TRANSFUSION TRANSMITTED INFECTIONS

CONTENTS

- TTI ?
- Characteristics of TTI
- Mandatory TTI
- Methods/Technologies for TTI Testing
- TTI Notification
- Why & How To Notify

TRANSFUSION CHAIN

Blood donors

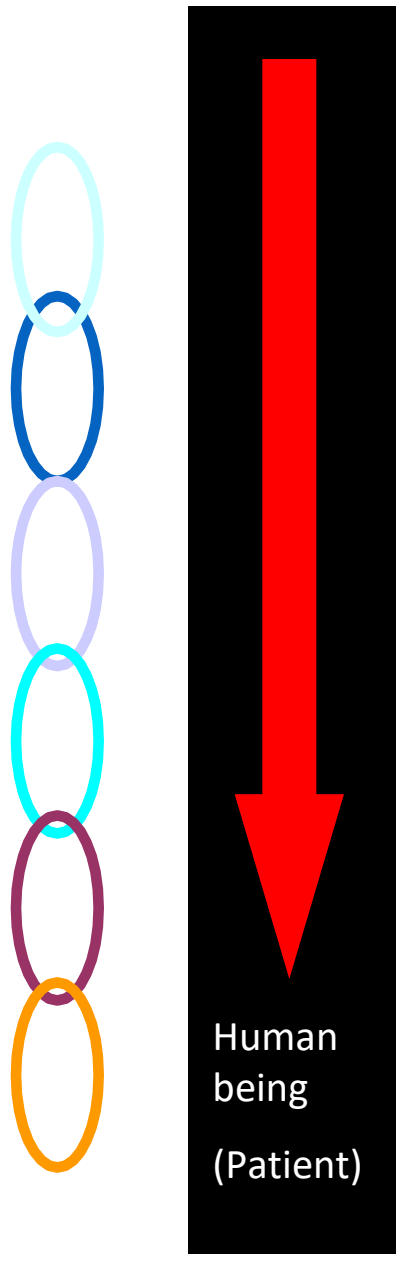
Collection

Processing

Screening and testing

Blood cold chain

Transfusion



Each link consists of several smaller links (primary processes)

The quality of the BTS is influenced by the quality of each of the links

TTI = TRANSFUSION TRANSMISSIBLE INFECTIONS

A pathogen :

- Able to transmit through blood or blood components
- Able to survive outside human body
- Able to survive through range of temperatures
- Able to replicate and re-establish following transfusion
- Exists naturally either free in plasma or in cellular component

INFECTIOUS AGENTS

1. Virus – most commonly transmitted
2. Bacteria
3. Protozoa
4. Fungi – not accepted as blood donor(too sick)
5. Parasite
6. Prion

VIRUS

1. Hepatitis: Hep B, Hep C, Hep D
2. Human immunodeficiency virus (HIV)
3. Human T-cell Lymphotrophic virus (HTLV-1,2)
4. Epstein barr virus (EBV)
5. Cytomegalo virus (CMV)
6. West nile virus (WNV)
7. Human herpes virus (HHV)

BACTERIA

1. Treponema pallidum
2. Yersinia enterocolitica
3. Pseudomonas
4. Propionibacterium acnes
5. Staphylococcus epidermidis
6. Bacillus cereus

PARASITES

1. Plasmodium species
2. Babesia microti
3. Trypanosoma Cruzi
4. Leishmania species
5. Toxoplasma gondi

PRIONS

Creutzfeld Jacob disease / Variant Creutzfeld Jacob disease

CHARACTERISTICS OF TTI

- Asymptomatic or only mild symptoms in donors –hence pass donor screening criteria
- Long incubation period before clinical signs and symptoms appear
- Stability in blood at $4^{O}C$ or lower
- Might cause a carrier state of infection (HBV, HCV)

HOW AND WHAT TO TEST ?

- Identify structural protein
- Identify antibody produced
- Identify antigen
- Identify nuclear material

HOW TO TEST?

- Rapid tests
- ELISA
- Chemiluminescence assay(CLIA)
- Nucleic Acid Amplification Testing (NAT)

SELECTION OF SCREENING ASSAYS

- What is the test?
- Who is going to use it?
- Is the staff experienced or newly recruited?
- What are the constraints?
- Are resources available?
- Are results needed in a very restricted period of time?
- How is it to be used? Large or small number of specimens?
- What are the existing systems?

