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## Editorial

HELP! And you did. Yes, you always did. Whenever a patient or a clinician got lost amidst a host of differential diagnoses, you showed them the way. Proper diagnosis depends on medical judgment that is based heavily on accurate and timely laboratory inputs. Every minute of the day, pathologists and medical technologists provide decision making (life saving) information to the clinicians. Yet their contribution to the diagnosis and subsequent therapy often goes unsung. Nevertheless, the laboratorians continue to practice their profession quietly as unseen members of the health care team.

The laboratorians work with dedication, foregoing their meals and even their sleep; yet, there are times when the clinicians appear not too amused with the inputs provided. There could be a multitude of reasons. Important amongst these are:

- 1) Improper timing for the investigation requisitioned for (like asking for an IgG antibody test during the first three weeks of a primary infection).
- 2) Improper patient preparation (patient coming post-cibum for a lipid profile test)
- 3) Employment of improper device/ kit/ reagent (usually cheap products give – what else? CHEAP RESULTS.)
- 4) Commencement of interfering medication prior to giving a sample (like starting steroids and then asking for absolute eosinophil count or IgE antibody levels).
- 5) Improper sample handling (causing haemolysis in a blood sample).
- 6) Typographical reporting errors.

You can isolate and rectify all the above-mentioned points by talking to the patient, requisitioning clinician and by taking all precautions at your end. In order to minimize problems the laboratorian must know everything about the investigation performed with special reference to the points elucidated above. Detailed knowledge of conditions where the values of the test conducted are altered will always be an added advantage and come in handy during times of distress.

We shall in the ensuing issues, take up specific disease entities and discuss threadbare all related diagnostic aspects and problems encountered therein. Needless to say that the remedial measure shall also be provided. Each forthcoming issue shall interpret and troubleshoot a problem for you. A part of the newsletter space shall be dedicated to brainteasers, case studies and specks of humour too. We shall apprise you of the latest available hardware, kits/ devices/ reagents to ease your quest for the best.

Our intention is to form an integral bond with you. Do send us your suggestions, queries or problems. Anything interesting! It shall be relayed to all members of our community. Any problems? We shall try to solve them. We all need each other; while we assist others there may be a day when we shall need our colleagues for ourselves. After all, not being bad is also not being good. How about all of us becoming as good as one can be? Within its covers

**Crux** shall bring to you the very soul of Laboratory Diagnosis making in an easily assimilable format.

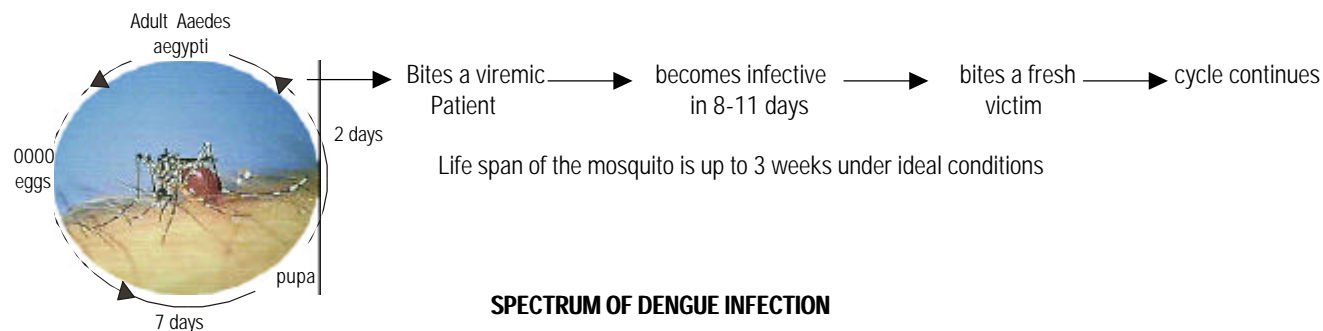
Your active participation is solicited and imperative for this effort and exercise to succeed.

## DISEASE · DIAGNOSIS

### DENGUE FEVER

Causative agent: A group B arbovirus (flavivirus) having four serotypes 1, 2, 3, & 4 (Den 1, Den 2, Den 3 and Den 4).

