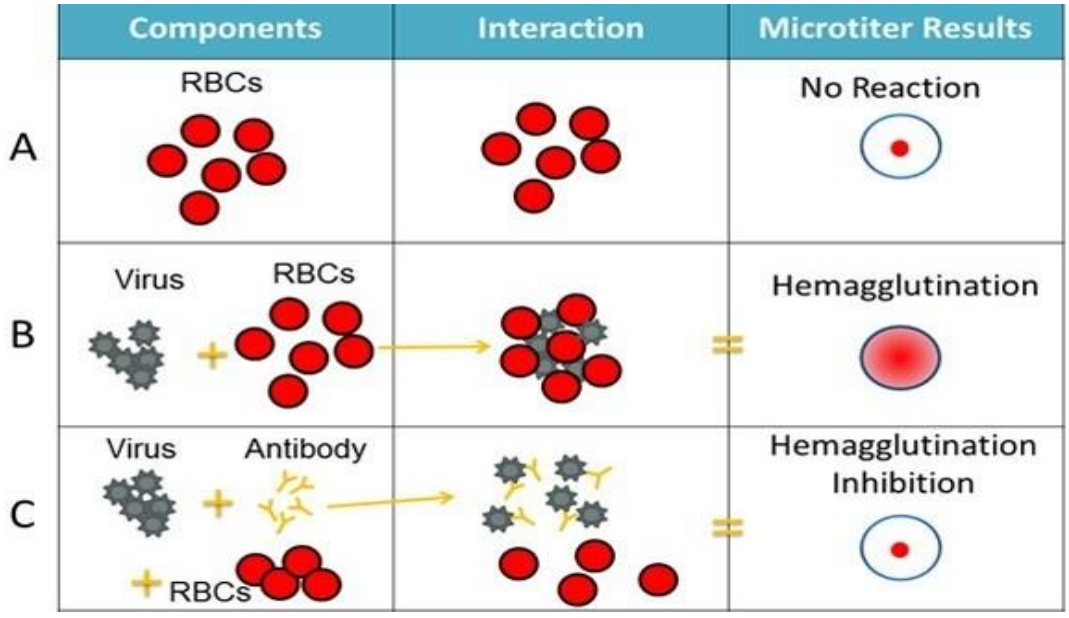
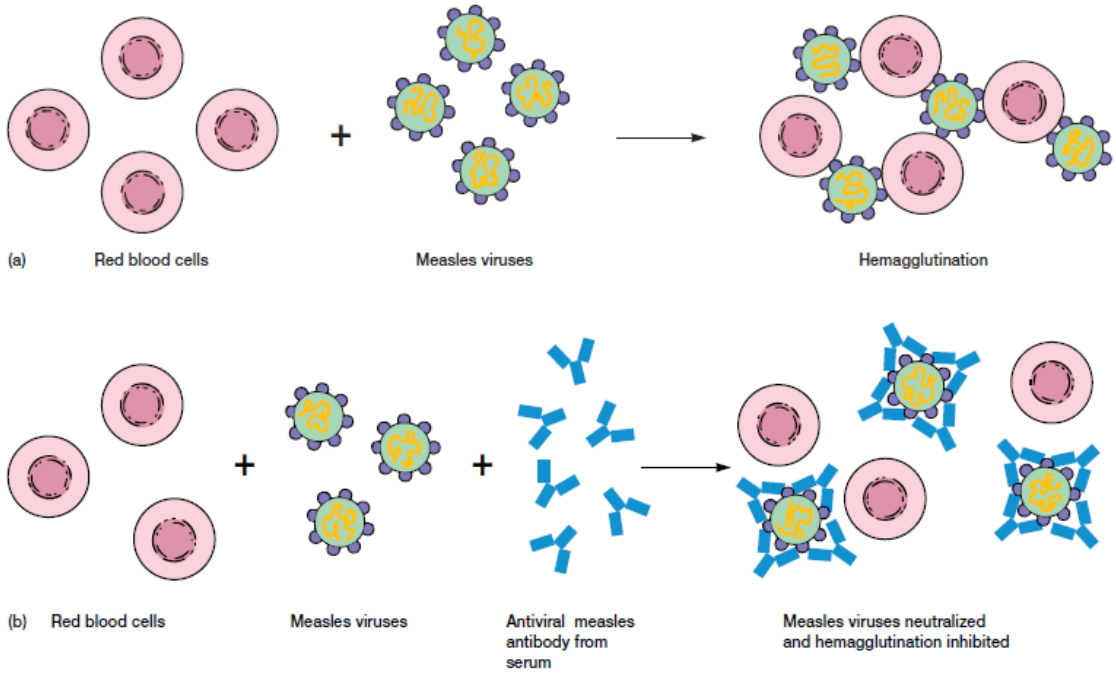
Hemagglutination Inhibition Assay (HIA)

