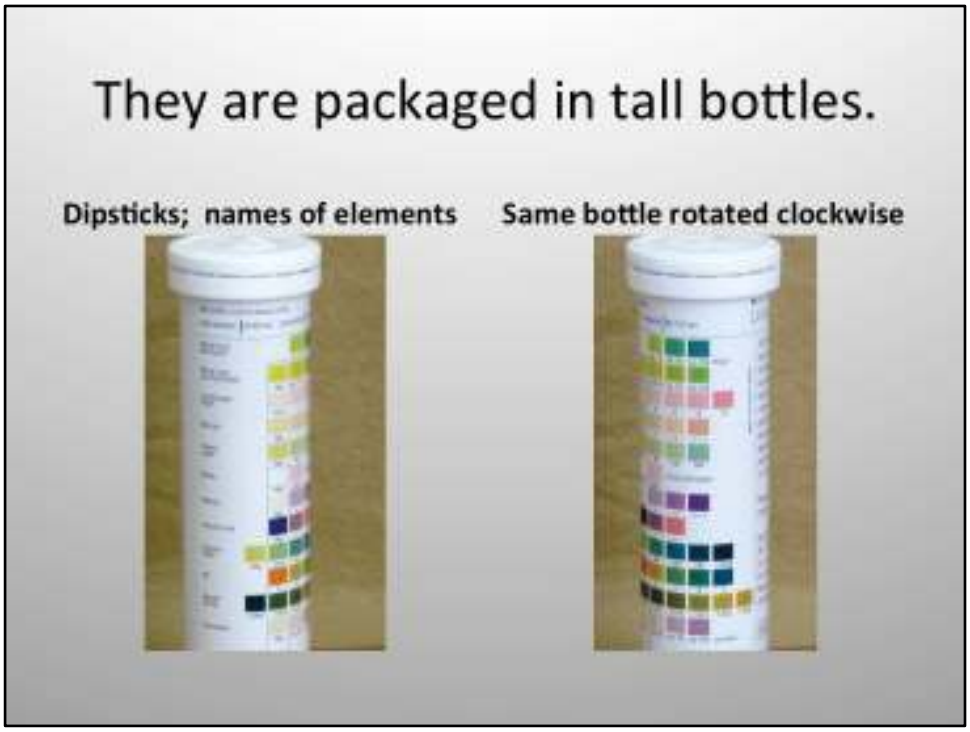
Urinalysis
urine dipsticks and alternatives

By Mary Vanderkooi M.D.

Urine dipsticks are a laboratory in a bottle; they are an important asset as you practice medicine in Timbuktu. There is a handout for this lecture which the students should have before them.

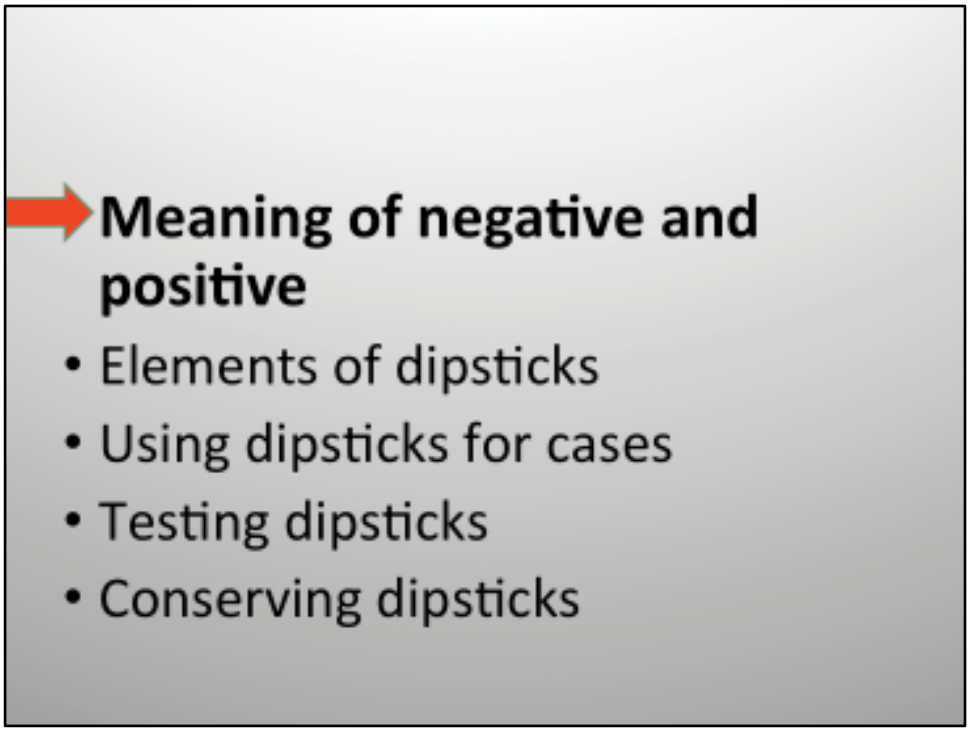
Dipsticks are strips of plastic. On one end there are black arrows printed, showing that that is the “handle” end. Bits of paper are pasted on each dipstick, each paper impregnated with a different chemical. These are called elements. Some examples of elements are blood and protein. Substances in the urine cause the bits of paper to turn various colors. Detecting these substances will help you make a correct diagnosis.



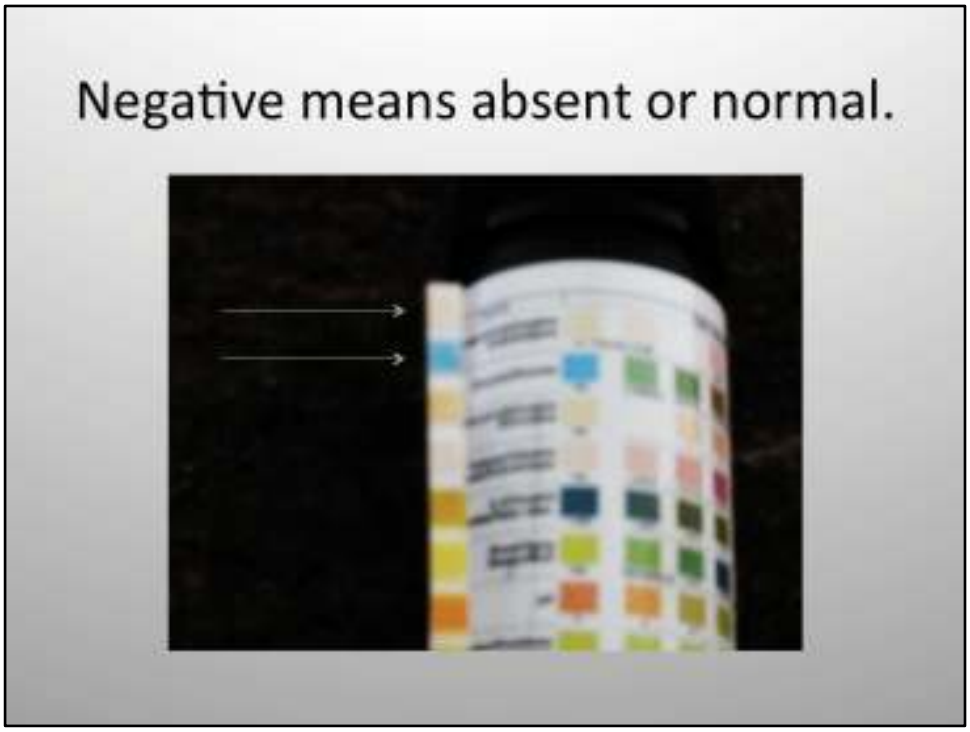
On the outside of the dipstick bottle there are the color standards. The color standard consists of the name of each element, followed by a series of colored squares. Usually the first column indicates a negative or normal color result for that element. The subsequent columns indicate the presence of the indicated substance in the urine.