Vector: *Aedes aegypti* (In India) and *Aedes albopictus* (day biting, urban, tropical mosquitoes)



### SPECTRUM OF DENGUE INFECTION

Clinical suspicion	Probable diagnosis suggested by	Confirmed Diagnosis	Differential Diagnosis	Other Lab. Findings
Acute undifferentiated respiratory disease	Fever, coryza, pharyngitis $\pm$ cough.			
Undifferentiated fever	Fever $\pm$ multisystem involvement			
Dengue fever (DF)	<i>Incubation period is 5-6 days</i> Acute fever with 2 or more of: myalgia, arthralgia, leucopenia, rash, retro orbital pain, haemorrhagic manifestation. Occurring at the same location & time as other confirmed cases of DF.	A case with one of the following – Haemagglutination Inhibition (HAI) titer $\geq 1280$ . Seroconversion is defined as fourfold change in titer by HAI. Positive for IgM anti-flavivirus antibodies during a time consistent with occurrence of the disease. Isolation & typing of a dengue virus from an early blood sample. IgG anti-flavivirus antibodies may be present if a previous infection has occurred.	Influenza, Acute viral exanthemas (measles, rubella) Leptospirosis, Chikungunya virus, Hanta virus, Enterovirus, Hepatitis A, Scarlet fever, Typhoid, Malaria, Rickettsial disease.	Leucopenia occasionally Thrombocytopenia $\pm$ . No evidence of plasma loss.
Dengue Haemorrhagic Fever (DHF)	<i>Reinfection of an individual by a different serotype - heterotypic reinfection leads to DHF / DSS. Seen more frequently in children &amp; young adults, when fever subsides, complications start.</i>	(Usually IgG anti-flavivirus antibodies may also be found)	Leptospirosis, Acute abdomen, other Viral haemorrhagic disorders or purpuras.	
DHF grade I	Symptoms as for DF and a positive tourniquet test	As for DF		Platelet count $\leq 100,000$
DHF grade II	Above symptoms & spontaneous bleeding – petechiae, bruises, epistaxis, hematuria, hematemesis, melena, hemoptysis, gingival bleeding etc.	As for DF		Hct 20% above average for that sex, age and population. (signifies plasma leakage)
DHF grade III	Signs & symptoms as above with circulatory failure (cold and clammy skin, weak pulse with tachycardia, hypotension, restlessness, repeated fainting).	As for DF	Acute abdomen, Septicemia, Acute meningococciemia.	As above, with metabolic acidosis
DHF grade IV	Profound shock with undetectable blood pressure and pulse. Becomes comatose. Irreversible shock is usually fatal.	As for DF		As above

(DHF grades III and IV are also known as Dengue Shock Syndrome)

## Laboratory Diagnosis

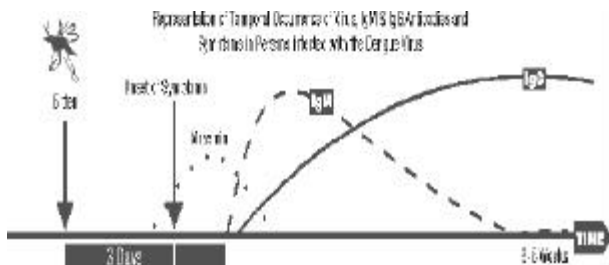
**General Laboratory:** a) Positive tourniquet test, b) diminished platelet count & c) Raised haematocrit (>20% above average for that age, sex & population).

**Special Laboratory:** a) Virus Isolation. b) PCR & c) Sero-immunological methods.

**Virus Isolation:** Serum taken within 3 days of onset (or autopsy material). Takes weeks, requiring serial passages in tissue cultures. (in mosquitoes or mammalian cell lines). After incubation, cell cultures are stained with fluorescein-conjugated polyclonal antibody to detect virus isolates, and then serotyped with monoclonal antibodies in an indirect fluorescent antibody test. A positive result confirms aetiology and identifies dengue virus type. A negative result does not rule out dengue infection. The rate of false negatives depends mainly on the shipment conditions.

**Polymerase Chain Reaction:** Reverse Transcriptase polymerase chain reaction (RT-PCR) can be used to detect all 4 serotypes, takes much lesser time as compared to viral culture. A multiplex PCR alone or followed by a nested PCR is commonly used in a single tube using four sets of primers. It can detect viruses in samples inactivated by improper storage or by neutralising antibody. Under routine conditions it yields less false negatives than virus isolation.

