Anti-Measles virus IFA (IgG or IgM)
Test instruction

ORDER NO. | ANTIBODIES AGAINST | SUBSTRATE | SPECIES | FORMAT SLIDES x FIELDS
--- | --- | --- | --- | ---
FI 2610-1003 G or M | Measles virus | Infected cells | EU 38 | 10 x 03 (1030)
FI 2610-1005 G or M | | | | 10 x 05 (5050)
FI 2610-1010 G or M | | | | 10 x 10 (1000)
FI 2610-2005 G or M | | | | 20 x 05 (1000)
FI 2610-2010 G or M | | | | 20 x 10 (2000)

**Intended use:** These kits are intended for the qualitative or semi-quantitative determination of antibodies against Measles virus (IgG or IgM) in human serum and plasma. They are used as an aid in the diagnosis/investigation of infections/vaccinations with Measles virus, in conjunction with other laboratory and clinical findings.

**Summary and explanation**

**Clinical significance:** The measles virus (MV) is the most instantly recognizable member of Morbilliviruses, a group of viruses belonging to the Paramyxoviridae family [1]. No animal reservoir is known. The measles virus causes an acute feverish illness which occurs mainly in childhood and is very infectious [2, 3]. In 1999, measles still caused worldwide 873,000 deaths per year [1, 4, 5]. Today they are less frequent because of vaccination, especially in the western hemisphere [6, 7]. However, measles epidemics are still observed in some countries [2, 3, 4, 5, 6, 8, 9]. Individuals acutely infected with the virus exhibit a wide range of clinical symptoms ranging from a characteristic mild self-limiting infection to death [1, 2, 8, 10].

MV infections are characterised by an incubation period of about 10 days, flue-like symptoms with fever, malaise, catarrh of the upper respiratory tract, cough, congestion and conjunctivitis. Soon afterwards the measles rash, a typical exanthema, appears first near the ears, then on the forehead, in the face and over the rest of the body [1, 5, 8, 11].

Complications arising from MV infections include secondary bacterial pneumonia, otitis media (approx. 1%), encephalitis (approx. 1%), myocarditis, miscarriage and a condition called subacute sclerosing panencephalitis (SSPE) [5, 12, 13]. Persistent MV infection of the otic capsule is an aetiologic factor in otosclerosis [9, 14]. Anti-measles IgG for the serological diagnosis of otosclerotic hearing loss has a high specificity and sensitivity [15]. SSPE is a progressive, generally fatal brain disorder caused by chronic measles virus infection. It occurs about 7 to 10 years after the infection and generally kills within 3 years from the onset of the symptoms. The patients suffer from behavioural changes, cognitive deterioration, vision problems and eventually advanced neurological symptoms, such as severe spasms, and finally severe physical and mental impairment that leads to death [13]. Males are more commonly affected than females. The risk of SSPE from measles was underestimated according to older data [12]. Actual papers put it at closer to 6.5 to 11 cases of SSPE per 100,000 measles infections; that means 7 to 13 times higher than the earlier estimates [1, 9, 12].

Women with acute measles infection during pregnancy and a negative result for measles-specific antibodies were observed e.g. in Japan, India, Thailand, Kenya and Brazil: 3 of 4 pregnancies ended in preterm delivery, spontaneous abortion or stillbirth; 2 of 4 neonates were found to have congenital measles with a positive result for IgM antibodies [5].
Antibodies against MV can be found in the serum of almost all patients during and after a measles infection. IgM antibodies develop soon after the onset of symptoms and can be measured using ELISA or indirect immunofluorescence tests (IIFT) [16, 20, 21, 22]. 50% of patients have IgM antibodies within three days, more than 90% within 10 days after occurrence of the rash [15, 17]. The Anti-Measles Virus IgM ELISA is more rapid and sensitive for the serological diagnosis of measles infections than other tests [15, 18, 19]. MV infections often cause an increase in heterologic antibodies. The statistically evaluated detection rate for antibodies is significantly higher for ELISA and IIFT in comparison with e.g. neutralisation tests [16, 20]. IgG and IgM antibodies against MV are reliable markers to confirm suspected measles infections.