Different brands of dipsticks have the elements in different orders and may have different chemicals. Don't bother learning the order and the colors that you use for this course. They do not apply elsewhere.

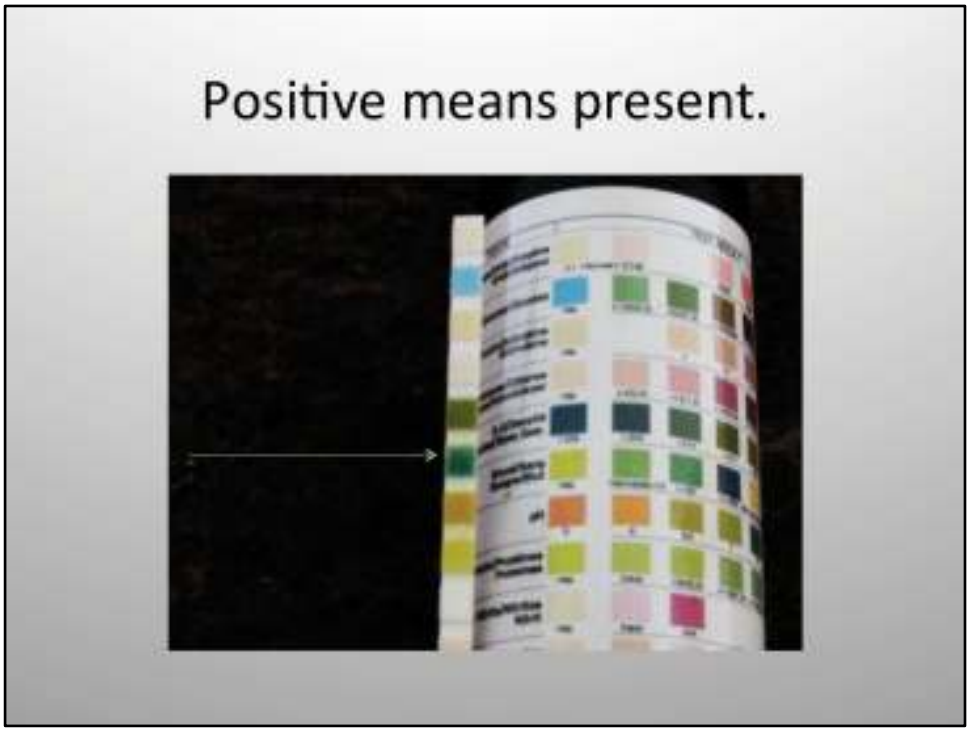
After dipping a stick into the urine, it is important that you hold it horizontally or nearly so, so the colors of the various elements don't run into each other. Hold the bottle horizontally also. You should wait the indicated time, usually 60 seconds, and then compare the colors. The leukocyte colors are usually read after 120 seconds. Note which elements are abnormal and to what extent they are.



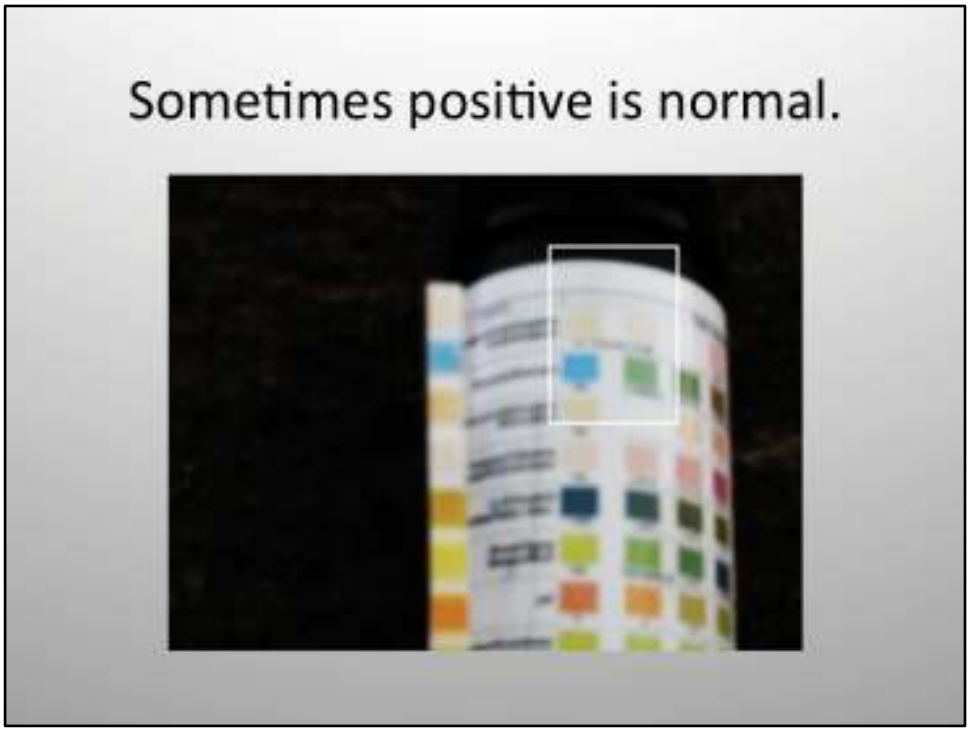
There are many substances, especially salts, that are normally present in all urine. The dipsticks do not test for these. Dipsticks test for substances that either should not be present, or they should not be present in more than a certain amount.