**Sero – Immunological techniques:** a) Haemagglutination inhibition (HAI) b) Elisa and c) Rapid immunochromatographic platform (ICT)



*Primary dengue virus infection is characterised by elevation in specific IgM levels 3-5 days after the onset of symptoms, persists for 30-60 days. After 10-14 days IgG levels also rise & remain detectable for life. During secondary infection, IgM levels rise more strongly & reach lower levels than in primary infection, while IgG levels rapidly rise from 1-2 days after onset of symptoms*

**HAI:** Detects IgG antibodies. Titers have been used to classify infection as primary or secondary. An assay of paired sera specimens separated in time by at least 7 days, with any acute specimen with a HAI titer  $\geq 2560$  is defined as coming from a secondary flavivirus infection. Or a fourfold increase in titer in paired sera is also considered as diagnostic (a titer of 640 is considered

insignificant, a titer of 1280 is said to be suggestive of secondary infection, while 2560 is diagnostic).

**ELISA:** IgM & IgG formats are available with cut off sera designed for a specific region. For IgM tests, take serum 1 week after onset of symptoms, in sera taken earlier the result is diagnostic only if positive. If first test is negative, a second repeat sample must be taken after a week. If positive, it indicates a recent flavivirus infection. Presence of IgG antibodies characterise a secondary infection and are detectable 1-2 days after onset of infection. In dengue endemic areas a high rate of IgG positivity makes analysis of paired samples critical. Cross-reactivity with other flaviviruses and heterophile antibodies can pose a problem. Cut off variability from run to run is a significant problem as is procedural loss in case of assays where sample pre-treatment is employed to neutralise a specific class of antibodies.

**ICT:** Immunochromatographic platforms detecting both IgG and IgM antibodies are excellent, rapid, field usable tools. The better systems use recombinant "Env" dengue virus antigens in the gold conjugate thereby eliminating the cross-reactivity problems. These systems have 100% specificity and sensitivity. ICT detects even the lowest possible antibody levels and therefore in hyper endemic regions (as in our country – WHO statistics) they are likely to detect greater number of IgG positives. If the first test detects both IgG and IgM it settles the diagnosis, however, where IgM is not positive a second sample testing after a week to detect emerging IgM antibodies is absolutely mandatory.

### INTERPRETATION OF ANTIBODY POSITIVITIES

IgM +, IgG + : Acute secondary dengue infection

IgM +, IgG - : Acute primary dengue infection

IgM -, IgG + : Suspected secondary dengue or emerging acute secondary dengue infection (MUST REPEAT TEST AFTER A WEEK), clinical correlation is essential

IgM -, IgG - : Negative / seronegative

### INFORMATION THAT A LABORATORY MUST SEEK

Patient identification, doctor in charge, clinical diagnosis, signs and symptoms, DF/DHF/DSS suspicion, date of onset, date of sample collection. Any previous history of DF/ DHF/ DSS in the patient. Immune status of the patient.

### FINAL DIAGNOSIS

Consider the clinical picture in conjunction with the laboratory data. If necessary, repeat the investigations after a week so as not to miss the emerging antibodies. Exercise utmost care when the patient becomes afebrile, as complications commence when the fever breaks. Be cautious while reporting on samples taken from immunocompromised patients.

## TROUBLE SHOOTING

### BLOOD COLLECTION

The tissue that is tested most often is blood. By and large most diseases would produce some alteration in this liquid connective tissue of the body. Before one tests it, one has to obtain it. Blood can be obtained from a) the capillaries b) veins or c) arteries.

Procedure common to all sources of blood collection:

1. Explain to the patient what you are going to do.
2. In a warm environment, relax (physically and mentally) and reassure the patient properly. Excessive stress and exercise increase factor VIII, vWFAg and fibrinolysis. Warm the site of puncture. (Can forego this under emergency situations).
3. Identify and sterilize the site of skin puncture with 70% alcohol (like IPA). Let dry.
4. Obtain required quantity of blood, dispense the same in appropriate containers (gently mixing wherever essential) and perform necessary tests as soon as possible. Having collected the sample, apply gentle pressure with sterile gauze with at least three fingers at the site for a time that is longer than the patient's clotting time. Rubbing of the puncture site is strictly contraindicated. Place an adhesive dressing at the puncture point.
5. Exercise all biohazard precautions. Wear disposable plastic or rubber gloves. Do not injure yourself with syringes, needles and lancets. Once used, they should be immediately discarded.

#### Capillary blood:

1. Use as a last resort only for infants less than one year of age.
2. Use medial or lateral aspects of a pre-warmed heel. Under aseptic precautions puncture to a depth of 2-3 mm with a sterile lancet. Wipe the first drop with a sterile gauge. If necessary squeeze very gently to encourage free flow of blood.
3. Collect into appropriate container, can be a micropipette, capillary tube or a microtainer or a microvette.

