Bordetella pertussis

IgM – ELISA

Enzyme immunoassay for the qualitative determination of IgM-class antibodies against Bordetella pertussis in human serum or plasma

For Laboratory use only

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Product Number: 40-521-475055 (96 Determinations)
Bordetella species are non-spore-forming encapsulated bipolar, cocccoid (pale staining) Gram-negative bacilli (about 0.3-0.5 µm thick and 1 µm long). The genus consists of the human parasites B. pertussis and B. parapertussis, and B. bronchiseptica and B. avium which cause enzootic infections in various wild and domestic animal species. B. pertussis is the classical exoter of pertussis and exists only in ill people; B. parapertussis causes 5-20% of a milder and often clinical unapparent form of pertussis. B. bronchiseptica has seldomly (eg close contact with animals) human pathogenic significance as opportunistic secondary exoter in mixed infections (bronchitis, pneumonia, wound infection).

Pertussis or whooping cough is a bacterial infection of the respiratory system. It is a highly contagious childhood disease which appears seldomly under adults. It is transmitted by respiratory contact. B. pertussis has the ability to stick to the cilia of the epidermal cells of the respiratory system. Fragments of the bacterial cell wall (Exotoxin = trachelic Cytotoxine, TCT) inhibit the movement of the cilia in the tracheal mucosa. After an incubation time of one to three weeks the disease runs through three stages (s. table below). The lethality is 0.6 % and concerns babies in the first six months with more than 70 %. For newborn and premature infants it is higher (1-2%). In Africa beside measle virus B. pertussis is the main reason for high infant mortality. The distribution of the disease is worldwide.

Clinical pertussis is followed by natural acquired immunity which is long-lasting but not permanent. In most countries an active vaccination is recommended which leads to 90% protection for three to twelve years. Usually the immunization preparation is combined with diphertheria and tetanus toxoids.

### Table: Pertussis Etiology

<table>
<thead>
<tr>
<th>Species</th>
<th>Disease</th>
<th>Symptoms</th>
<th>Mechanism of infection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bordetella</strong></td>
<td><strong>pertussis</strong></td>
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<tr>
<td></td>
<td>Pertussis whooping cough</td>
<td>1. Stadium catarrhal: symptoms of a cold with slight fever (1-2 weeks)</td>
<td>Highly contagious droplet infection</td>
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<tr>
<td></td>
<td></td>
<td>2. Stadium convulsivum: severe, spasmodic coughing; after deep inspiration follows a coughing staccato with protruded tongue (2-6 weeks)</td>
<td>Humans are the only reservoir of B. pertussis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Stadium decrement: Ease of disease with symptoms of a bronchitis (up to 6 weeks)</td>
<td>Incubation time: 1-3 weeks</td>
</tr>
</tbody>
</table>

- The presence of bacterium resp. infection may be identified by
  - Microscopy: identification on cultures, IF
  - Serology: Detection of antibody production by ELISA

Precise diagnosis is needed for effective treatment of patients, for isolation of unvaccinated infants at risk, and for differentiation of pertussis from atypical diseases and chronic infections.

### 2. INTENDED USE

The GenWay Bordetella pertussis IgM-ELISA is intended for the qualitative determination of IgM class antibodies against Bordetella pertussis and Bordetella pertussis **toxin** in human serum or plasma (citrate).

### 3. PRINCIPLE OF THE ASSAY

The qualitative immunoenzymatic determination of IgM-class antibodies against Bordetella pertussis is based on the ELISA (Enzyme-linked Immunosorbent Assay) technique. Microtiter strip wells are precoated with Bordetella pertussis/toxin antigens to bind corresponding antibodies of the specimen. After washing the wells to remove all unbound sample material horseradish peroxidase (HRP) labelled anti-human IgM conjugate is added. This conjugate binds to the captured Bordetella pertussis/toxin specific antibodies. The immune complex formed by the bound conjugate is visualized by adding tetramethylbenzidine (TMB) substrate which gives a blue reaction product. The intensity of this product is proportional to the amount of Bordetella pertussis/toxin specific IgM antibodies in the specimen. Sulphuric acid is added to stop the reaction. This produces a yellow endpoint colour. Absorbance at 450 nm is read using an ELISA microwell plate reader.