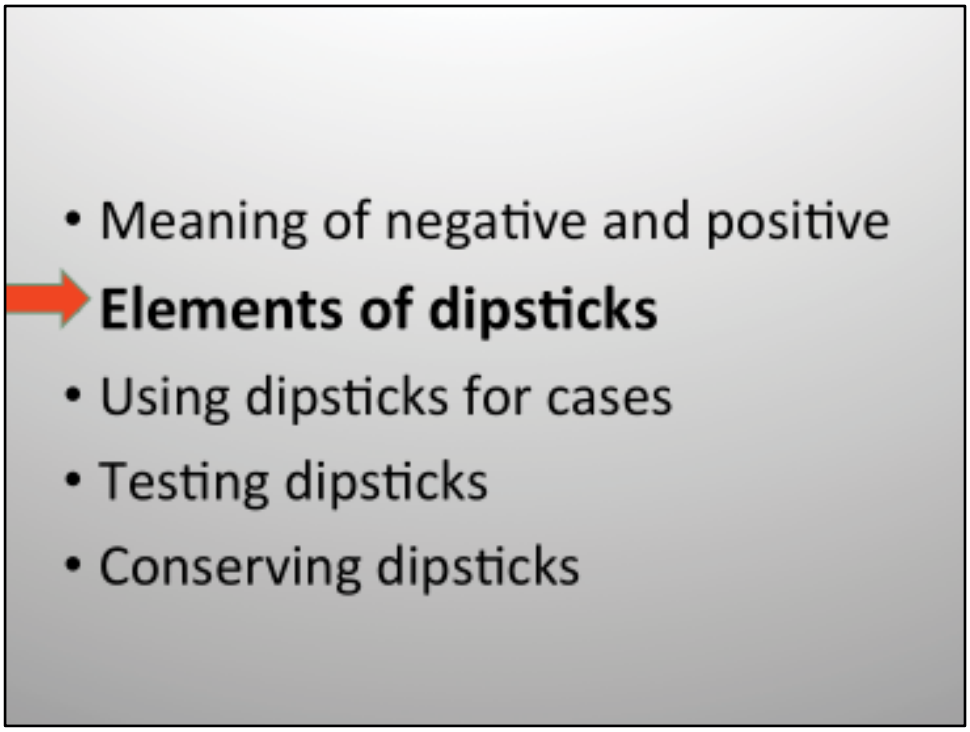
If an abnormal substance is absent from the urine, then the urine is negative in this respect. It is a strong vote against the patient having certain conditions. The conditions that he doesn't have are those that ordinarily put the particular substance in the urine.



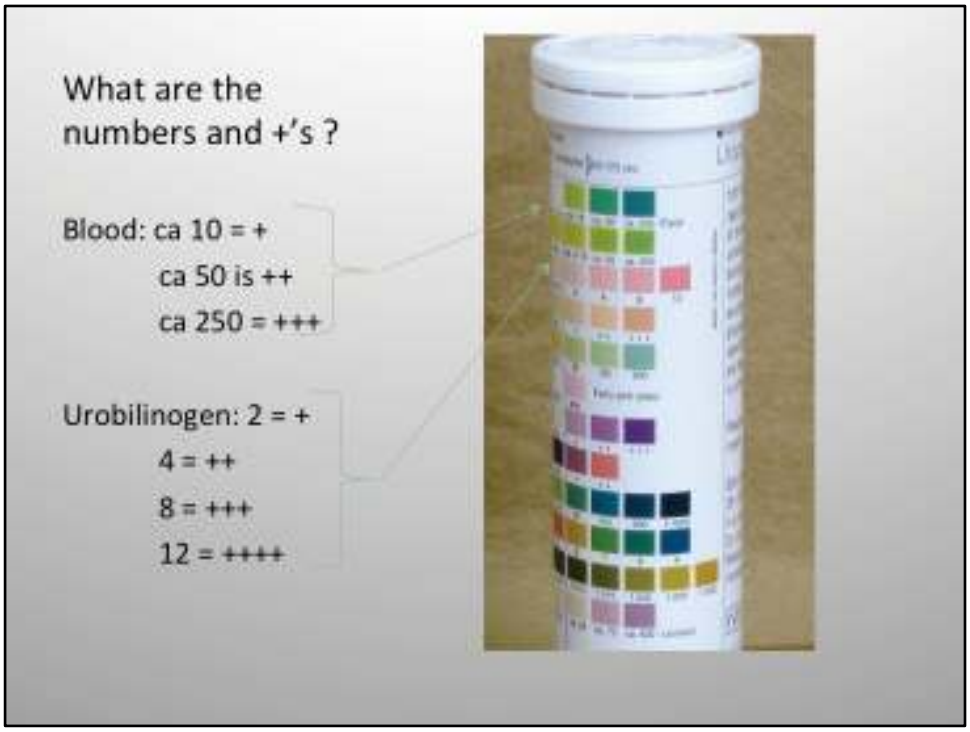
If the urinalysis is positive, it means one finds a particular substance that should not be there or that should be present in only small amounts. Usually a positive result is an abnormal result. It indicates that the patient has a disease or some other condition that most other people do not have.



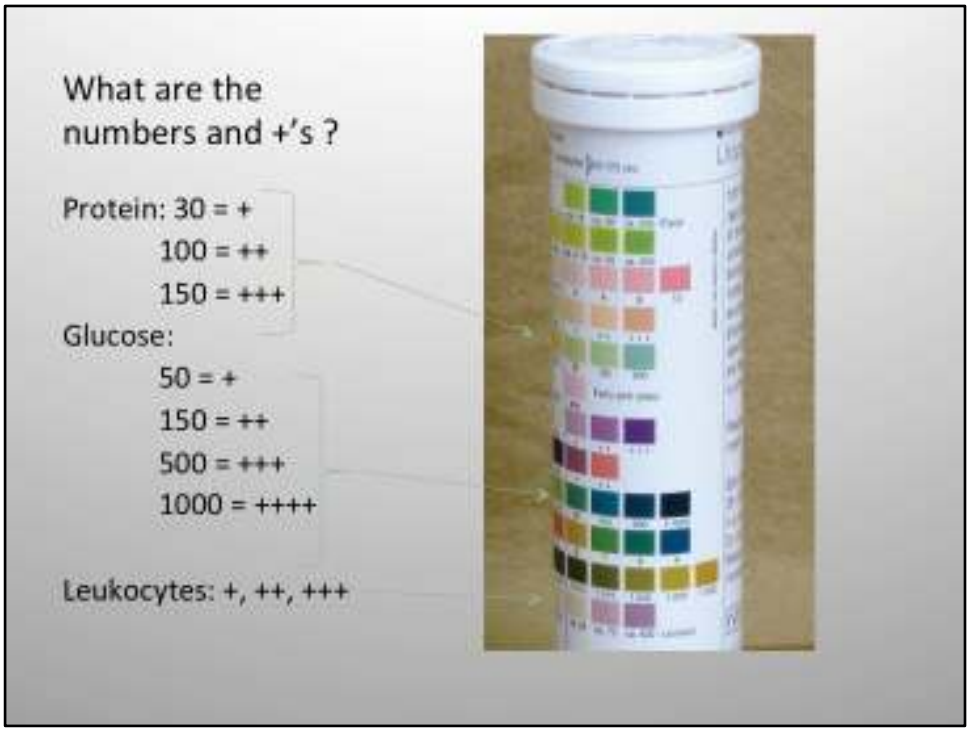
A positive result may on occasion be normal. The box on the photograph shows normals for urobilinogen and for glucose. A little bit of these two substances in urine is entirely normal. A result like this is both positive and normal. Usually, however, we consider a positive test result to indicate a disease condition.