#### Venous blood:

1. All sample collections (except arterial blood) should be from the veins, even in a neonate, if possible.
2. Whenever possible, venous blood samples must be collected without the use of a cuff. Venous occlusion causes haemoconcentration, increase in fibrinolytic activity, platelet release and activation of some of the clotting factors.
3. In the majority of patients, however, light pressure using a tourniquet is required. This should be applied for the shortest possible time (< 1 minute). A sphygmomanometer cuff can be used and inflated to diastolic pressure and the skin over the site can be tapped for a few times.
4. In obese patients veins over the dorsum of the hand can be used after warming it by immersion in warm water. Dry the hand; clench the fist and suitable veins will become apparent. This site tends to bleed readily than other sites, elevate the hand, apply gentle pressure for several minutes and place an adhesive dressing over the puncture site.
5. Loose and rolling veins can be fixed between the thumb and the index finger.
6. Sometimes one may transfix the vein and no blood flows, just retract the needle a bit and blood will start flowing.

7. Loosen the tourniquet when you enter the vein.
8. Draw the piston of the syringe slowly and once adequate blood is collected, dispense the same in appropriate anticoagulated or plain containers.
9. Make sure that the patient has relaxed the fist after the blood has been collected.
10. Venipuncture must be clean and blood from indwelling catheters should not be used.

Ideal site is the antecubital fossa of the arm. Needle gauge should be 21 or larger (this avoids unnecessary frothing and shearing stress). To minimize the affects of contact activation good quality plastic or polypropylene syringes should be used. If glass syringes are used they should be adequately coated with silicon.

*Differences between capillary and venous blood: PCV, RBC count and Hb. of capillary blood are slightly greater than in venous blood. TLC and neutrophils are higher by 8%; monocytes are higher by 12 – 100% (especially in children). Platelet count is lesser by 9 – 32 % (because of adhesion of platelets to the skin puncture site).*

#### Arterial blood:

Arterial blood is used to measure oxygen and carbon dioxide tension and to measure pH. Arterial punctures are technically more difficult, increased pressure within the arteries often leads to haematoma formation. Reflex arterial spasm restricts blood flow with possible severe effects on circulation. Patients may complain of uneasiness as aching, tenderness, sharp piercing sensation, and cramp.

1. Select the puncture site. Most commonly, the radial artery is used. Before starting, please ensure that the ulnar artery is present (perform Allen's test), if absent, choose another site. Femoral or brachial arteries can also be used. Scalp arteries are used in infants; catheterisation of the umbilical artery is frequently used in neonates for up to 48 hours after birth.
  2. Anaesthetise the puncture site, if necessary.
  3. Patient should be absolutely calm. Hyperventilation caused by anxiety may significantly alter the blood gas measurements.
  4. Prepare the syringe. Wet the barrel and needle or cannula with sterile anticoagulant (usually heparin). Expel excess solution.
  5. Record the patient's temperature.
  6. Palpate the artery.
  7. With the bevel of the needle facing up, puncture the skin 5 to 10 mm distal to the finger which locates the artery. Aim for the artery at a point directly below the finger. Blood rushing to the finger usually forces the plunger back. If not, gently pull back on the plunger. Obtain required amount of blood. Quickly withdraw the needle and syringe. At the same time place a sterile cotton ball or a dry gauze sponge over the puncture site. Apply firm pressure for at least five minutes, or longer if the patient has a longer clotting time. Watch the puncture site for another two minutes to avoid haematoma formation. Expel any air bubbles from the syringe. Remove the needle and cap the syringe with a tight-fitting Luer cap. Mix the specimen with anticoagulant by gentle inversion of the syringe. Immediately transport the specimen on ice to the laboratory.
- Allen's test - Compress the radial and ulnar arteries at the wrist until the palm of the hand becomes blanched. Release pressure from the ulnar artery. Observe that the hand becomes flushed. If it does not, it means that the ulnar artery is absent*

## BOUQUET

### In Lighter Vein

● A Punjabi immigrant in Canada, one Mr. Honk Singh, earned and saved enough dollars to buy himself a brand new car. Splashing the "L" sign on the car, he drove it in a haphazard fashion. As the car zigzagged down the main boulevard, a traffic cop picked him up "Why are you going from one side of the road to the other?" he demanded.

