



8.0 The Basic Laboratory

8.1 Diagnosis

The basics of a diagnosis can generally be reached by a careful history and physical examination. Modern medicine relies heavily on laboratory investigations. In a survival situation these will not be available. However there are some simple laboratory tests which can be performed with very little equipment or chemicals. The problem is that even basic tests require some equipment. Ranging from simple test strips to a microscope and a few chemicals. Obviously what you are preparing for will dictate what tests you may want to be able to perform.

8.2 Urine Testing

Urine Testing: Urine is easily tested with multi-function dip stix. These can test for the presence of protein, glucose, ketones, nitrates, red blood cells and white blood cells. The test strip is dipped in a specimen of clean catch urine (i.e. you start to pee in the toilet, stop, then start again into the specimen container, stop, and continue into the toilet) and panels containing the test reagents change color depending on the presence and concentrations of the substance being tested for. The color changes are compared to a table supplied with the strips. Can be used to diagnose urinary infections, toxemia in pregnancy, dehydration, diabetes (outside pregnancy) and renal stones/colic.

The following is a quote on analyzing urine from a book to be published on the practice of medicine under relatively primitive conditions.

From . Roberts, S. D.; A Guide to the Practice of Medicine Under Austere Conditions (Revised Ed.), 1997, to be published.

Urinalysis

Of the various bodily fluids, urine is the most easily obtained. It is possible to perform a number of tests on urine with little or no equipment. Visual and olfactory examination of a urine sample alone can provide considerable information. Urine which is pink, red, or red-orange may contain blood, although it is important to remember that these colors may also be seen in those who have eaten certain foods, such as beets, blackberries, or rhubarb. Urine which is green or blue-green, or which takes on these hues on standing, may indicate diseases of the liver or gall bladder. Bright yellow or yellow-orange urine is indicative of kidney dysfunction (if there is no reason for the urine to be concentrated and if the color is maintained for several days). Cloudy urine may result from abnormally high levels of phosphates or carbonates in the urine, and may be a precursor of kidney stones. Cloudy urine may also indicate the presence of an infection, particularly if the fresh urine has an odor of ammonia or other disagreeable odor (note that urine will develop an ammoniacal odor on standing).

It is possible to approximately localize an infection that is producing cloudy urine by using the three glass test. This test requires three clean containers (glasses), of which at least one (the second used) will need a capacity of at least 500 ml. In this test, the first 5 ml is voided into the first container, the second container is used until the patient is almost done, and then the third container is used to collect the last 5 ml. If the urine in the first container is the most cloudy, with decreasing cloudiness in the remaining containers, a urethral infection is the most likely cause. If the urine in the first container is less cloudy than either of the following two, a kidney, bladder, or prostate infection is indicated as the cause, while, if the urine in the third container is the cloudiest, the prostate is the likely site of the infection.

The odor of maple syrup associated with fresh urine is, of course, the classic sign of maple syrup urine disease. The urine may also have characteristic odors which are associated with other genetic disorders: the 'mousy' odor associated with phenylketonuria, for instance. The presence of glucose in urine has long been recognized as an indication of diabetes, and its detection has been assigned a high degree of importance by the general public. While its presence was at one time detected by taste, a more aesthetically acceptable

method (which is also less likely to transmit infection) is to heat the urine and observe the odor. If the scent of burning sugar or caramel is detected, there is an excessive amount of sugar present.

Proteins, or carbonates and phosphates, in urine may be detected by filling a test tube three-fourths full of urine and boiling the upper portion. Any cloudiness produced by this may arise from either the presence of carbonates and phosphates (which may be normal) or from the presence of proteins. These two causes may be differentiated by adding a small amount of acetic acid (3-5 drops of 10% acetic acid) to the tube: if the cloudiness vanishes, carbonates and phosphates were the cause; if the cloudiness persists (or becomes apparent only after the acid is added), proteins are present.

The iodine ring test is a simple test which can detect the presence of bile in the urine before color changes or jaundice make its' presence obvious. In this test, the appearance of a green ring after layering a 10% alcoholic iodine solution over the urine in a test tube indicates the presence of bile.

8.3 Blood Counts

Blood Counts : There is no easy way to do blood counts without some basic equipment. You require a microscope and a graded slide. A graded slide is a microscope slide which has very small squares etched onto its surface. Using a standardized technique a smear of blood is placed on the slide. Now using the microscope the number of different types of blood cells in a square on the slide is counted, this is then repeated several times and then averaged. This technique will give you:

- White Cell count
- White Cell differential
- Red Cell count
- Platelet count

8.4 Blood Grouping

Blood Grouping: The simplest thing to do is have your group or expedition blood typed prior to your expedition or TEOTWAWKI. However provided you have several basic chemicals a cross match is a simple test. But due to its potential fatal complications if done incorrectly I will not describe the procedure here. It is

well described in any basic laboratory medicine textbook. Also see *Lucifer's Hammer* quote in [section 12.1](#).

8.5 Pregnancy Tests

Pregnancy Tests: The ability to accurately diagnose pregnancy may be important, both for psychological reasons and for the practical reasons. Currently available pregnancy test kits test urine for the presence of the hormone Human chorionic gonadotrophin (HCG). They require only a small amount of urine, and are accurate from 10-14 days from conception.

8.6 Blood Glucose test strips

Blood Glucose test strips: Also known as BM stix, after a common brand. This can be used to diagnose diabetes (in a survival situation), both generally and during pregnancy, also it can detect low or high blood sugars in other severe illnesses. A finger or toe is pricked a drop of capillary blood is collected onto a test strip. It's allowed to sit for 30 seconds, then is wiped off, and a further 90 seconds, then the color of the test strip is compared to a control chart to give a blood glucose level.

8.7 Gram Staining

Gram Staining: This is a technique for approximate identification of bacteria in urine, pus, sputum, cerebral spinal fluid (csf) and from bacterial cultures. Although not highly accurate in species identification, combined with a knowledge of the clinical situation, it enables a good guess to be made for the appropriate antibiotic. It requires a microscope and also several chemical solutions. This is a very standard microbiological procedure and can be learned very easily at any entry level microbiology course.

The basic technique is: (1) the infected area or fluid is swabbed and the swab smeared onto a slide and dried and fixed. (2) It is then washed with crystal violet for 1 min, rinsed, washed grams iodine for 1 min, long rinse, washed safranin 30 seconds, washed again then dried. It is then examined down the microscope. The bacteria will stain certain colors and appear certain shapes depending on species, this aids in identification as discussed already.

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