### 4. MATERIALS

#### 4.1. Reagents supplied

- **Bordetella pertussis Coated Wells (IgM):** 12 breakapart 8-well snap-off strips coated with Bordetella pertussis antigen; in resealable aluminium foil.
- **IgM Sample Diluent***: 1 bottle containing 100 ml of ready to use buffer for sample dilution; pH 7.2 ± 0.2; coloured green; white cap.
- **Stop Solution**: 1 bottle containing 15 ml. Ready to use sulphuric acid, 0.2 mol/l; red cap.
- **Washing Solution (20x conc.)***: 1 bottle each containing 50 ml of a 20-fold concentrated buffer (pH 7.2 ± 0.2) for washing the wells; white cap.
- **Bordetella pertussis anti-IgM Conjugate**: 1 bottle containing 20 ml of peroxidase labelled rabbit antibody to human IgM; coloured red, Ready to use; black cap.
- **TMB Substrate Solution**: 1 bottle containing 15 ml 3,3',5,5'-tetrathylbenzidine (TMB); ready to use; yellow cap.
- **Bordetella pertussis IgM Positive Control***: 1 bottle containing 2 ml; coloured yellow; ready to use; red cap.
- **Bordetella pertussis IgM Cut-off Control***: 1 bottle containing 3 ml; coloured yellow; ready to use; green cap.
- **Bordetella pertussis IgM Negative Control***: 1 bottle containing 2 ml; coloured yellow; ready to use; blue cap.

* contains 0.1 % Bronidox L after dilution
** contains 0.2 % Bronidox L
*** contains 0.1 % Kathon

### 4.2. Materials supplied
- 1 Strip holder
- 1 Cover foil
- 1 Test protocol
- 1 distribution and identification plan

### 4.3. Materials and Equipment needed
- ELISA microwell plate reader, equipped for the measurement of absorbance at 450/620 nm
- Incubator 37°C
- Manual or automatic equipment for rinsing wells
- Pipettes to deliver volumes between 10 and 1000 µl
- Vortex tube mixer
- Deionised or (freshly) distilled water
- Disposable tubes
- Timer

### 5. STABILITY AND STORAGE
The reagents are stable up to the expiry date stated on the label when stored at 2…8 °C.

### 6. REAGENT PREPARATION

*It is very important to bring all reagents, samples and controls to room temperature (20…25°C) before starting the test run!*

#### 6.1. Coated snap-off strips
The ready to use breakapart snap-off strips are coated with Bordetella pertussis antigen. Store at 2…8°C. **Immediately after removal of strips, the remaining strips should be resealed in the aluminium foil along with the desiccant supplied and stored at 2…8 °C; stability until expiry date.**

#### 6.2. Bordetella pertussis anti-IgM Conjugate
The bottle contains 20 ml of a solution with anti-human-IgM horseradish peroxidase, buffer, stabilizers, preservatives and an inert red dye. The solution is ready to use. Store at 2…8°C. **After first opening stability expiry date when stored at 2…8°C.**

#### 6.3. Controls
The bottles labelled with Positive, Cut off and Negative Control contain a ready to use control solution. It contains 0.1% Kathon and has to be stored at 2…8°C. **After first opening stability expiry date when stored at 2…8°C.**

#### 6.4. IgM Sample Diluent
The bottle contains 100 ml phosphate buffer, anti-human-IgG, stabilizers, and an inert green dye. It is used for the dilution of the patient specimen. The solution contains antihuman IgG class antibodies to eliminate competitive inhibition from specific IgG class antibody to remove rheumatoid factor. This ready to use solution has to be stored at 2…8°C. **After first opening stability expiry date when stored at 2…8°C.**

#### 6.5. Washing Solution (20xconc.)
The bottle contains 50 ml of a concentrated buffer, detergents and preservatives. Dilute Washing Solution 1+19; e.g. 10 ml Washing Solution + 190 ml fresh and germ free redistilled water. The diluted buffer is stable for 5 days at room temperature. **After first opening stability until expiry date when stored at 2…8°C.**

#### 6.6. TMB Substrate Solution
The bottle contains 15 ml of a tetramethylbenzidine/hydrogen peroxide system. The reagent is ready to use and has to be stored at 2…8°C, away from the light. **The solution should be colourless o could have a slight blue tinge. If the substrate turns into blue, it may have become contaminated and should be thrown. After first opening stability expiry date when stored at 2…8°C.**
6.7. Stop Solution
The bottle contains 15 ml 0.2 M sulphuric acid solution (R 36/38, S 26). This ready to use solution has to be stored at 2...8°C.