"I am learning how to drive," replied Honk Singh.

"You have a driving teacher beside you. May I see your license?"

Honk Singh pulled out an envelope from his pocket and quipped,

"Here, I am learning driving by correspondence."

● A young officer from the Family Planning Department was deputed to gauge the success of the Family Planning message in rural Bihar. He reached a remote village, which proudly housed a family of eight children.

On reaching the house, he saw the father lazily enjoying a hookah under the shade of a neem tree. In a dignified manner the official introduced himself, and asked "Sir, hadn't you thought of our Family Planning methods before you had these eight children!"

"Why should I?" he replied angrily. "The methods are all useless!" jeered the Bihari.

"But, Sir, have you tried using condoms?" enquire the official.

Without responding to his question, the Bihari called two of his children rolling in the dirt. "Oye Bablu, Dablu, come here!" Then he addressed the official. "Can you see them! They are the result of a torn condom!" Saving his pride, the official replied. "Ok, Sir, you could have tried Copper-T."

"Oye Lallu, Kallu, come here!" he called.

"Can you see them! They came out of their mother's womb with Copper-T in their hands!" he quipped.

"Ok, Sir, leave alone Copper-T and condoms. You could have tried pills! After all, they are very convenient and effective!"

"Oye Bolu, Cholu, come here!" and two more came running. "Can you see them? They were born after my wife took those goddamned pills!"

"Ok, Sir, forget everything," quoted the official, trying to repair his faltering image, "at least you could have practiced self restraint!"

"Oye Bali, Vali, come here," called the Bihari.

"Can you see them!" he asked smilingly and continued, "they are the result of self restraint."

● Two Babus lived in a multistoried building, one on the first floor and the second on the eighth floor. But there was great animosity between the two. Once the Babu on the eighth floor tried to fool the other one living on the first floor by calling him for dinner. When the first floor Babu reached the eighth floor for dinner he saw that the house was locked and a board was hanging on the door, on which was written: "*Kaisa ulloo banaya*" (How I fooled you) The first floor Babu felt embarrassed and turning the board on the other side, wrote: "*Main to yahan aayaa hee nahin tha*" (I had never come here).

- A colleague recently visited Kulu Manali. He was so overwhelmed by the scenic beauty that he wired his wife – WISH YOU WERE HERE. On his return the poor fellow had to face a fuming and fretting wife. Reason? The Telecom officer had made a mistake and sent a message reading – WISH YOU WERE HER!

### Wisdom Whispers

- Give yourself time and room; what reason could avoid, delay has often cured. - Seneca
- In the end, the hands that work are better than the hands that pray. - Zarathushtra
- No battle is more surely lost than the one that is not fought. - Anonymous
- Jo mil gaya usi ko muqaddar samajh liya, jo kho gaya main usko bhulata chala gaya.  
(Whatever befell me, I accepted as fate; whatever I lost, I let slip from memory.)  
- Song from Hindi Film Hum Dono - Mujrooh Sultanpuri
- Facing two foes, unaided and alone, make one your friend. - Thiruvalluvar
- Most ideas never work - unless you make sure they do. - Ruskin Bond
- Between tomorrow's dreams and yesterday's regrets is today's opportunity. - Anonymous
- Luck is what happens when preparation meets opportunity. - Anonymous

### Brain Teasers

1. Which animal has elliptocytic red blood cells?  
A) Dog B) Camel C) Lion D) Porcupine
2. Which animal is more likely to develop Benign Hyperplasia of Prostate at old age?  
A) Tiger B) Bear C) Dog D) Platypus
3. Which enzyme would you look for in vaginal secretions in a rape trauma case?  
A) Acid phosphatase B) LDH C) CPK D) Amylase
4. Under normal circumstances when will the maternal serum alpha fetal protein level be highest?  
A) At 2 to 3 months of pregnancy B) At 4 to 5 months of pregnancy C) At 7 to 8 months of pregnancy D) At 9 months of pregnancy.
5. Prolonged fasting is known to increase the level of which blood analyte?  
A) Glucose B) Uric acid C) Total bilirubin D) Cholesterol
6. Hepatitis D is an incomplete virus that requires the presence of which other hepatitis virus for replication and expression?  
A) Hepatitis A virus B) Hepatitis B virus C) Hepatitis C virus D) Hepatitis E virus



## INTERPRETATION

### TRACE ELEMENTS

The term trace elements refers to inorganic substances which occur in concentrations < 0.01% of the body mass, i.e. in amounts <  $10^{-6}$  g/g of body weight.. They are divided into essential and nonessential trace elements. In humans, Cr, Co, Cu, Fe, I, Mn, Mo, Ni, Se, Zn belong to the former category; Al, Ag, As, Au, Ba, Bi, Cs, Cd, Pb, Ti, and V belong to the group of nonessential trace elements. The latter also include elements without physiological functions as well as toxic heavy metals. Magnesium, in a strict sense, is not a trace element but is customarily considered to be one. In this issue three trace elements are considered.