Measles myelitis or encephalitis can be verified by detecting antibodies against measles in the cerebrospinal fluid (CSF) [23, 24, 25, 26]. These specific antibodies are synthesised in the brain [24]. The CSF-serum quotient (LSQ) allows to differentiate between a blood-derived and a pathological, brain-derived specific antibody fraction in CSF, taking into account individual changes in the blood/CSF barrier function [24, 25, 26, 27]. Therefore it is necessary to confirm the presence of antibodies against MV using ELISA both in CSF and in the serum. During measles myelitis or encephalitis an intrathecal synthesis of antibodies against MV in CFS takes place. Due to the fact that specific antibodies can pass the blood-cerebrospinal fluid barrier by diffusion from serum to CSF it is necessary to determine the relative CSF/serum quotient (CSQrel., synonym: antibody specificity index) [24, 25, 26]. The quotient is calculated from the amount of specific anti-measles virus IgG antibodies in total CSF IgG in proportion to the amount of specific IgG antibodies in total serum IgG. During conversion the CSF/serum quotient of the pathogen-specific IgG-antibody concentrations CSQpath.-spec. (IgG) is put into relation to the CSF/serum quotient of the total IgG concentrations CSQtotal (IgG) [27]. A relative CSQ result above 1.5 indicates the production of specific antibodies in the central nervous system (CNS) and the involvement of the CNS in the disease [25, 26].

With respect to the severe complications known from measles infections, the Robert Koch Institute in Germany recommends vaccinating small children, with a first shot between the age of 11 to 14 months and a second between 15 and 23 months [2, 4, 10, 11]. Neutralisation activity and persistence of antibodies are induced in response to the immunisation [6, 15].

Life-long immunity is generally developed. However, antibody levels are 8 to 10 times lower in post-vaccination sera than in convalescent sera [6, 19, 28]. A passive immunisation with specific immunoglobulin concentrates is usually given to immunosuppressed seronegative individuals, such as tumour patients and recipients of transplants, as well as to seronegative pregnant women after exposure to the virus.

The European Regional Office of the WHO aims at eliminating measles from the region in the following years by area-wide vaccination campaigns [4, 9, 10]. This is expected to limit the number of apparent infections and especially of severe courses of the disease. For the diagnosis of the remaining cases of measles infection and of infections acquired outside Europe as well as for the clarification of atypical courses of the disease in partly immunised patients the antibody determination in serum and CSF will be of growing importance [3, 5, 8, 9].

**Antigen:** For the detection of antibodies against measles virus by indirect immunofluorescence, measles virus infected cells (species EU 38) are used.

**Principles of the test:** Measles virus infected cells are incubated with diluted patient sample. If the reaction is positive, specific antibodies of classes IgA, IgG and IgM attach to the viral antigens. In a second step, the attached antibodies are stained with fluorescein-labelled anti-human antibodies and made visible with a fluorescence microscope.
Materials

Contents of a test kit for 50 determinations (FI 2610-1005 G):