Hemagglutination Inhibition Assay (HIA)is a procedure used to identify certain viruses that can cause haemagglutination. Certain viruses such as Rubella, Herpes zoster and Influenza are composed of a protein envelope that is recognised to bind to erythrocytes in mammalian and avian species. This binding causes the formation of a lattice which can be seen as agglutination. The efficiency of haemagglutin binding is dependent upon the type of linkage that connects the RBC to the receptor molecule of the virus, as well as the type of virus and host specie.

The Hemagglutination Inhibition Assay can be used to prevent RBCs from binding to viruses through the addition of specific antibodies. Antibodies for either the hosts RBC or Virus receptor can be added to a patients sera to prevent attachment, with the antibodies binding to the receptor sites instead. Viruses such as Rubella and Infleunza are highly specific to the antibodies used within HAI which makes the use of this method highly effective for diagnosis. Other viruses such as Flaviviruses have been found to cross react to other related viruses which make the use of the HAI test less sensitive and specific.

The advantages to using HAI tests are that they are relatively easy and inexpensive to perform, they can also be adapted for the detection of different viral infections . However they are considered less sensitive to EIA's or RIA's. It is also important to ensue samples and reagents used are are fresh otherwise abnormal agglutination patterns may arise. Pretreatment of sera may also cause the accidental removal of antibodies being tested which may influence the results.





Materials and Reagents:

1. Red cells from an appropriate species (chicken, goose, guinea pig, trypsinized human O) collected in Alsever's solution or heparin
2. Diluent (e.g. Bovine albumin veronal buffer) at appropriate pH
3. Solutions to remove nonspecific hemagglutinins from serum
4. Infected cultural fluid or standard antigen (e.g preparation of influenza virus) for serology

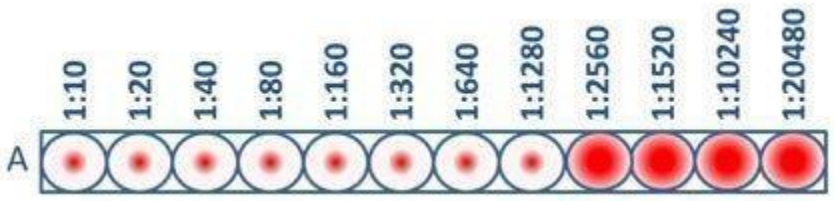
Procedure

1. Obtain a preparation of virus (e.g. influenza viruses) with known HA titer or determine its HA titer
2. Prepare two-fold dilutions of patient/test serum to be tested e.g. from 1:4 to 1:1024.
3. Add a fixed amount of virus to every well of a 96-well plate, equivalent to 4 HA units (varies according to the virus), except for the serum control wells.

4. The plate is then allowed to stand at room temperature for 60 minutes (time varies according to specific requirements).
5. Add red blood cells (RBC) and incubate at 4°C for 30 minutes.
6. Read the wells.

Results/interpretation

The highest dilution of serum (Ab) that prevents hemagglutination is called the HAI titer of the serum. A smooth or jagged shield of cells or an irregular button indicates agglutination. Observation of movement of the button of red cells when the plate is tilted may help to clarify the endpoint.



This virus sample has an HAI titer of 1280, which means that the greatest dilution of antibody that still blocked hemagglutination from occurring was at 1280 dilution. At this dilution, the antibodies were still capable of recognizing and binding to the antigens on the virus.

Uses of Hemagglutination-Inhibition Test

1. Hemagglutination inhibition test is widely used for the diagnosis of infection caused by orthomyxoviruses (influenza), paramyxoviruses (measles, mumps), mononucleosis, abroviruses-togaviruses (including rubella), flaviviruses, and bunyaviruses.
2. The presence of virus in infected cell cultures can be detected by hemagglutination; the identity of the virus or of antibodies in a patient's serum can be determined by specific inhibition of that hemagglutination.
3. Although influenza viruses can be detected by hemadsorption test, typing of the isolate is done most efficiently by hemagglutination inhibition (HAI).