#### Zinc

Oxidation state +2,  
Atomic number 30,  
Atomic symbol Zn,  
Atomic weight 65.38,  
Electron configuration -8-18-2.

##### Description.

Zinc is a nutritional trace metal essential for cellular growth and metabolism. Both, zinc toxicity and serious deficiency are seen in clinical practice.

##### Normal Values.

For all ages 60-120µg/dl or 9.18-18.4 µmol/L.  
Less than 60 µg/dl is considered as deficiency state.

##### Toxic level symptoms:

Cough, chest discomfort, tachycardia, hypertension, gastrointestinal discomfort, nausea, vomiting, diarrhoea, metallic taste in the mouth. Treatment includes removal of intake and peritoneal dialysis.

##### Deficiency symptoms:

May progress from decreased weight, low sperm count, and impaired wound healing to alopecia, hypogonadism, ataxia, tremors, and impaired resistance to infection. Treatment includes dietary replenishment, medication or hyperalimentation.

##### Values are increased in:

Anemia, arteriosclerosis, coronary heart disease, dietary intake of acidic food or beverages from galvanized containers, industrial exposure to zinc (welding), and primary osteosarcoma of bone. Drugs include cisplatin, corticosteroids, estrogens, interferon, oral contraceptives (containing estrogen), phenytoin, and thiazides.

##### Values are decreased in:

Acrodermatitis enteropathica, alopecia, alcoholism, anemia (hemolytic), celiac sprue, cirrhosis, diarrhoea, gallbladder disease, hepatic metastases, hypoalbuminemia, hypogonadal dwarfism, acute infections, leukemias, lymphomas, malabsorption, myocardial infarction, dietary deficiency, pregnancy (especially third trimester), receiving parenteral nutrition, chronic renal failure, acute stress, thalassemia major, enteric fever, and pulmonary tuberculosis. Drugs include antimetabolites, chlorthalidone, cisplatin, diuretics, estrogens, histidine, and penicillamine.

### Copper

Oxidation state +1 +2,  
Atomic number 29,  
Atomic symbol Cu,  
Atomic weight 63.546,  
Electron configuration -8-18-1.

##### Description.

Copper is an essential trace element that functions in haemoglobin synthesis and activation of respiratory enzymes. Over 90% of the copper is bound to the protein ceruloplasmin.

##### Normal Values.

Serum  
Adult males 80-140 µg/dl;  
Adult females 80-155 µg/dl,  
Newborns 12- 67 µg/dl,  
Children upto 10 years 30- 150µg/dl.

##### Toxic level symptoms.

Jaundice, hepatic injury, headache, vomiting, and may lead to haemolytic shock.

##### Deficiency symptoms:

Impaired erythrocyte production and survival time and lowered catabolism by copper- containing enzymes

##### Values are increased in:

Alzheimer's disease, anemia (aplastic, pernicious, megaloblastic anemia of pregnancy; iron deficiency), cirrhosis (biliary), elevated CRP, glomerulonephritis, haemochromatosis, Hodgkin's disease, hyperestrogenemia, hypothyroidism, hyperthyroidism, infections, leukemia, lymphoma, Lofgren syndrome, myocardial infarction, pellagra, pregnancy (especially third trimester), rheumatic fever, rheumatoid arthritis, sarcoidosis, and systemic lupus erythematosus. Drugs include carbamazepine, estrogens and oral contraceptives,

Phenobarbital, and phenytoin sodium.

## COPPER, URINE

Normal Values:

All ages 0-60µg/24 hours  
Wilson's disease >100µg/24 hours

Values are increased in:

Alzheimer's disease, aminoaciduria, cirrhosis (biliary, Indian childhood), hepatitis (chronic active), hyperceruloplasminemia, nephritic syndrome, pellagra, proteinuria, and Wilson's disease.

Values are decreased in:

Burns, hypoproteinemia, kwashiorkor, malabsorption, Menkes' hair syndrome, nephrosis, and Wilson's disease.