<table>
<thead>
<tr>
<th>Description</th>
<th>Format</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Slides, each containing 5 BIOCHIPS coated with Measles virus infected cells</td>
<td>10 slides</td>
<td>SLIDE</td>
</tr>
<tr>
<td>2. Fluorescein-labelled anti-human IgG (goat), ready for use</td>
<td>1 x 1.5 ml</td>
<td>CONJUGATE</td>
</tr>
<tr>
<td>3. Positive control: antibodies against Measles virus (IgG), human, ready for use</td>
<td>1 x 0.1 ml</td>
<td>POS CONTROL</td>
</tr>
<tr>
<td>4. Negative control: anti-Measles virus negative, human, ready for use</td>
<td>1 x 0.1 ml</td>
<td>NEG CONTROL</td>
</tr>
<tr>
<td>5. Salt for PBS pH 7.2</td>
<td>2 packs</td>
<td>PBS</td>
</tr>
<tr>
<td>6. Tween 20</td>
<td>2 x 2.0 ml</td>
<td>TWEEN 20</td>
</tr>
<tr>
<td>7. Embedding medium, ready for use</td>
<td>1 x 3.0 ml</td>
<td>GLYCEROL</td>
</tr>
<tr>
<td>8. Cover glasses (62 mm x 23 mm)</td>
<td>12 pieces</td>
<td>COVERGLASS</td>
</tr>
<tr>
<td>9. Instruction booklet</td>
<td>1 booklet</td>
<td>---</td>
</tr>
<tr>
<td>Lot description</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In vitro diagnostics</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Additional materials and equipment (not supplied):

- Performance of the test with TITERPLANE technology requires reagent trays TRAY, which are not provided in the test kits. These reagent trays are reusable. They are available from EUROIMMUN under the following order number:
  - ZZ 9999-0110  Reagent trays for slides containing up to 10 fields (5x5 mm)
- Single slides (e.g., EUROIMMUN order no. FK 2610-1005) are provided together with cover glasses.
- Additional positive control (e.g., order no. CI 2610-0101 G) and negative control (e.g., order no. CI 2610-0101 Z) can be ordered.
- Fluorescent Microscope: Equipped with a 488 nm excitation filter; 510 nm color separator; & 520 nm blocking filter with a 100 W mercury vapour lamp light source or LED blue light.
- Distilled or De-ionized water for wash buffer production
- Pipettes with a range of 10µl to 200µl
- Cuvettes or wash/staining dishes for PBS wash step
- Lint free towelling

Warnings and precautions

For in vitro diagnostic use.

Warning: Potentially biohazardous material. The BIOCHIPS coated with antigen substrates have been treated with a disinfecting fixing agent. Neither HBsAg nor antibodies against HIV-1, HIV-2, and HCV could be detected in the control sera using FDA-cleared or European CE-approved test systems. Nevertheless, all test system components should be handled as potentially infectious materials. Patient samples, controls and slides are to be handled as potentially infectious materials. All reagents are to be disposed of in accordance with official disposal regulations.

Some of the reagents contain sodium azide at a concentration of ≤ 0.09%. Sodium azide has been reported to form lead or copper azides in laboratory plumbing which may cause explosions. Rinse sink thoroughly with water after disposing of solutions containing azide. Avoid skin contact.

The individual reagents of one lot are matched with one another and should not generally be swapped with reagents of another lot or with reagents from another manufacturer.
Preparation and stability of the reagents

Storage and stability: The slides and the reagents should be stored at a temperature of between +2°C and +8°C. Stability is guaranteed for 18 months after the date of manufacture if stored properly. Do not use beyond the expiration date noted on the kit label. After initial opening, the reagents are stable until the expiry date when stored between +2°C and 8°C and protected from contamination, unless stated otherwise below. Protect from exposure to heat and light.

Indications of instability: Do not use if reagents appear cloudy.

- **Slides:** Ready for use. Remove the protective cover only when the slides have reached room temperature (condensed water can damage the substrate). Mark with a felt-tip pen. Do not touch the BIOCHIPS. After the protective cover has been opened, the slide should be incubated within 15 minutes. If the protective cover is damaged, the slide must not be used for diagnostics.

- **Fluorescein-labelled secondary antibody (FITC):** Ready for use. Before using for the first time, mix thoroughly. The conjugate is sensitive to light. Protect from sunlight ☀.

- **Positive and negative controls:** Ready for use. Before using for the first time, mix thoroughly.