COMMON BLOOD TESTS

A **blood test** is a laboratory analysis performed on a blood sample that is usually extracted from a vein in the arm using a hypodermic needle, or via fingerprick. Multiple tests for specific blood components, such as a glucose test or a cholesterol test, are often grouped together into one test panel called a **blood panel** or **blood work**. Blood tests are often used in health care to determine physiological and biochemical states, such as disease, mineral content, pharmaceutical drug effectiveness, and organ function. Typical clinical blood panels include a basic metabolic panel or a complete blood count. Blood tests are also used in drug tests to detect drug abuse. In some of countries , a blood test is required before marriage.

TYPES OF TESTS

1.Biochemical analysis

A basicmetabolicpanel measures sodium, potassium, chloride, bicarbonate , blood urea nitrogen (BUN), magnesium, creatinine, glucose, and sometimes calcium. Tests that focus on cholesterol levels can determine LDL and HDL cholesterol levels, as well as triglyceride levels.

Some tests, such as those that measure glucose or a lipid profile, require fasting (or no food consumption) eight to twelve hours prior to the drawing of the blood sample.

For the majority of tests, blood is usually obtained from the patient's vein. Other specialized tests, such as the arterial blood gas test, require blood extracted from an artery. Blood gas analysis of arterial blood is primarily used to monitor carbon dioxide and oxygen levels related to pulmonary function, but is also used to measure blood pH and bicarbonate levels for certain metabolic conditions. While the regular glucose test is taken at a certain point in time, the glucose tolerance test involves repeated testing to determine the rate at which glucose is processed by the body.

2.Normal ranges

Blood tests results should always be interpreted using the ranges provided by the laboratory that performed the test. Example ranges are shown below.

Test	Low	High	Unit	Comments
Sodium (Na)	134	145	mmol/L	
Potassium (K)	3.5	5.0	mmol/L	
Urea	2.5	6.4	mmol/L	Blood urea nitrogen
Urea	15	40	mg/dL	
Creatinine - male	62	115	µmol/L	
Creatinine - female	53	97	µmol/L	
Creatinine - male	0.7	1.3	mg/dL	
Creatinine - female	0.6	1.2	mg/dL	
Glucose (fasting)	3.9	5.8	mmol/L	*See also* glycated hemoglobin
Glucose (fasting)	70	120	mg/dL	

Common abbreviations

Upon completion of a blood test analysis, patients may receive a report with blood test abbreviations. Examples of common blood test abbreviations are shown below.

Abbreviation	Stands for	Description
HDL	High Density Lipoprotein	Level of "good cholesterol" in the blood (ratio of HDL:LDL is usually more significant than actual values)
LDL	Low Density Lipoprotein	Level of "bad cholesterol" in the blood (ratio of HDL:LDL is usually more significant than actual values)
CRP	C-Reactive Protein	Level of inflammation with the body. If the immune system is fighting an

		infection or illness, CRP will be higher.
CBC (UK: FBC)	Complete Blood Count (UK: Full Blood Count)	Analysis of 15 different blood test readings to provide information about overall health.
TSH	Thyroid-stimulating hormone	Thyroid regulates the function of metabolism. Low levels can lead to weight loss, while high levels lead to weight gain.
ESR	Erythrocyte Sedimentation Rate	Indicates the time it takes for red blood cells to move down a tube. This shows signs of inflammation within a body.
INR	International Normalized Ratio	This is a blood clotting test.
LFT	Liver Function Test	This test reveals the levels of waste products, enzymes and proteins that are processed by the liver.
U+E	Urea and Electrolytes	This test is performed to measure the function of kidney.
CMP	Comprehensive Metabolic Panel	This analysis provides an overall picture of the metabolism and chemical balance of the body.
WBC	White Blood Cell Count	The level of white blood cells.
RBC	Red Blood Cell Count	The level of red blood cells.

HBC	Hemoglobin	Level of hemoglobin molecules.
HCT	Hematocrit	Similar to RBC but in percentage.
PLT	Platelets	Platelets levels in the blood.

3.Molecular profiles

- Protein electrophoresis (general technique—not a specific test)
- Western blot (general technique—not a specific test)
- Liver function tests
- Polymerase chain reaction (DNA). DNA profiling is today possible with even very small quantities of blood: this is commonly used in forensic science, but is now also part of the diagnostic process of many disorders.
- Northern blot (RNA)
- Sexually transmitted diseases

4.Cellular evaluation

- Full blood count (or "complete blood count")
- Hematocrit
- MCV ("mean corpuscular volume")
- Mean corpuscular hemoglobin concentration (MCHC)
- Erythrocyte sedimentation rate (ESR)
- Cross-matching. Determination of blood type for blood transfusion or transplants
- Blood cultures are commonly taken if infection is suspected. Positive cultures and resulting sensitivity results are often useful in guiding medical treatment.