

## **9 FAM 42.41 Exhibit II BLOOD AND DNA TESTING**

(TL:VISA-170; 10-01-1997))

### **Conventional Blood Testing**

There are four basic tests. The laboratory begins by conducting the first test. If parentage cannot be ruled out based upon the results of that test, it then conducts the second test. The process continues with only as many of the tests as are required to either absolutely rule out a putative relationship, or to provide a good statistical probability that the relationship is *bona fide*. In all cases, the laboratory should provide the statistical probability of accuracy of the results it obtains. The joint AMA-ABA guidelines provide the following interpretation of the ratio for likelihood of parentage:

Plausibility of parentage (percent) interpretation:

99.80-99.90	practically proved
99.1-99.75	extremely likely
95-99	very likely
90-95	likely
80-90	undecided
less than 80	not useful

The consular officer should consult with the panel physician and/or laboratory in the United States which will conduct the tests to determine the appropriate test for any particular visa applicant. Facilities in the host country and nature of the relationship being tested are both significant factors which will weigh in the physician's/laboratory's recommendation. Some posts may be limited to DNA or buccal swab testing in some circumstances because of the difficulty in shipping fresh blood samples to a laboratory quickly enough for accurate analysis.

### **Test 1: Basic Red Cell Antigens - ABO, MN, CDE**

The groups of blood factors which have been known for the longest time are composed of bio-chemicals which are bound to red blood cells. These factors are referred to as red cell antigens because they produce antibodies when they are introduced into blood that does not contain the same factors. These factors are called ABO, MN and CDE. A test may be made for each set of these factors.

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### **The ABO Test**

The ABO test is performed on the subject's red blood cells and serum. This test breaks the blood group down into the broadest terms, classifying all subjects as belonging to either types A, B, AB or O. ABO testing is not conclusive evidence of paternity, in that it can only exclude twenty percent of those tested, however, if the test does determine that a relationship cannot possibly exist because of a difference in subjects' blood types, no further testing is necessary.

### **The MN Test**

The MN test further excludes the parentage of subjects tested. MNs are located on the surface of the red blood cells. These markers are associated with other groups in specific patterns. This test is based on two pairs of co-dominant allelic genes (MNs) and three phenotypes (M,N, and MN). It involves four chromosomes and further confirms the credibility of gene-related elements of blood compatibility. The MN test will exclude 31 percent of those tested.

### **The RH or CDE Test**

RH or CDE testing breaks down the components further. The test is somewhat complicated. In addition to showing a factor of RH positive or RH negative, it can now decipher characterization of 40 phenotypes or markers. This test will exclude 25 percent of those tested.

The cumulative exclusion of ABO, MN and CDE tests is approximately 59 percent. Thus, in approximately 41 percent of cases, it will be necessary to proceed with another stage of testing, either to rule out or establish the relationship.

## **Test 2: Extended Red Cell Antigens**

These group systems test specific red cell antigens through the use of antisera which define specific markers on the red blood cells. The procedure is quite simple to perform, and relatively inexpensive. The handling of the specimen poses no special problem, because the process involves no living tissue. If a person is excluded by red cell antigen testing, no further tests are required. The exclusion rate of red cell antigen tests is approximately 77 percent.

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### **Test 3: White Cell Antigens (Human Leukocyte Antigen, or HLA Test)**

HLA tests the histocompatibility system of white blood cells and can only be performed by a laboratory capable of doing tissue typing for transplants. HLA testing involves the exposure of living human leukocytes to antibodies specific to the various antigens. Antibodies that cause death are specific to antigens present in the individual's leukocyte sample. Because HLA testing involves a very wide range of possibilities, and because the leukocytes must be handled while they are still living, the procedure is significantly more expensive than red blood cell testing. In addition, blood samples that are to be used for HLA testing must be handled much more expediently than other samples; labs generally require HLA samples to arrive at the lab no more than 24 hours after they are drawn from the donor. Nevertheless, HLA testing is an exceptionally valuable resource for paternity establishment; it is especially useful when not all parties are available for testing. When red blood cell tests fail to produce conclusive results, HLA testing may settle the controversy. Cumulative probability of exclusion is 90 percent.

### **Test 4: Red Cell Enzymes and Serum Protein**

A relatively new test is the serum proteins and red cell enzymes test. Numerous types of proteins either are bound to the surface of red blood cells or suspended in the nonparticulate component of the blood known as serum. Scientists have identified many variations of these proteins; the variations manifest themselves as observable differences of shape and electrical charge. Electrophoresis is a laboratory process that identifies protein variations. Because electrophoretic testing does not require living tissue, procedures for handling samples are quite flexible. When electrophoresis is combined with red blood cell testing, the probability of excluding a person can exceed 95 percent. When electrophoresis is combined with red cell antigen and HLA testing, the exclusion rate is 99.98 percent.

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### **DNA Testing**

DNA (deoxyribonucleic acid) parentage testing provides an alternative to more conventional parentage blood testing methods. DNA testing can be especially useful in countries with limited medical and transportation facilities because unlike HLA testing it does not require the use of live blood cells. Some posts may be limited to DNA testing due to the difficulty of shipping live blood samples to a laboratory quickly enough for accurate analysis. DNA parentage testing can often provide conclusive results even when not all parties are available for testing. Further, as more laboratories in the United States are accredited for DNA parentage testing (there are currently 54 laboratories in the United States included in the AABBs list of accredited parentage testing laboratories [see 9 FAM 42.41 Exhibit III] to perform DNA tests) the cost decreases.

### **DNA Testing Employing Buccal Swab Collection Method**

*Buccal (cheek or mouth cavity) swabs are an alternative specimen collection technique sometimes used in DNA testing. Cells are collected from the inside cheek using a long cotton swab. A number of the laboratories on the AABB list of accredited parentage testing facilities have indicated that, while they can do DNA testing using buccal swabs, they would usually use this method only as a last resort where blood is not available (i.e. forensic cases). A person must be specially trained to collect tissue samples using buccal swabs or the result may be a quantity not sufficient for testing. Specimens must be packed and shipped correctly since poor quality control could also affect test results. Testing on blood samples allows laboratories greater flexibility in performing the hierarchy of tests that may be required. Although buccal swabs are sometimes viewed as an ideal method for testing infants, blood samples usually may be safely taken from babies. Phlebotomists with little experience in drawing blood from infants may be reluctant to do so, however.*

*In all blood testing cases, the panel physician should consult with the laboratory chosen by the applicant from the accredited list to determine the appropriate collection method. The laboratory will forward the test kit and detailed instructions for drawing samples and identifying donors directly to the panel physician.*

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*Because buccal swabs are a less intrusive specimen collection method, the likelihood of a “stand-in” being used is increased. The presence of the consular officer at the time samples are obtained is strongly urged in cases where buccal swabs are used in lieu of blood samples. Samples obtained by buccal swab must be collected by a trained medical professional. Under no circumstances should consular officers attempt to collect samples themselves [see 9 FAM 42.41 Exhibit II ].*