- **PBS-Tween:** 1 pack of “Salt for PBS” should be dissolved in 1 liter of distilled water and mixed with 2 ml of Tween 20 (stir for 20 min until homogeneous). The prepared PBS-Tween can be stored at +2°C to +8°C, generally for 1 week. PBS-Tween should not be used if the solution becomes cloudy or contamination appears.

- **Embedding medium:** Ready for use.

- **Reagent trays:** Reaction fields of the reagent tray must be hydrophilic and surrounding area hydrophobic. If necessary, wipe with Extran MA 01 (Merck) and rinse generously with water. To disinfect: Immerse in Sekusept Extra (Henkel) (3% in water) for 1 hour. After disinfection rinse generously with water and dry with absorbent paper.

Preparation and stability of the patient samples

**Samples:** Human serum or EDTA, heparin or citrate plasma.

**Stability:** CLSI (formerly NCCLS) Document H18-A2 recommends the following storage conditions for samples: Samples should be stored at room temperature no longer than 8 hours. If the assay will not be completed within 8 hours, the samples should be refrigerated at 2-8°C. If the assay will not be completed within 48 hours, or for shipment of the sample, samples should be frozen at -20°C or lower. Frozen samples must be mixed well after thawing and prior to testing. Diluted samples should be incubated within 8 hours. Do not use bacterially contaminated samples.

**Antibodies of class IgM:** Before determining specific antibodies of class IgM, antibodies of class IgG should be removed from the patient samples by immunoabsorption (e.g., EUROSORB: EUROIMMUN Order No.: ZF 1270-0145). This prevents rheumatoid factors of class IgM present in the sample from reacting with specifically bound IgG and giving false IgM positive results, or specific IgG displacing IgM from the antigen (false IgM negative results). With immunoabsorption rheumatoid factors are removed at the same time (RF absorbent).
**Recommended sample dilution for qualitative evaluation:** Determination of antibodies of class IgG: The sample to be investigated is diluted 1:10 in PBS-Tween. For example, dilute 11.1 µl sample in 100 µl PBS-Tween and mix thoroughly, e.g., vortex for 4 seconds.

Determination of antibodies of class IgM: For immunoabsorption, dilute patient samples 1:10 with EUROSORB (for example, add 11.1 µl sample to 100 µl EUROSORB and mix thoroughly, e.g. by vortexing for 4 seconds). Incubate the mixture for 15 minutes at room temperature. Do not stir the pellet, which might have formed. Alternatively, centrifuge the mixture (5 minutes, 2000 rpm, room temperature).

**Recommended sample dilution for semi-quantitative evaluation:** The dilution of samples to be investigated is performed using PBS-Tween (for special considerations for the determination of class IgM antibodies, see above). For each add 100 µl of PBS-Tween to the tube and mix with 11.1 µl of the next highest concentration, e.g., vortex for 2 seconds. EUROIMMUN recommends incubating samples from a dilution of 1:10.

<table>
<thead>
<tr>
<th>Dilution</th>
<th>Dilution scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:10</td>
<td>100 µl PBS-Tween + 11.1 µl undiluted sample</td>
</tr>
<tr>
<td>1:100</td>
<td>100 µl PBS-Tween + 11.1 µl 1:10 diluted sample</td>
</tr>
<tr>
<td>1:1000</td>
<td>100 µl PBS-Tween + 11.1 µl 1:100 diluted sample</td>
</tr>
</tbody>
</table>

After every two dilution steps, a new pipette tip should be used to prevent carryover.
Procedure

The TITERPLANE Technique was developed by EUROIMMUN as an aid in standardizing immunological analyses: Patient samples, controls and in separate steps conjugate and embedding medium are applied to the reaction fields of a reagent tray. The BIOCHIP Slides are then placed into the recesses of the reagent tray, where all BIOCHIPs of the slide come into contact with the fluids, and the individual reactions commence simultaneously. The fluids are confined to the recessed wells eliminating the need to use a conventional “humidity chamber”.