MANDATORY TTI TESTING

Under **Drugs and Cosmetic Act 1940**

Rules 1945 amendments thereafter, (SCH. F, Part XII B)

Ministry of Health And Family Welfare

Government of India

Screening of each blood & blood components is Mandatory

- HBsAg
- Anti HIV 1 & 2
- Anti HCV
- VDRL
- Malarial parasite

MANDATORY TTI TESTING

HIV 1 & 2, Hepatitis C,, Hepatitis B Syphilis & Malaria

1. **Screening for antibodies to HIV-1 & 2**

   (Rapid/3rd or 4th generation ELISA /Chemiluminescence and / NAT)

2. **Screening for antibodies to HCV**

   (Rapid/3rd or 4th generation ELISA /Chemiluminescence and / NAT)

3 **Hepatitis B Surface Antigen**

   (Rapid/ 3rd or 4th generation ELISA /Chemiluminescence and / NAT)

4. **Syphilis (TPHA/VDRL/RPR)**

5. **Malarial parasite (PBF / Rapid card test)**

MANDATORY BLOOD SCREENING FOR INFECTIOUS MARKERS

Infectious Markers	Year of Enforcement	Mandatory Testing Technology	Newer Technologies
Syphilis	1975	RPR/VDRL/TPHA	ELISA
Hepatitis B virus	1975	ELISA/Rapid	Chemiluminescence/NAT
Malaria	1975	Smear/Rapid	ELISA
HIV	1988	ELISA/Rapid	Chemiluminescence/NAT
Hepatitis C Virus	2001	ELISA/Rapid	Chemiluminescence/NAT

RECENT CONCERNS

- Latency and carrier state leading to persistent infections: HIV, HBV, HCV were major concerns but Hep A and Hep E

- Emerging infections like Dengue Virus ,West Nile Virus, Zika Virus, and others are posing risk for infection

VARIOUS TESTING TECHNOLOGIES

Technology	Window Period		
	HIV	HCV	HBV
ELISA-III Generation	20.6 days	58.3 days	36.3 days
ELISA-IV Generation	13.7 days	9.4 days	24 days
ID NAT	5.6 days	4.9 days	20.6 days

ELISA Testing

Definition: Detection of antigen and/or antibody in plasma/serum using an enzyme-linked chromogenic end point detection system.

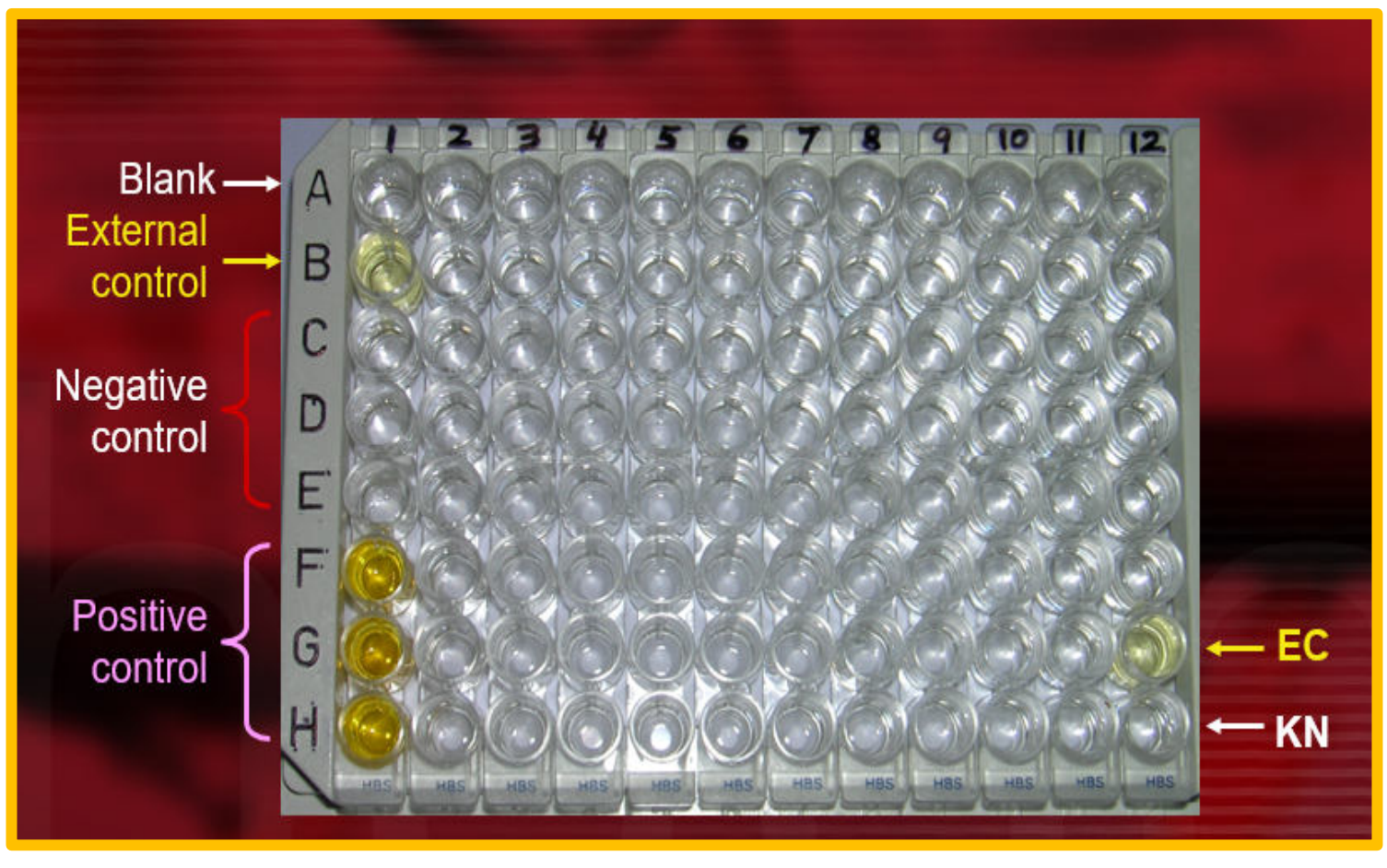
Types of ELISA:

- Indirect
- Competitive
- Sandwich
- Capture

ELISA – Enzyme linked Immunosorbent Assay - Evolution

- **1st generation**: Infected cell lysate is used as an antigen.
- **2nd generation**: Glycopeptides (Recombinant antigens) are used.
- **3rd generation**: Synthetic peptides.
- **4th generation**: Synthetic peptides and antibodies.

IDEAL ELISA PLATE(96 wells) LAYOUT



RAPID TESTS

Employ a variety of techniques

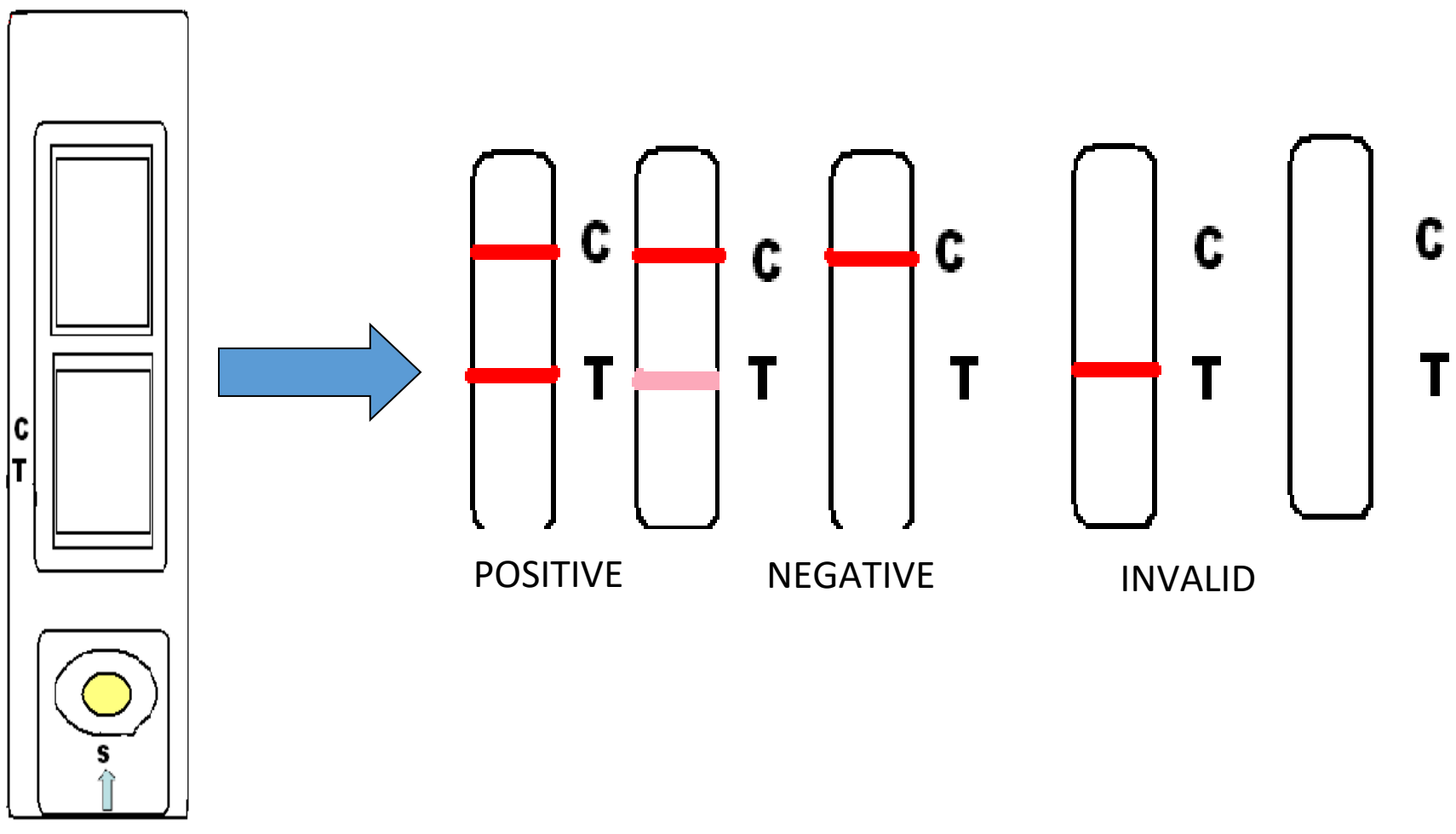
- **Dot blot assays**
- **Particle agglutination**
- **Spot tests**
- **Immuno- chromatographic tests or Card Tests**