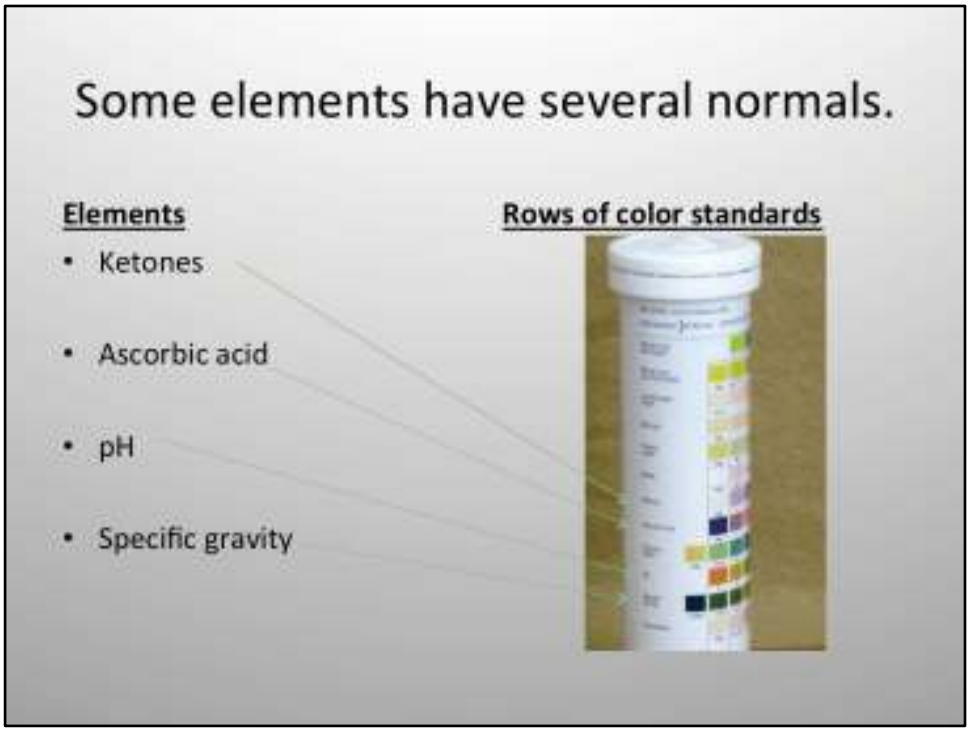
Each row of squares on the outside of the bottle is called an element. We will now consider what these elements usually are.



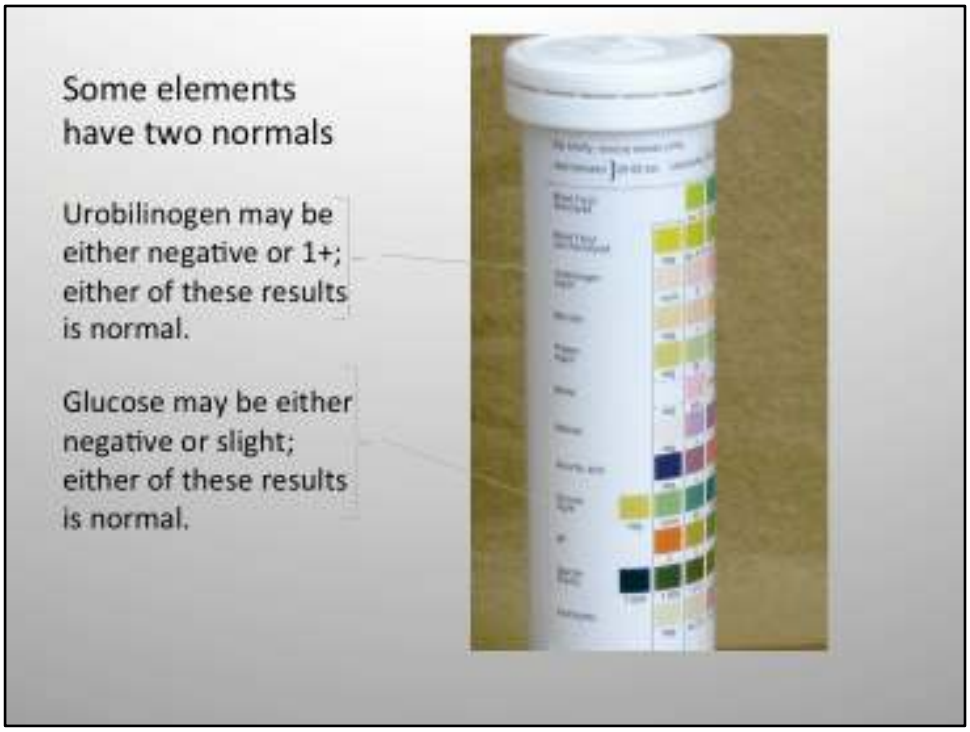
Some of the element standards have numbers by the various colors and some of them have +, ++, or +++. It is easiest to use the plus system. A simple + or 1+ means that that element is present in the urine in a small amount. Likewise 2+ stands for a moderate amount, and 3+ stands for a large amount. The illustration shows how this works out for blood and urobilinogen.



The situation is similar with the substances protein, glucose, and leukocytes. There is a box around the negative results, indicating the absence of these substances in the urine. Anything to the right of this indicates the presence of these substances in various amounts.

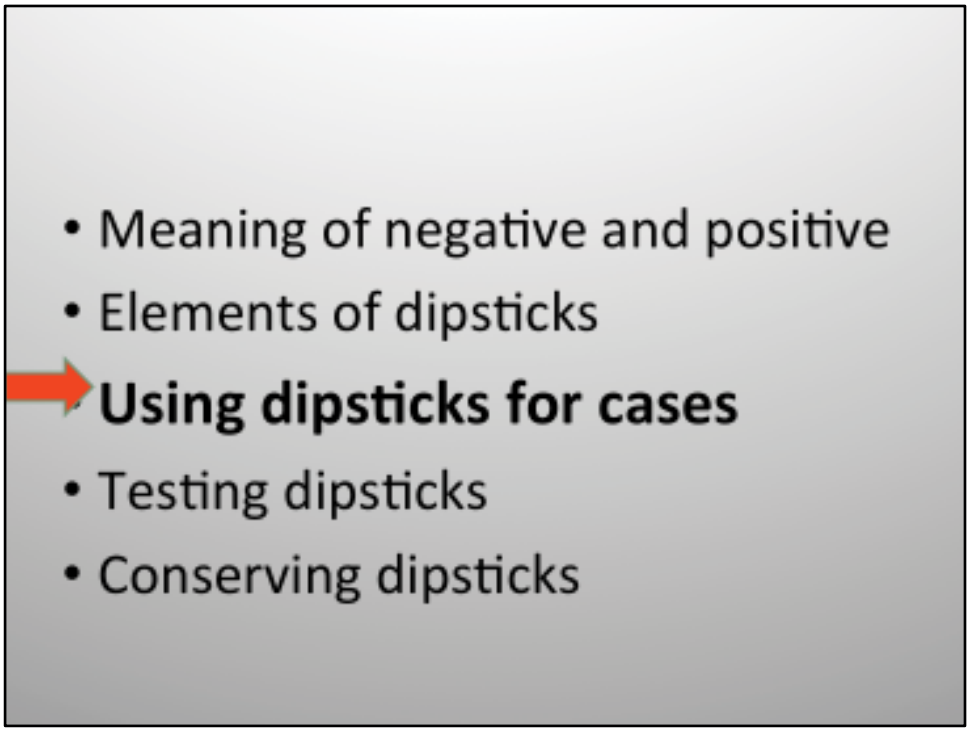


Some portions of the dipstick change color according to what the patient ate or drank recently. Hence, for these elements, there is a wide range of normal. Ketones, ascorbic acid, pH, and specific gravity are in this category. With some diets, other elements may appear to be abnormal in nearly all the population. This may render that element useless for diagnosis.