*Reaction fields of the reagent tray must be hydrophilic and surrounding area hydrophobic. The reagent tray may be used repeatedly as long as the hydrophilic and hydrophobic properties are maintained. Clean with mild laboratory glassware detergent and rinse thoroughly with DI water. The tray can be checked for these properties by adding a defined amount of PBS (25µl) to each well to be sure it is restricted to the well.

**Prepare:**

The preparation of the reagents and of the serum and plasma samples is described in this test instruction.

**Pipette:**

Apply **30 µl of diluted sample** to each reaction field of the reagent tray, avoiding air bubbles. Transfer all samples to be tested before starting the test to a reagent tray.

**Incubate:**

Start reactions by fitting the BIOCHIP Slides into the corresponding recesses of the reagent tray. Ensure that each sample makes contact with its BIOCHIP and that the individual samples do not come into contact with each other. Incubate for **30 min** at room temperature (+18°C to +25°C).

**Wash:**

Rinse the BIOCHIP Slides with a gentle flush of PBS–Tween using a beaker and immerse them immediately afterwards in a cuvette containing PBS–Tween for **5 min**. Shake with a rotary shaker if available. Wash max. 16 slides then replace PBS–Tween with new buffer.

**Pipette:**

Apply **25 µl of fluorescein-labelled anti-human globulin** to each reaction field of a clean reagent tray. Fill all the fields needed before continuing incubation. The labelled anti-human serum should be mixed before use.

**Incubate:**

Remove one BIOCHIP Slide from cuvette. Within five seconds blot only the back and the sides with a lint free paper towel and immediately fit the BIOCHIP Slide into the recesses of the reagent tray. Do not dry the areas between the reaction fields on the slide. Check for correct contact between the BIOCHIPs and liquids. Then continue with the next BIOCHIP Slide. Protect the slides from direct sunlight. Incubate for **30 min** at room temperature (+18°C to +25°C).

**Wash:**

Fill cuvette with new PBS-Tween. Rinse the BIOCHIP Slides with a gentle flush of PBS–Tween using a beaker and place them into the cuvette filled with the new PBS-Tween for **5 min**. Optional: shake with a rotary shaker if available. 10 drops of Evans Blue for each 150 ml phosphate buffer can be added for counterstaining. Wash max. 16 slides then replace PBS-Tween with new buffer.

**Embed:**

Place embedding medium onto a cover glass – drops of **max. 10 µl per reaction field**. Use a reagent tray. Remove one BIOCHIP Slide from PBS–Tween and dry the back, all four sides, as well as the surface around, but not between the reaction fields with a lint free paper towel. Put the BIOCHIP Slide, with the BIOCHIPs facing downwards, onto the prepared cover glass. Check immediately that the cover glass is properly fitted into the recesses of the slide. Gently correct the position if necessary.

**Evaluate:**

Read the fluorescence with the microscope.

General recommendation: Objective ‘20x (tissue sections, infected and transfected cells), 40x (cell substrates).


Light source: mercury vapor lamp, 100 W, EUROIMMUN LED, EUROStar Bluelight.
**TITERPLANE Technique**

**Pipette:** 30 µl per field

**Incubate:** 30 min

**Wash:** 1 s flush
5 min cuvette

**Pipette:** 25 µl per field

**Incubate:** 30 min

**Wash:** 1 s flush
5 min cuvette

**Embed:** max. 10 µl per field

**Evaluate:** fluorescence microscopy

**BIOCHIP slide**

**BIOCHIPs**

**reagent tray**

**diluted samples**

**PBS-Tween**

**labelled antibody**

**embedding medium**

**cover glass**

**20 x**

**40 x**
Interpretation of results

**Fluorescence pattern (positive reaction):** Antibodies against Measles virus cause a distinct fluorescence of the infected cells. Mainly in the area of the cytoplasm, granular to coarse droplet-shaped structures containing viral material fluoresce. Some cells are not infected and show no specific fluorescence. Depending on the degree of infection, tiny grains to coarser droplets fluoresce in a few cells, while more seriously infected cells show a pattern of coarse droplets and, in parts, a spread of fluorescence.