After first opening stability until expiry date.

7. SPECIMEN COLLECTION AND PREPARATION

Use human serum or plasma (citrate) samples with this assay. If the assay is performed within 5 days after sample collection, the specimen should be kept at 2...8°C; otherwise they should be aliquoted and stored deep-frozen (-70...-20°C). If samples are stored frozen, mix thawed samples well before testing. Avoid repeated freezing and thawing.

Heat inactivation of samples is not recommended.

7.1. Sample Dilution
Before assaying, all samples should be diluted 1+100 with IgM Sample Diluent. Dispense 10µl sample and 1 ml IgM Sample Diluent into tubes to obtain a 1+100 dilution and thoroughly mix with a Vortex.

8. ASSAY PROCEDURE

8.1. Test Preparation
Please read the test protocol carefully before performing the assay. Result reliability depends on strict adherence to the test protocol as described. If performing the test on ELISA automatic systems we recommend to increase the washing steps from three to five and the volume of washing solution from 300µl to 350µl to avoid washing effects. Prior to commencing the assay, the distribution and identification plan for all specimens and controls should be carefully established on the result sheet supplied in the kit. Select the required number of microtiter strips or wells and insert them into the holder.

Please allocate at least:
1 well (e.g. A1) for the substrate blank,
1 well (e.g. B1) for the negative control,
2 wells (e.g. C1+D1) for the cut-off control and
1 well (e.g. E1) for the positive control.

It is left to the user to determine controls and patient samples in duplicate, if necessary.

Perform all assay steps in the order given and without any appreciable delays between the steps.

A clean, disposable tip should be used for dispensing each control and sample.

Adjust the incubator to 37° ± 1°C.

1. Dispense 100µl controls and diluted samples into their respective wells. Leave well A1 for substrate blank.
2. Cover wells with the foil supplied in the kit.
3. Incubate for 1 hour ± 5 min at 37±1°C.
4. When incubation has been completed, remove the foil, aspirate the content of the wells and wash each well three times with 300µl of washing solution. Avoid overflows from the reaction wells. The soak time between each wash cycle should be >5 sec. At the end carefully remove remaining fluid by tapping strips on tissue paper prior to the next step!
   Note: Washing is critical! Insufficient washing results in poor precision and falsely elevated absorbance values.
5. Dispense 100µl Bordetella pertussis anti-IgM Conjugate into all wells except for the blank well (e.g. A1). Cover with foil.
6. Incubate for 30 min at room temperature. Do not expose to direct sunlight.
7. Repeat step 4.
8. Dispense 100µl TMB Substrate Solution into all wells
9. Incubate for exactly 15 min at room temperature in the dark.
10. Dispense 100µl Stop Solution into all wells in the same order and at the same rate as for the TMB Substrate Solution. Any blue colour developed during the incubation turns into yellow.
   Note: Highly positive patient samples can cause dark precipitates of the chromogen! These precipitates have an influence when reading the optical density. Predilution of the sample with physiological sodium chloride solution, for example 1+1, is recommended. Then dilute the sample 1+100 with dilution buffer and multiply the results in NTU by 2.
11. Measure the absorbance of the specimen at 450/620 nm within 30 min after addition of the Stop Solution.

8.2. Measurement
Adjust the ELISA Microwell Plate Reader to zero using the substrate blank in well A1.

If - due to technical reasons - the ELISA reader cannot be adjusted to zero using the substrate blank in well A1, subtract the absorbance value of well A1 from all other absorbance values measured in order to obtain reliable results!

Measure the absorbance of all wells at 450 nm and record the absorbance values for each control and patient sample in the distribution and identification plan.