- Most have sensitivities and specificities of 99% and 98% respectively

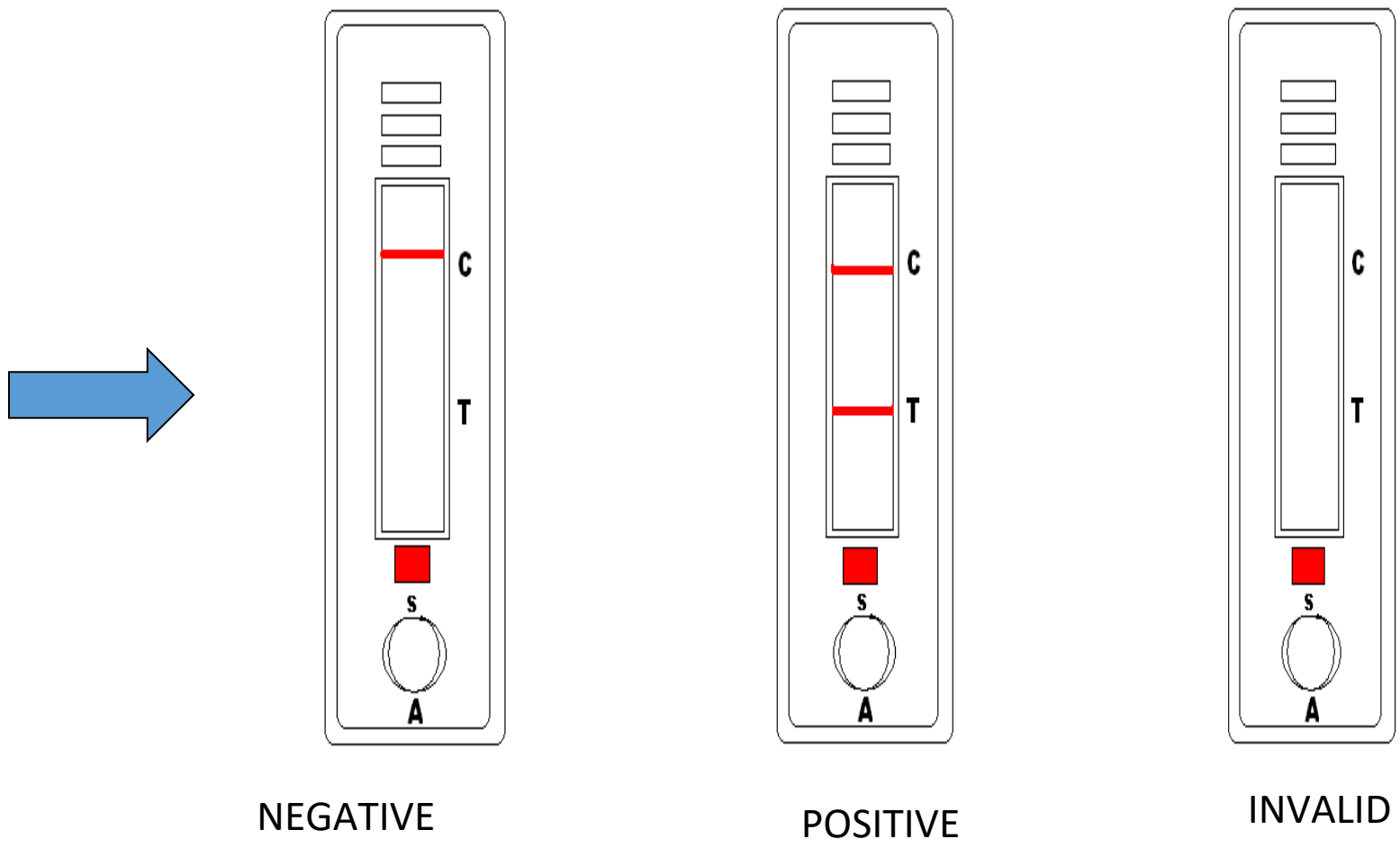
Applications of Rapid tests

- Useful in small blood banks
- Useful in emergency

RAPID IMMUNOCHROMATOGRAPHIC ASSAY



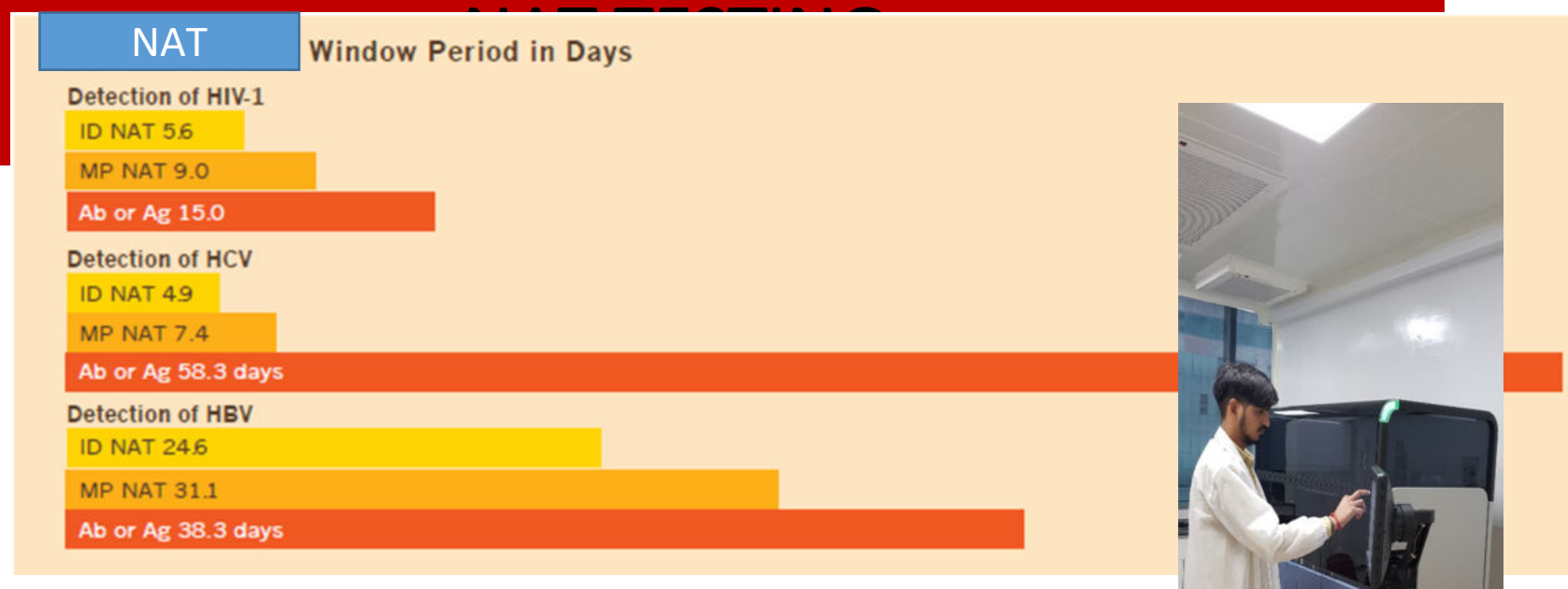
MALARIA CARD TEST



NEGATIVE POSITIVE INVALID

CHEMILUMINESCENCE IMMUNOASSAY

- **Principle:** It is the production of light [Luminescence] from an oxidation-reduction chemical reaction.