If a patient sample contains antibodies against Measles virus, the same pattern must essentially be obtained as for the positive control serum.

If the cell nuclei or the cytoplasm of all cells are stained, i.e. also those of non-infected cells, antinuclear antibodies or antibodies against mitochondria and other cell antigens are present.

If the positive control shows no specific fluorescence pattern or the negative control shows a clear specific fluorescence the results are not to be used and the test is to be repeated.

A large range of fluorescence images can be found on the EUROIMMUN website (www.euroimmun.com).

**Qualitative evaluation:**

<table>
<thead>
<tr>
<th>IgG reactivity</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>No reaction at 1:10</td>
<td>Negative. No IgG class antibodies against Measles virus detected in the patient sample. Infection cannot be excluded.</td>
</tr>
<tr>
<td>Positive reaction at 1:10</td>
<td>Positive. Former or acute infection.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IgM reactivity</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>No reaction at 1:10</td>
<td>Negative. No IgM class antibodies against Measles virus detected in the patient sample. Infection cannot be ruled out.</td>
</tr>
<tr>
<td>Positive reaction at 1:10</td>
<td>Positive. Indication of an acute infection.</td>
</tr>
</tbody>
</table>

**Semi-quantitative evaluation:** The titer is defined as the sample dilution factor for which specific fluorescence is just identifiable. This should be compared to the reaction obtained with an equivalently diluted negative serum.

Antibody titers can be determined according to the following table from the fluorescence of the different sample dilutions.

<table>
<thead>
<tr>
<th>Fluorescence at</th>
<th>Antibody titer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:10</td>
<td></td>
</tr>
<tr>
<td>weak</td>
<td>negative</td>
</tr>
<tr>
<td>moderate</td>
<td>negative</td>
</tr>
<tr>
<td>strong</td>
<td>negative</td>
</tr>
<tr>
<td>strong</td>
<td>negative</td>
</tr>
<tr>
<td>strong</td>
<td>weak</td>
</tr>
<tr>
<td>strong</td>
<td>moderate</td>
</tr>
<tr>
<td>strong</td>
<td>strong</td>
</tr>
<tr>
<td></td>
<td>weak</td>
</tr>
<tr>
<td>1:100</td>
<td></td>
</tr>
<tr>
<td>weak</td>
<td>negative</td>
</tr>
<tr>
<td>moderate</td>
<td>negative</td>
</tr>
<tr>
<td>strong</td>
<td>negative</td>
</tr>
<tr>
<td>strong</td>
<td>weak</td>
</tr>
<tr>
<td>strong</td>
<td>moderate</td>
</tr>
<tr>
<td>strong</td>
<td>strong</td>
</tr>
<tr>
<td></td>
<td>weak</td>
</tr>
<tr>
<td>1:1000</td>
<td></td>
</tr>
<tr>
<td>weak</td>
<td>negative</td>
</tr>
<tr>
<td>moderate</td>
<td>negative</td>
</tr>
<tr>
<td>strong</td>
<td>negative</td>
</tr>
<tr>
<td>strong</td>
<td>weak</td>
</tr>
<tr>
<td>strong</td>
<td>moderate</td>
</tr>
<tr>
<td>strong</td>
<td>strong</td>
</tr>
<tr>
<td></td>
<td>weak</td>
</tr>
<tr>
<td>1:10000</td>
<td></td>
</tr>
<tr>
<td>weak</td>
<td>negative</td>
</tr>
<tr>
<td>moderate</td>
<td>negative</td>
</tr>
<tr>
<td>strong</td>
<td>negative</td>
</tr>
<tr>
<td>strong</td>
<td>weak</td>
</tr>
<tr>
<td>strong</td>
<td>moderate</td>
</tr>
<tr>
<td>strong</td>
<td>strong</td>
</tr>
<tr>
<td></td>
<td>weak</td>
</tr>
</tbody>
</table>

An increase of titer fourfold or higher within two weeks indicates an acute infection.