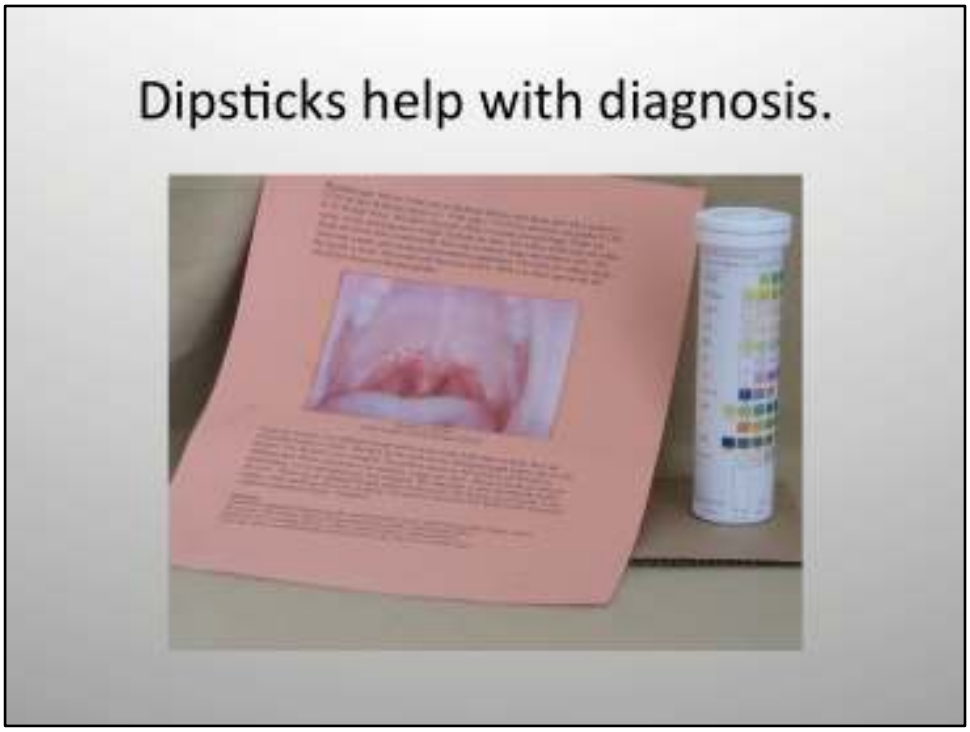


Urobilinogen and glucose both have two normals. Small amounts of these substances in the urine are consistent with health.

Some substances should not appear in the urine at all. If they do , it indicates a problem. Blood, bilirubin, nitrite, and leukocytes are in this category. There is only one normal for these, the color that indicates their absence in the urine.

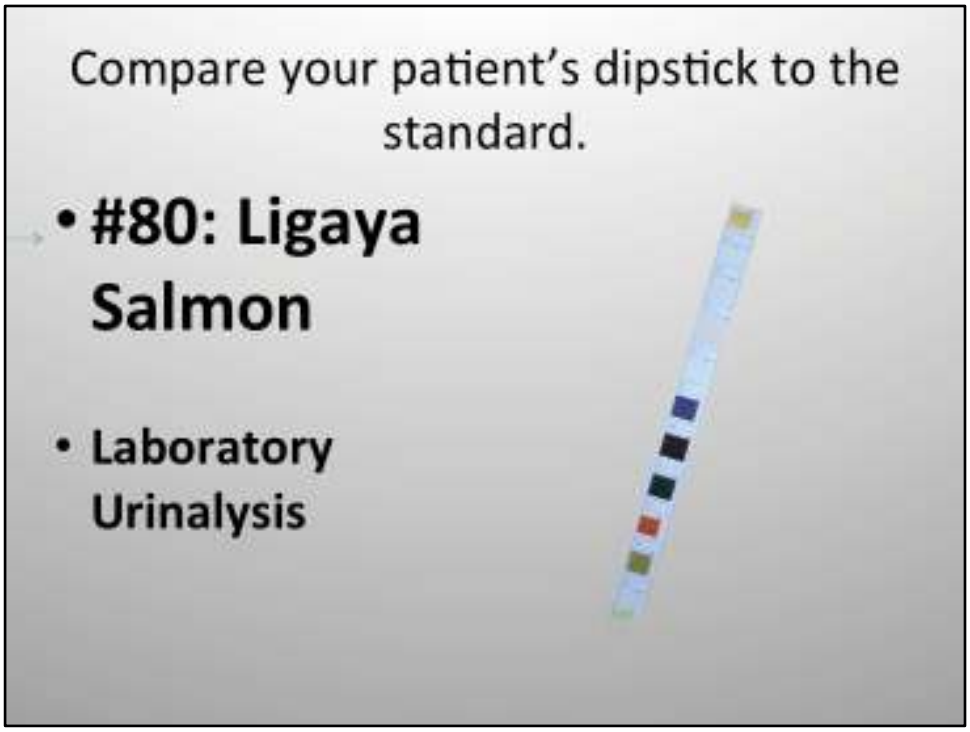


You should become comfortable with using and interpreting dipsticks; hence many of the case studies include color reproductions of urine dipsticks.