## Magnesium

Oxidation state +2,  
Atomic number 12,  
Atomic symbol Mg,  
Atomic weight 24.305,  
Electron configuration 2-8-2

### Description.

Measurement of magnesium levels is used as an index to (1) metabolic activity (e.g., such as carbohydrate metabolism, protein synthesis, nucleic acid synthesis, contraction of muscular tissue), and (2) renal function, since 95% of the magnesium that is filtered through the glomerulus is reabsorbed in the tubules. Most of the body's magnesium, which is an electrolyte, is concentrated in the bone, cartilage, and within the cell itself. In addition, magnesium is needed in the blood clotting mechanism, regulates neuromuscular irritability, acts as a cofactor that modifies the activity of many enzymes, and has a significant effect on the metabolism of calcium.

### Normal Values.

Serum (Children)	1.5-2.0 mEq/L
(Adults)	1.3-2.5 mEq/L
CSF	2.0-3.0 mEq/L
Urine	6.0-8.5 mEq/24 hours

*Panic level (serum) > 3.0 mEq/L or < 0.5 mEq/L*

*Toxic level (serum) > 12 mEq/L*

### Toxic level symptoms:

Lethargy, drowsiness, flushing, nausea, vomiting, slurred speech, hypotension, weak or absent deep tendon reflexes, ECG changes (prolonged PR and QT intervals, widened QRS, bradycardia), respiratory depression. (Treatment includes – stop magnesium intake, promote

excretion, give calcium salts, haemodialysis).

### Deficiency symptoms:

Muscle tremors, twitching, tetany, hypocalcemia, hyperactive deep tendon reflexes, ECG changes (prolonged PR and QT intervals, broad flat T-waves, premature ventricular contractions, ventricular tachycardia, fibrillation), anorexia, nausea, vomiting, lethargy, insomnia.

### Values are increased in:

Addison's disease, adrenalectomy, ataxia, dehydration (severe), diabetes (uncontrolled diabetes, diabetic acidosis before treatment, controlled diabetes in older patients), dysarrhythmias, hypercalcemia, hypothyroidism, hypophosphatemia, renal lithiasis, leukemias (lymphocytic and myelocytic), renal insufficiency and failure. Drugs include antacids containing magnesium, calcium containing medications, cathartics, ethacrynic acid, laxatives (Epsom salt and magnesium citrate), loop diuretics, and thyroid medications.

### Values are decreased in:

Acute tubular necrosis (diuretic phase), alcoholism (chronic), Bartter's syndrome, bowel resection complications, convulsions, diabetic ketoacidosis, diarrhoea (chronic), dysarrhythmias, excessive lactation, excessive sweating, hepatitis, hepatic cirrhosis, hepatic insufficiency, hungry bone syndrome, hypokalemia, hypercalcemia, hyperthyroidism, hypoparathyroidism, hypocalcemia, IV solutions without magnesium, ketoacidosis, kwashiorkor (severe malnutrition), laxative abuse, magnesium deficiency tetany syndrome, pancreatitis (acute and chronic), phosphate depletion, post-obstructive diuresis, postoperatively, primary hyperaldosteronism, prolonged gastric drainage, reduced magnesium intake, reduced magnesium absorption (specific magnesium malabsorption, generalized malabsorption syndrome, excessive bowel resection, diffuse bowel disease or injury), renal disease (chronic), renal defect of resorption, renal transplant, renal tubular acidosis, stress states with catecholamine excess, tetany, toxemia of pregnancy, ulcerative colitis, volume expansion (extracellular fluid). Drugs include alcohol, amphotericin B, some antibiotics (neomycin, aminoglycosides), calcium gluconate, corticosteroids, cyclosporine, diuretics (e.g., mercurial, ethacrynic acid), glucose, insulin, mannitol, and urea.

## MAGNESIUM, URINE

Values are increased in: Alcoholism, Bartter's syndrome, hypermagnesemia, and nephrolithiasis. Drugs include aldosterone, cisplatin, corticosteroids, diuretics (ethacrynic acid), and thiazide.

Values are decreased in: Renal disease, magnesium deficit, osteoporosis, and syndrome of inappropriate antidiuretic hormone secretion (SIADHS).