For diagnosis the clinical symptoms of the patient should always be taken into account along with the serological results.
Limitations of the procedure

1. A diagnosis should not be made on a single test result. The clinical symptoms of the patient should always be taken into account along with the serological results by the physician.

2. In the case of positive and questionable immunofluorescence reactions, an enzyme immunoassay with defined target antigens should be performed subsequently for the verification and differentiation of the results.

3. Adaptation of this assay for use with automated sample processors and other liquid handling devices, in whole or in part, may yield differences in test results from those obtained using the manual procedure. It is the responsibility of each laboratory to validate that their automated procedure yields test results within acceptable limits.

4. Mishandling of slides during the staining procedure, especially allowing slides to dry between steps, may result in a "washed out" pattern appearance and/or a high level of background staining.

5. Coplin jars used for slide washing should be free from all dye residues. Use of coplin jars containing dye residue may cause staining artifacts.

6. The light source, filters and optical equipment of the fluorescence microscope can influence the sensitivity of the assay. Using traditional mercury vapour lamp systems, the performance of the microscope is significantly influenced by correct maintenance, especially alignment of the lamp and replacement of the lamp after the recommended period of time. The EUROIMMUN EUROStar fluorescence microscope with LED-Bluelight as the light source offers many advantages. Contact EUROIMMUN for details.

7. Cross reactivity: Cross reactivities with other Paramyxoviridae cannot be ruled out.

8. Interference: Hemolytic, lipaemic or icteric samples were not found to affect the test results with concentrations up to 500 mg/dl for hemoglobin, 2000 mg/dl for triglyceride and 40 mg/dl for bilirubin.

Expected values

Specificity and sensitivity:

<table>
<thead>
<tr>
<th>Substrate</th>
<th>Reference</th>
<th>Specificity</th>
<th>Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measles virus (IgG):</td>
<td>reference centers (n = 31, Germany)</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Measles virus (IgM):</td>
<td>reference centers (n = 31, Germany)</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Reference range: Titer 1: < 10 (IgG, IgM)

The following antibody prevalences (1:10 or higher) were determined using a panel of samples from healthy blood donors (origin: Germany):

- IgG: 95%  (n= 198)
- IgM: 0.7%  (n= 149)

Note: It is recommended that each laboratory determine its own normal range based on the population and equipment used.
Performance characteristics

**Measurement range:** The dilution starting point for this measurement system is 1:10. Samples can be further diluted by a factor of 10 so that the dilution series is 1:100, 1:1000, 1:10000 etc. There is no upper limit to the measurement range.

**Reproducibility:** Reproducibility was tested with more than 10 different lots. In semi-quantitative evaluation of results, the deviation amounted to no more than ±1 fluorescence intensity level for all samples. The intensity of the specific fluorescence as a numeric value is called fluorescence intensity level by EUROIMMUN. These values can reach from “0” (no specific fluorescence) to “5” (extremely strong specific fluorescence).

**Literature references**

11. CDC **Measles outbreaks still occur among school-age children and travelers.** MMWR 46 (1997) 242-245.


22. EUROIMMUN AG. Aktuelle Themen der Autoimmundiagnostik und der Infektions-Serologie. Wissenschaftliches Fortbildungsseminar mit Vorträgen von Prof. Dr. G. Wick, Prof. Dr. N. Sepp, Prof. Dr. F. Deisenhammer, Dr. med. W. Stöcker, Prof. Dr. Gerold Stanek, Prof. DDr. R. Würzner, A. Krapf, Dr. med. Dipl. oec. med. J. Brunner, Innsbruck (2007).


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