- Two chemicals react to form an excited (high-energy) intermediate, which breaks down releasing its energy as photons of light and interpreted as Optical density value.



Preventive strategies for bacterial contamination

- Improved venipuncture site disinfection
- Removal of first aliquot of the donor blood by using bags with diversion pouch.
- Optimizing storage temperature
- Visual inspection of component before use

Preventive strategies for TTI (contd…)

- **Improved pre- transfusion blood testing**
  - Sensitive and specific serological testing
  - Addition of newer methodologies/ better proven kits - added
- **Reducing recipient exposure to blood donor**
  - Optimizing transfusion indications
  - Increased use of single donor products
- **Pathogen inactivation**

Preventive strategies for TTI (contd…)

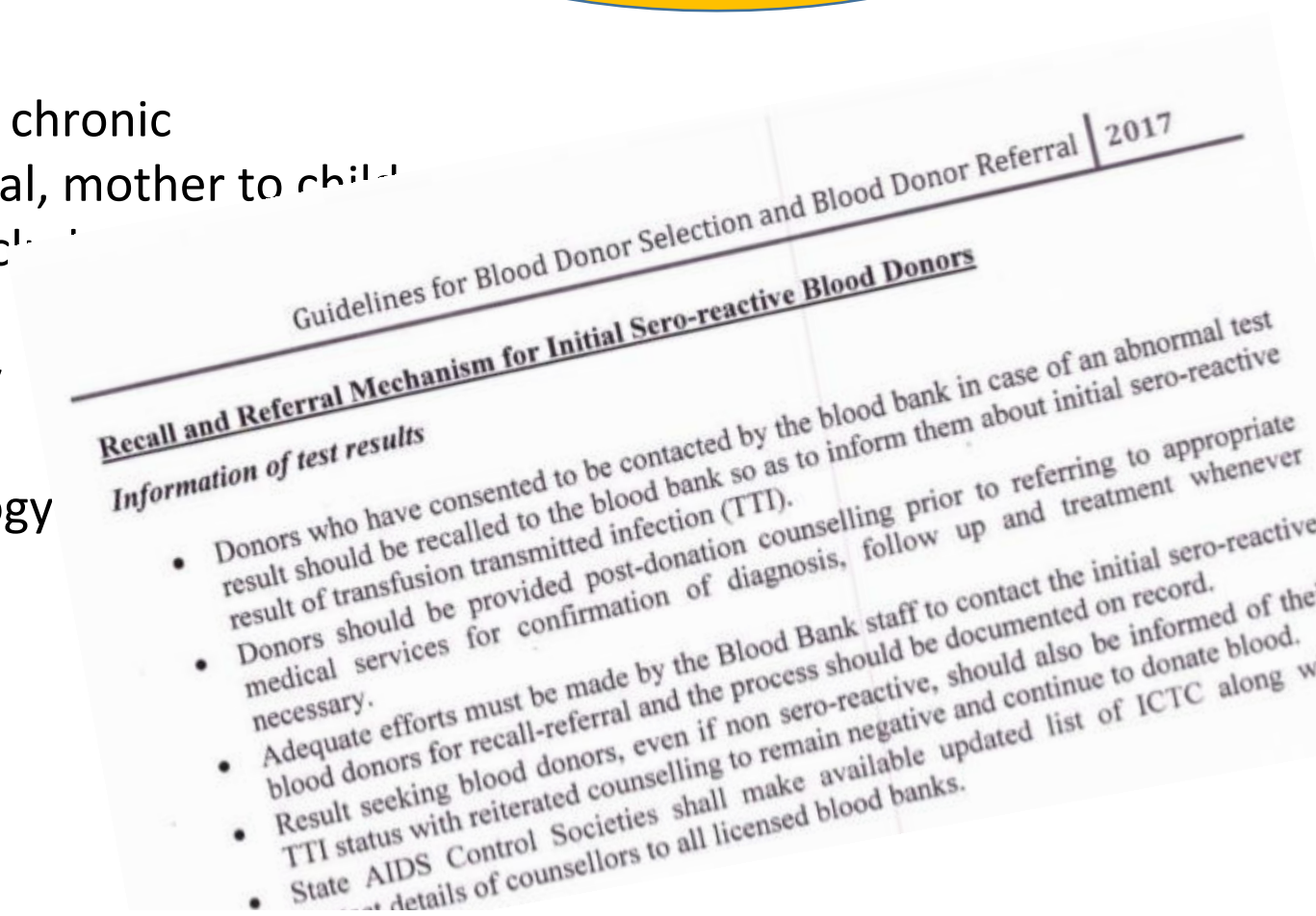
- **Careful donor selection.**
  - Repeat voluntary blood donors
  - Education counselling and retention of these donors
  - Improvement in the blood donor screening criteria
- **Universal leukocyte reduction**