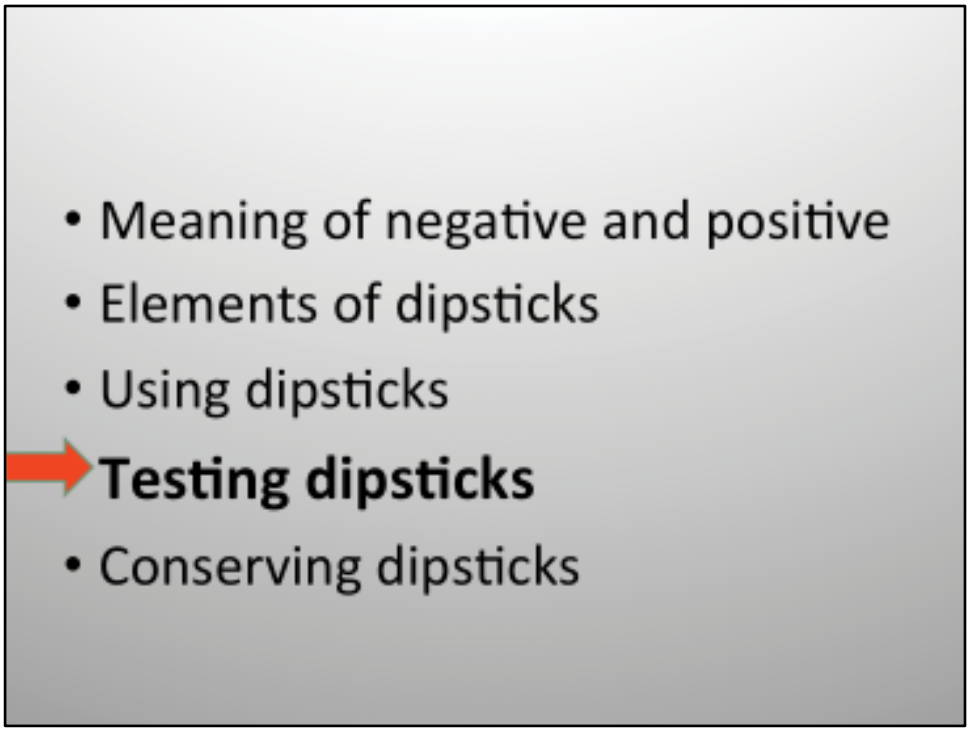


Some of the cases you solve in the medical course require dipstick results. The dipstick may confirm the candidate diagnosis or suggest another.

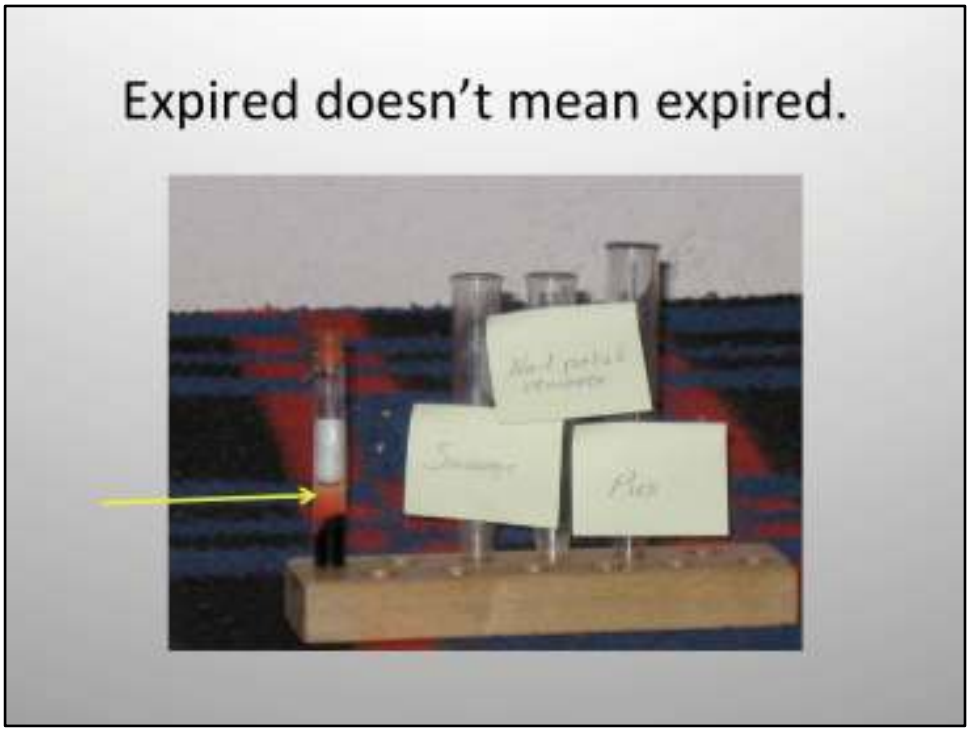
You will be given a sheet of paper with the color standards for the case urinalyses in the case studies. The colors resemble those of the bottle used to illustrate this lecture, but they are not exact. The color standard used for the cases should not be used for real-life dipsticks. However, the standard is consistent and adequate for doing the cases.



If a case has a urinalysis available, you will be able to find a facsimile of the moistened dipstick on the question portion of the case. You must compare that to your copy of the color standards in order to determine which elements are abnormal. This will aid you in finding the correct diagnosis.

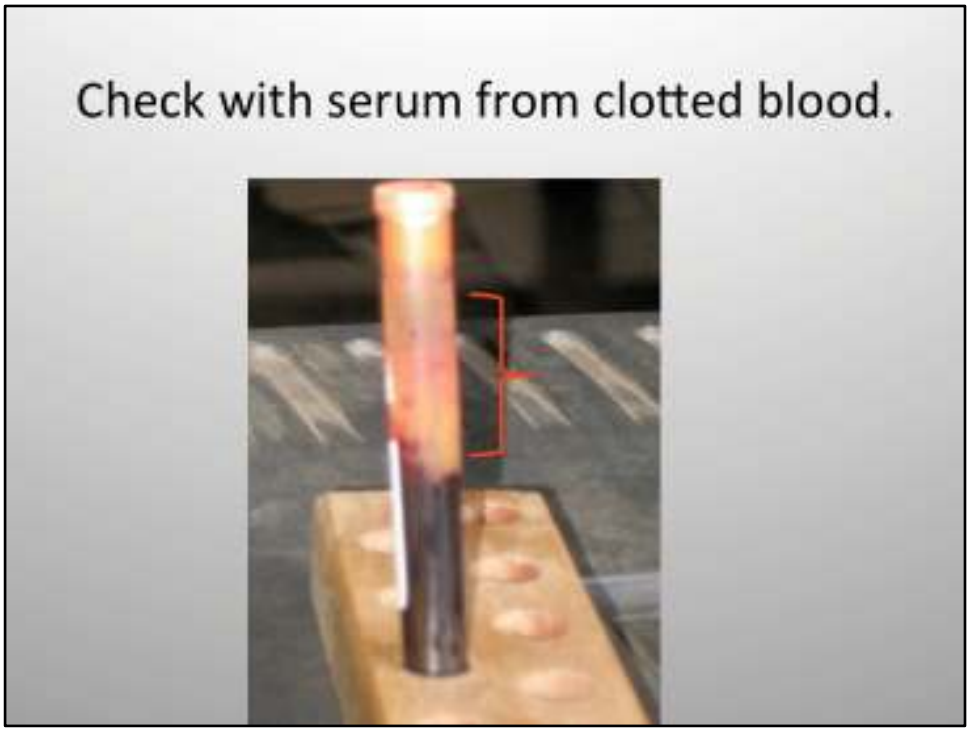


It is important that you not run out of dipsticks and that your dipsticks give you accurate results. Therefore, you need to be able to test them.