Dual wavelength reading using 620 nm as reference wavelength is recommended.
Where applicable calculate the **mean absorbance values** of all duplicates.

### 9. Results

#### 9.1. Run Validation Criteria

In order for an assay to be considered valid, the following criteria must be met:

- **Substrate blank** in A1: Absorbance value < 0.100.
- **Negative control** in B1: Absorbance value < 0.200 and < cut-off.
- **Cut-off control** in C1 and D1: Absorbance value 0.150 – 1.30.
- **Positive control** in E1: Absorbance value > cut-off.

If these criteria are not met, the test is not valid and must be repeated.

#### 9.2. Calculation of Results

The cut-off is the mean absorbance value of the Cut-off control determinations.

*Example*: Absorbance value Cut-off control 0.39 + absorbance value Cut-off control 0.37 = 0.76 / 2 = 0.38

\[
\text{Cut-off} = 0.38
\]

#### 9.3. Interpretation of Results

Samples are considered **POSITIVE** if the absorbance value is higher than 10% over the cut-off.

Samples with an absorbance value of 10% above or below the cut-off should not be considered as clearly positive or negative → grey zone

It is recommended to repeat the test again 2 - 4 weeks later with a fresh sample. If results in the second test are again in the grey zone the sample has to be considered **NEGATIVE**.

Samples are considered **NEGATIVE** if the absorbance value is lower than 10% below the cut-off.

#### 9.3.1. Results in GenWay Units

\[
\text{Patient (mean) absorbance value x 10} = \frac{\text{[GenWay-Units = NTU]}}{\text{Cut-off}}
\]

*Example*: \[
\frac{1.216 \times 10}{0.38} = 32 \text{ NTU (GenWay Units)}
\]

Cut-off: 10 NTU

Grey zone: 9-11 NTU

Negative: <9 NTU

Positive: >11 NTU

### 10. Specific Performance Characteristics

#### 10.1. Precision

<table>
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<th></th>
<th>n</th>
<th>Mean</th>
<th>CV (%)</th>
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<tbody>
<tr>
<td><strong>Interassay</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Pos. Serum</td>
<td>12</td>
<td>0.85</td>
<td>9.4</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>2.25</td>
<td>8.2</td>
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<tr>
<td><strong>Intraassay</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Pos. Serum</td>
<td>20</td>
<td>0.44</td>
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<tr>
<td></td>
<td>24</td>
<td>1.04</td>
<td>14.0</td>
</tr>
</tbody>
</table>

#### 10.2. Diagnostic Specificity

The diagnostic specificity is defined as the probability of the assay of scoring negative in the absence of the specific analyte.

It is >95%.

#### 10.3. Diagnostic Sensitivity

The diagnostic sensitivity is defined as the probability of the assay of scoring positive in the presence of the specific analyte.

It is 84.2%.

#### 10.4. Interferences

Interferences with hemolytic, lipemic or icteric sera are not observed up to a concentration of 10 mg/ml hemoglobin, 5 mg/ml triglycerides and 0.2 mg/ml bilirubin.

**Note**: The results refer to the groups of samples investigated; these are not guaranteed specifications.
11. LIMITATIONS OF THE PROCEDURE

Bacterial contamination or repeated freeze-thaw cycles of the specimen may affect the absorbance values. Diagnosis of an infectious disease should not be established on the basis of a single test result. A precise diagnosis should take into consideration clinical history, symptomatology as well as serological data.

In immunosuppressed patients and newborns serological data only have restricted value.

12. PRECAUTIONS AND WARNINGS

- In compliance with article 1 paragraph 2b European directive 98/79/EC the use of the in vitro diagnostic medical devices is intended by the manufacturer to secure suitability, performances and safety of the product. Therefore the test procedure, the information, the precautions and warnings in the instructions for use have to be strictly followed. The use of the testkits with analyzers and similar equipment has to be validated. Any change in design, composition and test procedure as well as for any use in combination with other products not approved by the manufacturer is not authorized; the user himself is responsible for such changes. The manufacturer is not liable for false results and incidents for these reasons. The manufacturer is not liable for any results by visual analysis of the patient samples.

- Only for in-vitro diagnostic use.