DONOR NOTIFICATION

Why should the donors be informed of test results?

- Results are significant to their health
- Ensures no further donations
- Unethical to hold information
- Informing about Pathology - acute and chronic
  - Secondary transmission - sexual, mother to child
  - Mode of infection-why not excl
  - Treatment and management
- General surveillance and epidemiology
  - acute infection (WP)
  - To improve testing methodology

NBTC/NACO Recommendation



Guidelines for Blood Donor Selection and Blood Donor Referral | 2017

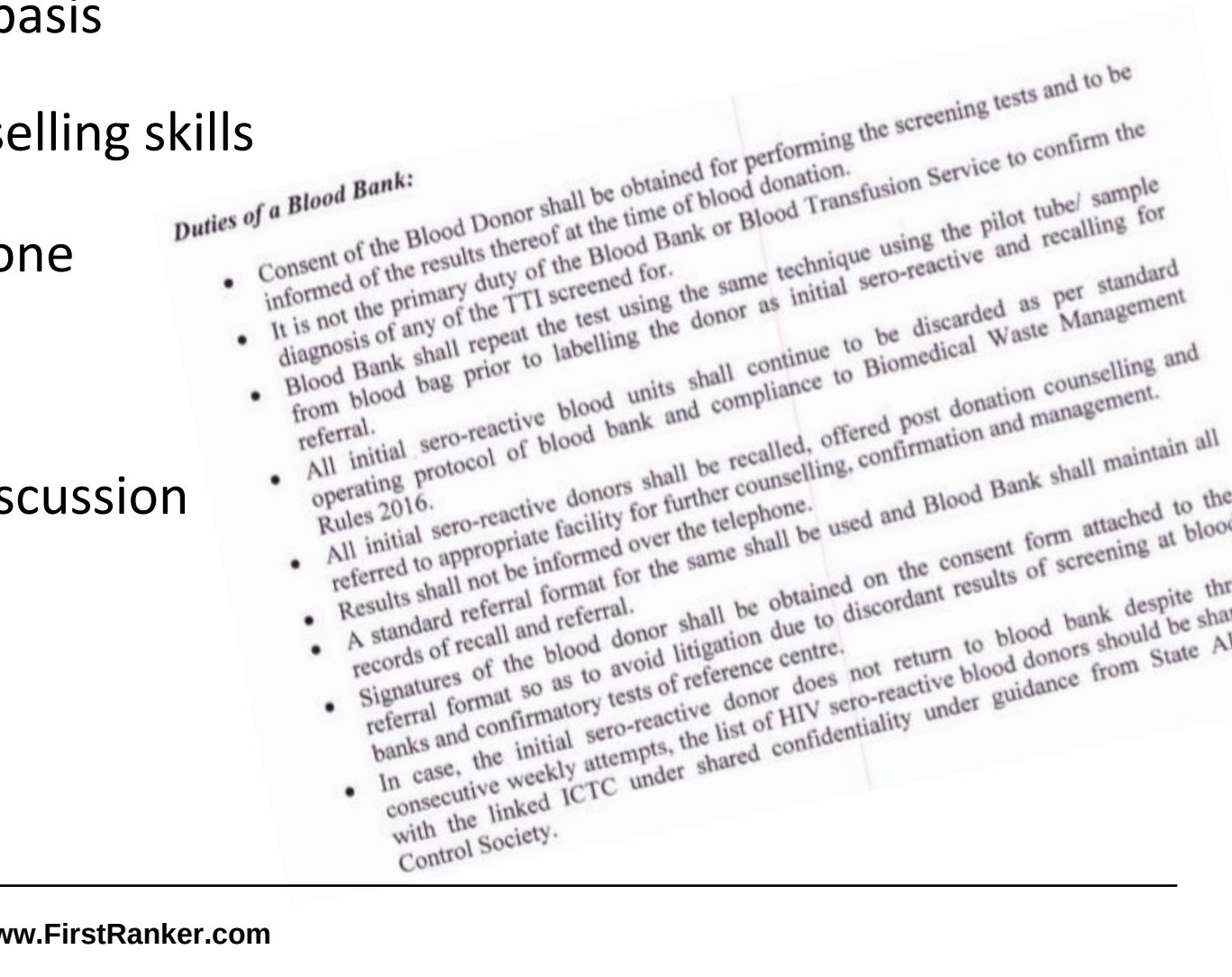
Recall and Referral Mechanism for Initial Sero-reactive Blood Donors