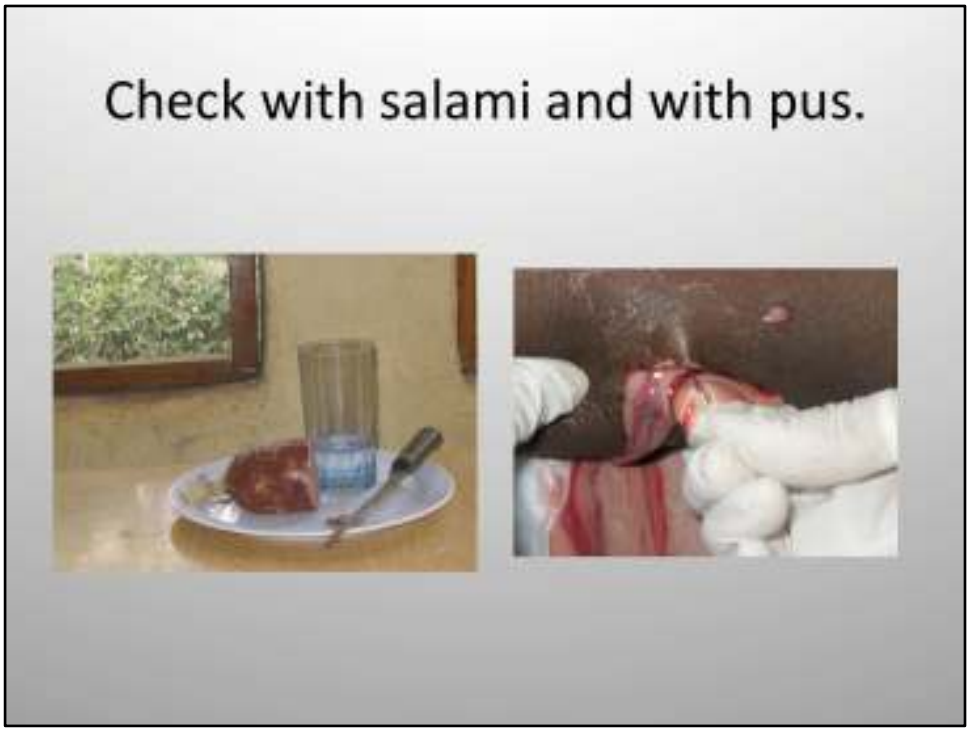


Urinalysis dipsticks have expiration dates on them. Supposedly you should throw out the dipsticks when they are expired. An alternative to this wastefulness, however, is to check which elements on the dipstick are still good and which are not.

The pH section of the dipsticks never goes bad. You don't need specific gravity to determine dehydration; you need only look in your patient's mouth. That section is useless anyway. Hence, there is no need to test for the accuracy of either the pH or specific gravity elements.



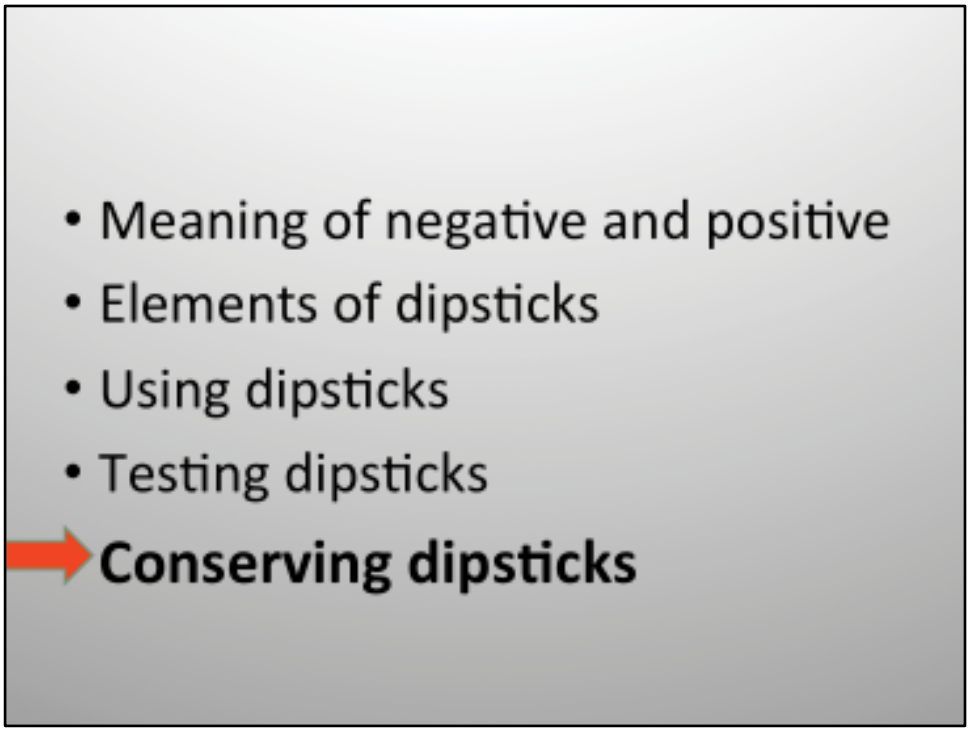
Draw some blood from the arm of a patient or a friend. Put it in a plain, clean glass container with a small diameter. A clean, empty antibiotic vial will do. The blood will clot and the clot will navigate to the bottom and side of the container. The serum, a slightly yellowish liquid, will go to the top.. In the photograph, the serum is indicated with the red bracket. Withdraw some of the serum and squirt it on your dipstick. Blood, protein, and glucose will be positive if those portions of the dipsticks are good.



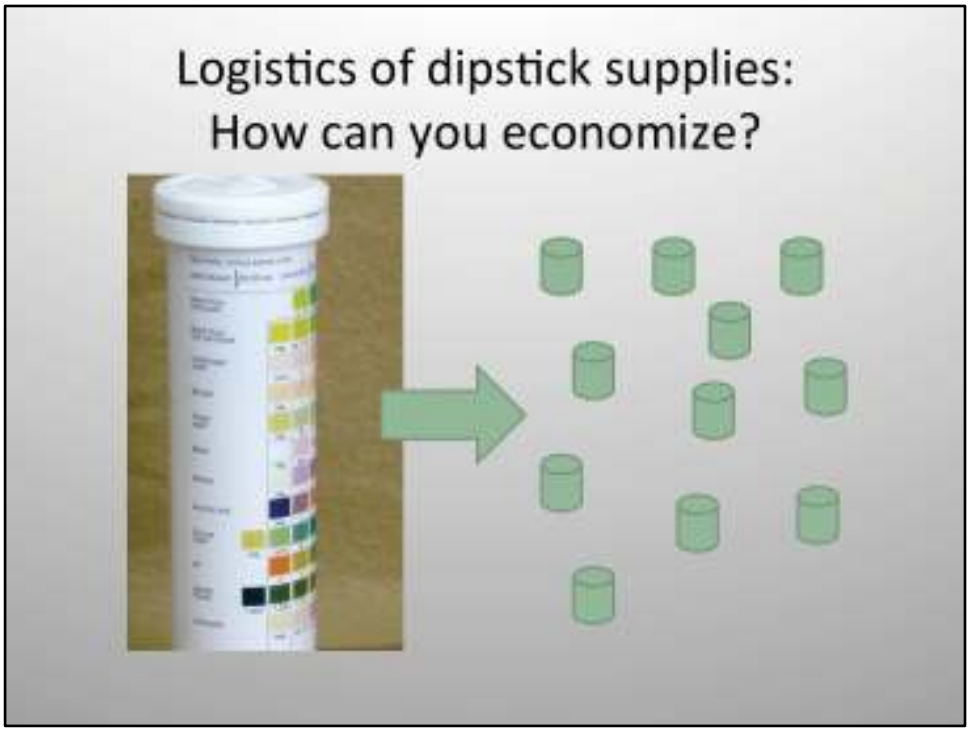
Cut a sliver of sausage, something like salami. Put it in a container of water and let it sit for an hour. The nitrite section of your dipstick will turn positive and possibly the blood portion also, if it is good. Put some pus in a little water in a third tube. The leukocyte section of the dipstick will turn positive, and most of the time the blood element also. A teenager with acne is a good source of pus, or a draining abscess like the one pictured.