- All components of human origin used for the production of these reagents have been tested for anti-HIV antibodies, anti-HCV antibodies and HBsAg and have been found to be non-reactive. Nevertheless, all materials should still be regarded and handled as potentially infectious.

- Do not interchange reagents or strips of different production lots.

- No reagents of other manufacturers should be used along with reagents of this test kit.

- Do not use reagents after expiry date stated on the label.

- Use only clean pipette tips, dispensers, and lab ware.

- Do not interchange screw caps of reagent vials to avoid cross-contamination.

- Close reagent vials tightly immediately after use to avoid evaporation and microbial contamination.

- After first opening and subsequent storage check conjugate and control vials for microbial contamination prior to further use.

- To avoid cross-contamination and falsely elevated results pipette patient samples and dispense conjugate without splashing accurately to the bottom of wells.

- The GenWay ELISA is only designed for qualified personnel who are familiar with good laboratory practice.

| WARNING: | In the used concentration Bronidox L has hardly any toxicological risk upon contact with skin and mucous membranes! |
| WARNING: | Sulphuric acid irritates eyes and skin. Keep out of the reach of children. Upon contact with the eyes, rinse thoroughly with water and consult a doctor! |

12.1. Disposal Considerations

Residues of chemicals and preparations are generally considered as hazardous waste. The disposal of this kind of waste is regulated through national and regional laws and regulations. Contact your local authorities or waste management companies which will give advice on how to dispose hazardous waste.

13. ORDERING INFORMATION

Prod. No.: 40-521-475055 Bordetella pertussis IgM-ELISA (96 Determinations)
BIBLIOGRAPHY


<table>
<thead>
<tr>
<th>Symbols Key</th>
<th>Description</th>
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<tr>
<td><img src="image" alt="Sample diluent buffer IgM" /></td>
<td>Sample diluent buffer IgM</td>
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<tr>
<td><img src="image" alt="Stop solution" /></td>
<td>Stop solution</td>
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<td><img src="image" alt="TMB Substrate solution" /></td>
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<tr>
<td><img src="image" alt="Washing solution 20x concentrated" /></td>
<td>Washing solution 20x concentrated</td>
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<tr>
<td><img src="image" alt="Contains sufficient for “n” tests" /></td>
<td>Contains sufficient for “n” tests</td>
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</tbody>
</table>
SCHEME OF THE ASSAY
Bordetella pertussis IgM-ELISA

Assay preparation

Prepare reagents and samples as described.
Establish the distribution and identification plan for all specimens and controls on the result sheet supplied in the kit.
Select the required number of microtiter strips or wells and insert them into the holder.

Assay procedure

<table>
<thead>
<tr>
<th>Substrate blank (e.g. A1)</th>
<th>Negative control</th>
<th>Positive control</th>
<th>Cut-off control</th>
<th>Sample (diluted 1+100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative control</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Positive control</td>
<td>-</td>
<td>100µl</td>
<td>-</td>
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<tr>
<td>Cut-off control</td>
<td>-</td>
<td>-</td>
<td>100µl</td>
<td>-</td>
</tr>
<tr>
<td>Sample (diluted 1+100)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>100µl</td>
</tr>
</tbody>
</table>

Cover wells with foil supplied in the kit

**Incubate for 1 h at 37°C**
Wash each well three times with 300µl of washing solution

<table>
<thead>
<tr>
<th>Conjugate</th>
<th>100µl</th>
<th>100µl</th>
<th>100µl</th>
<th>100µl</th>
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</table>

Cover wells with foil supplied in the kit

**Incubate for 30 min at room temperature**
Wash each well three times with 300µl of washing solution

<table>
<thead>
<tr>
<th>TMB Substrate</th>
<th>100µl</th>
<th>100µl</th>
<th>100µl</th>
<th>100µl</th>
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</thead>
</table>

**Incubate for exactly 15 min at room temperature in the dark**

<table>
<thead>
<tr>
<th>Stop Solution</th>
<th>100µl</th>
<th>100µl</th>
<th>100µl</th>
<th>100µl</th>
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</table>

Photometric measurement at 450 nm (reference wavelength: 620 nm)