Information of test results

- Donors who have consented to be contacted by the blood bank in case of an abnormal test result should be recalled to the blood bank so as to inform them about initial sero-reactive result of transfusion transmitted infection (TTI).
- Donors should be provided post-donation counselling prior to referring to appropriate medical services for confirmation of diagnosis, follow up and treatment whenever necessary.
- Adequate efforts must be made by the Blood Bank staff to contact the initial sero-reactive blood donors for recall-referral and the process should be documented on record.
- Result seeking blood donors, even if non sero-reactive, should also be informed of their TTI status with reiterated counselling to remain negative and continue to donate blood.
- State AIDS Control Societies shall make available updated list of ICTC along with details of counsellors to all licensed blood banks.

HOW TO NOTIFY ?

- Follow NACO/NBTC policy on how to notify donors about positive TTI
- Tell the results on a face-to-face basis
- Counsellor - well-trained in counselling skills
- Given in person, never on telephone
- Maintain confidentiality
- Opportunity to ask questions / discussion
- Further appointment offered



Duties of a Blood Bank:

- Consent of the Blood Donor shall be obtained for performing the screening tests and to be informed of the results thereof at the time of blood donation.
- It is not the primary duty of the Blood Bank or Blood Transfusion Service to confirm the diagnosis of any of the TTI screened for.
- Blood Bank shall repeat the test using the same technique using the pilot tube/ sample from blood bag prior to labelling the donor as initial sero-reactive and recalling for referral.
- All initial sero-reactive blood units shall continue to be discarded as per standard operating protocol of blood bank and compliance to Biomedical Waste Management Rules 2016.
- All initial sero-reactive donors shall be recalled, offered post donation counselling and referred to appropriate facility for further counselling, confirmation and management.
- Results shall not be informed over the telephone.
- A standard referral format for the same shall be used and Blood Bank shall maintain all records of recall and referral.
- Signatures of the blood donor shall be obtained on the consent form attached to the referral format so as to avoid litigation due to discordant results of screening at blood banks and confirmatory tests of reference centre.
- In case, the initial sero-reactive donor does not return to blood bank despite three consecutive weekly attempts, the list of HIV sero-reactive blood donors should be shared with the linked ICTC under shared confidentiality under guidance from State AIDS Control Society.

REFERRAL

- Refer the donor to other sources of advice and support

  HIV - ICTC (Integrated Counselling and Testing Center)

  HBV/HCV - Medicine / Gastro/ Hepatologist

  Syphilis - Dermatology / STD Clinic

  Malaria - Physician /Medicine

IMPACT ON BLOOD DONORS

- What will the test result mean?
- Will I become ill?
- What about my partner / offspring?
- Am I infectious?
- How did I become infected?
- Is infection treatable?