## TULIP NEWS

The group participated at the MEDICA 2003, the largest medical exhibition held annually at Dusseldorf, Germany. The group received an excellent response to its products and is poised to take its products to newer markets



From Left to Right : Mr H.S. Khani (National Sales Manager), Mr D.G. Tripathi (Director), Mr N. Sriram (Director), Mr A. Tulaskar (Production Manager), Mr V. Shungloo (Manager-Biochemistry), Mr R.S. Prajapati (Marketing Manager-Biochemistry). Sitting Dr. V.K. Naik (Director).

Since its inception in 1988, Tulip Group of companies comprising of eight independent diagnostic companies, has emerged as a leading manufacturer and marketer of in vitro diagnostic reagents and kits, nationally and internationally. Well known for its innovative approach, the companies are owned, managed and run by highly involved professionals. The individual group companies specialize in research, development and designing of specific systems and platforms in diverse technological fields covering almost all areas of diagnostic relevance. The products are manufactured in professionally set up modern facilities complying to relevant FDA guidelines and cover 150000 sq. ft. Of GMP. space.

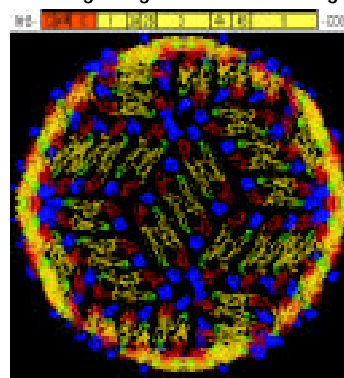
While Tulip Diagnostic (P) Ltd., focuses on assay systems for Immunohaematology, Hematology, Rheumatology, Infectious Diseases and Hemostasis, its Division Microexpress focuses on essential microbiology and mycobacteriology oriented products. Orchid Biomedical Systems focuses on rapid membrane based immunodiagnostic platforms for Fertility, Infectious Diseases and Parasitology. Qualpro & Zephyr Biomedicals focus on Virology and Emerging Infectious Diseases and other markers. Coral Clinical Systems focuses on Clinical Biochemistry and Analytical Reagents

The group believes in creating 'better testing systems for better diagnostics' and sets trends by innovating continuously. The innovativeness is fuelled by an inventive streak with an accent on indigenous technology as a fundamental basis for product development and designing of viable technological platforms for diagnosis. Production systems have been devised around process flows to achieve consistent product performance batch to batch and are overseen by specialized production groups to achieve stated performance characteristics within the prescribed GMP and GLP in force. Stringent incoming, in process QA ensures adherence to expected performance parameters whereas finished QC benchmarked to standard reference materials ensures accuracy of products.

The company's national business is built around branch locations, nationwide with product flow all over the country through a diverse and efficient distributor network that guarantees product availability, maintenance of cool chain and customer responsiveness. Internationally, the company channelises its technology through Distributors, NGO's & arrangements with other international companies. The group products are exported through own, OEM label and bulk supply agreements to fifty countries around the world.

## Dengucheck WB

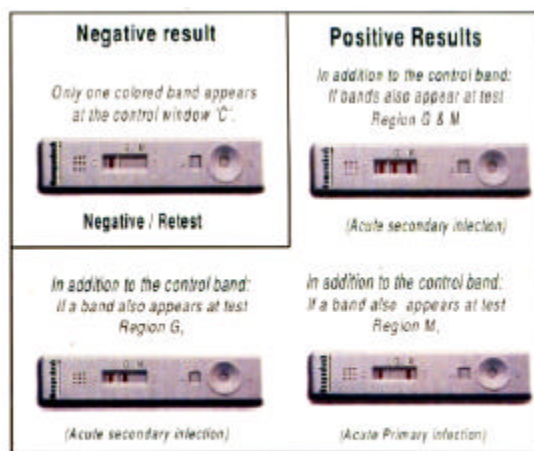
Rapid Test for IgM & IgG antibodies to Dengue Virus



Computer Simulated Image of Dengue Virus

Dengue virus infection is an emerging infectious disease with significant morbidity and mortality globally. Correct diagnosis of Dengue primary and secondary infections is critical to detect Dengue virus fever and prevent potentially life threatening conditions such as DHF and DSS early and for correct patient management. Dengucheck-WB is a new generation rapid ICT test for the serodiagnosis of IgM and IgG antibodies to Dengue virus. Dengucheck-WB is a simple and accurate tool for the differential and objective diagnosis of Dengue virus infections.

### Interpretation of Results



Dengucheck	Presentation	
Pack Size	10 Test	25 Test

Manufactured by  
**Zephyr Biomedicals**

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