Put a drop of fingernail polish remover into some water. The ketones section of the dipstick should turn positive.

Testing bilirubin and urobilinogen is more difficult. For bilirubin, you need urine from a jaundiced patient with liver problems. For urobilinogen, you need to find a malaria patient in the high-fever phase. Once you have these two urines, put some in old, cleaned, labeled vials and freeze it. It should be good indefinitely—you can thaw it to check dipsticks, then refreeze it. If you find a patient with positive bilirubin and urobilinogen both, you can use just one frozen urine sample rather than two.



If you have an adequate supply of dipsticks, then skip the next 6 slides. Go directly to the slide showing alternatives to dipsticks. If procurement will be a problem for you, then you will want to know how to cut the dipsticks so the elements can be used separately. The next 6 slides show how to do that.

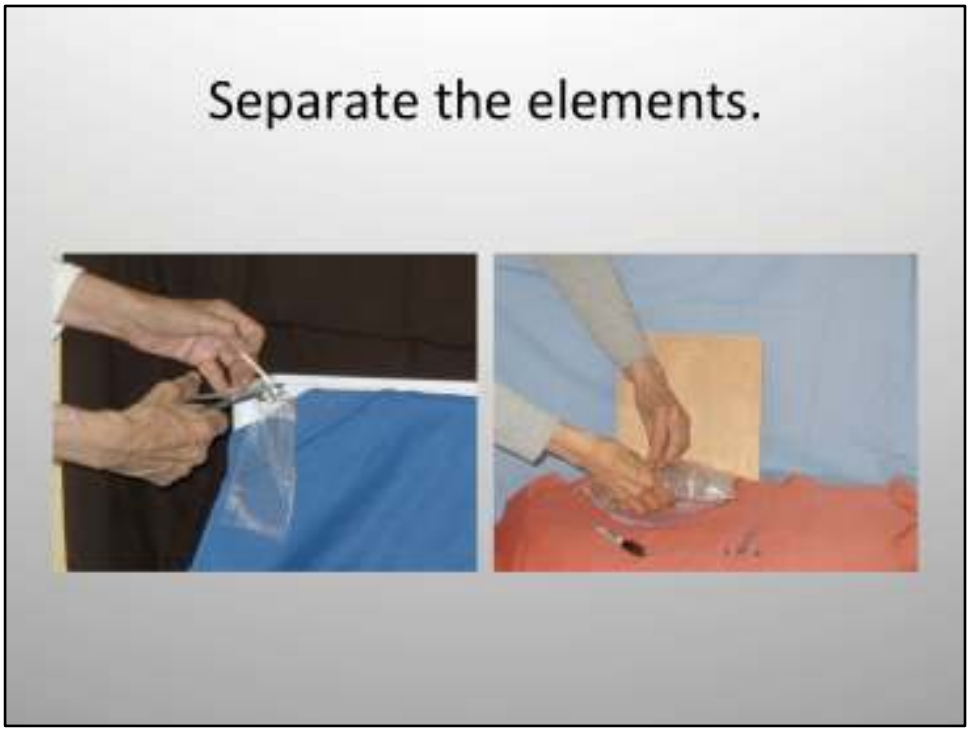


You do not need to determine every substance on every patient. Doing a complete urinalysis on every patient is a waste of money. After you make your differential diagnosis and read about the various diseases, you will note that some of them will involve positive results on the urine dipsticks. You need only check the particular elements that are mentioned. If you are considering diabetes, then you need only test for glucose and ketones. If you are considering hepatitis, you need only check for bilirubin and urobilinogen. You can economize by only testing for what you need to know. How is that done? It is done by separating the elements, cutting each dipstick into its component pieces.

The least bit of moisture will ruin the dipsticks. As long as the intact dipsticks are in the original bottle, they will stay good because of the dessicant in the lid. Dessicant absorbs moisture and thus keeps the sticks dry. If you want to separate the elements, then you must provide dessicant to take the place of the bottle cap.

Dessicant is a substance that looks like vermiculite, used for drying flowers. It is usually available with chemical supplies and also in craft stores. It comes in bags which are best left intact rather than emptied. Drive the moisture out of your dessicant beforehand by heating it (bag and all) in a very low oven for 24 hours. Put this in a sealed container, ready to receive the component parts of the dipsticks.

You need to have clean, dry containers to receive the elements of your dipsticks. Two options are pictured. On the left there are small zip-lock plastic baggies held open and lined up with pinching clothespins. On the right is a tray of small containers with screw tops. Label each bag or bottle with the name of the dipstick element it contains.



Use a very clean, dry scissors. Starting at the far end, snip off the last element along with the portion of plastic between that and the adjacent element. As you snip off each, let it drop untouched into a very small zip-lock plastic bag, film canister or another small container. Line the containers up and be very careful to get the right element in the right container.

Place a bag of dried dessicant in a new, closeable, good-quality plastic bag, gallon size. Then add the separated elements in their bags or bottles, and seal the plastic bag. This will keep everything dry.

When removing a piece of dipstick, use tweezers. Your fingers will impart moisture to the pieces and ruin them.

There are alternative tests for protein and for bilirubin in the urine. If a patient's body is generally swollen, it is due to heart failure, liver failure, or kidney failure. If the problem is liver failure, he will have bilirubin in his urine. Take a sample of the patient's urine and a sample of your own urine. Put them in two glass vials and shake them. Then compare the heads of foam. If there is bilirubin in the urine, there will be a larger head of foam and the foam will have a slightly yellowish color. To check for protein, put some urine in a test tube (or even an old tin can will do) and boil it. If there is a lot of protein in it, the urine will turn milky white, like cooked egg white.

THE END

Feedback, suggestions, and questions are welcome.

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