

HyTest NEWS



Influenza and Other Acute Respiratory Diseases (ARDs)



Influenza

Influenza viruses are unique in their ability to cause sudden, pervasive illnesses in all age groups of human population on a global scale. Three “pandemics” associated with “shift” of surface viral glycoproteins (HA, NA) have occurred in the past century. One of them, “Spanish flu”, in 1918 was responsible for more than 20 million deaths worldwide, primarily in young adults. Annual influenza epidemics associated with different virus types or subtypes caused excess morbidity and mortality especially in groups of high risk. In spite of special clinical signs of influenza (such as sudden fever (>38 °C), pronounced intoxication (headache, myalgias), dry cough, shortness of breath and sternal pain) common clinical picture varied in dependence of age, individual immunity condition, accompanied person pathology and pathogenicity of virus strain. Diagnosis during pre- and inter-epidemic periods became available as a result of laboratory test applications. Laboratory diagnosis for influenza is based on direct examination and paired serum specimens serological assay. Immunofluorescence (IF) testing performed directly on nasopharyngeal secretions. EIA tests are often more objective and more sensitive than IF for direct detection. These diagnoses are necessary for etiotropic chemotherapy prescription.

Influenza virus types A and B belong to the family *Orthomyxoviridae*, containing eight segments of single-stranded RNA, generally spherical (30-100 nm in di-

ameter). The nucleoprotein (NP) antigen of influenza viruses is associated with viral RNA and determines the type of specificity (A, B or C). Two other important antigens are hemagglutinin (HA) and neuraminidase (NA). Both are glycoproteins and determine the subtypes.

Technology of viral antigen production is similar for all the influenza viruses. The source is allantoic fluid of 10-12 days old embryonated hen eggs, inoculated with appropriate strain. Allantoic fluid is clarified by low speed centrifugation and the virus is pelleted by centrifugation at top speed for 1h in the SW 27 rotor (Beckman). Further virus purification is performed by two successive ultracentrifugations. After sucrose density gradient ultracentrifugation, the virus band is collected, diluted with STE buffer and finally pelleted by ultracentrifugation for 1h.

To ensure the stability the viral stocks are stored at high protein concentration at -20 °C. Immunoreactivity is tested in in-house ELISA, using the panel of MAbs against influenza virus A and B. The viral antigen titer varies from 1:5 000 to 1:10 000. The infectivity testing on MDCK cultures is negative. Viral antigens of influenza viruses A and B have a very good performance in serology tests for specific IgG, IgM and IgA antibody detection, including EIA. We also recommend these viral antigens for polyclonal antibody production.



1. Influenza A antigens

HyTest is offering following Influenza A antigens:

- Influenza A (H1N1) virus, strain A/Taiwan/1/86***
- Influenza A (H1N1) virus, strain A/Beijing/262/95***
- Influenza A (H1N1) virus, strain A/New Caledonia/20/99 (See Fig. 1.)***
- Influenza A (H1N1) virus, strain A/Solomon Islands/03/06***

- Influenza A (H3N2) virus, strain A/Shangdong/9/93***
- Influenza A (H3N2) virus, strain A/Panama/2007/99 (See Fig. 2.)***
- Influenza A (H3N2) virus, strain A/Kiev/301/94***
- Influenza A (H3N2) virus, strain A/Wisconsin/67/05***
- Influenza A (H3N2) virus, strain A/Brisbane/10/07***

The source is allantoic fluid of 10-12 days old embryonated chicken eggs, inoculated with the appropriate influenza A strain. Purified viruses are inactivated with thimerosal and beta propiolactone treatment. Purity of all products is >90 % and these antigens can be used for detection of antibodies to influenza A viruses in ELISA, HIT and Western blotting.

Influenza A (H1N1) antigens do not have cross-reactivity in ELISA with panel of MAbs to HA of heter-

ological subtype of influenza A (H3N2) viruses, and Influenza A (H3N2) antigens do not have cross-reactivity in ELISA with panel of MAbs to HA of heterological subtype of influenza A (H1N1) viruses. Also these antigens are not cross-reacting with MAbs to HA of influenza B virus, MAbs to NP of influenza B virus and in hemagglutination inhibition test with antisera to different subtypes of influenza A and B viruses (See table 1.).

Table 1. Control investigation of influenza A antigens in hemagglutination inhibition test.

Virus:	Antibody titers in strain specific rabbit sera to:				
	Influenza A virus				Influenza B virus
	SH1	Ssw1	SH3	SH2	SB1
A/Panama/2007/99 (H3N2)	<10	<10	320	<10	<10
B/Tokio/53/99	<10	<10	<10	<10	320
A/New Caledonia/20/99 (H1N1)	640	<10	<10	<10	<10
A/swine/1976/31 (Hsw1N1)	<10	160	<10	<10	<10
A/St.Petersburg/186/00 (H3N2)	<10	<10	320	<10	<10
A/Singapore/1/57 (H2N2)	<10	<10	<10	320	<10

SH1: antiserum to strain A/New Caledonia/20/99 (H1N1)
 Ssw1: antiserum to strain A/swine/1976/31 (Hsw1N1)
 SH3: antiserum to strain A/St.Petersburg/186/00 (H3N2)
 SH2: antiserum to strain A/ Singapore/1/57 (H2N2)
 SB1: antiserum to strain B/Tokio/53/99

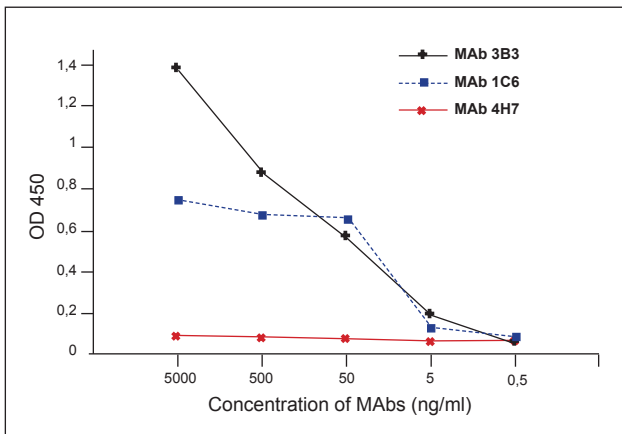


Figure 1. Control of specific activity and cross-reactivity of influenza A/New Caledonia/20/99 virus in ELISA with monoclonal antibodies to different influenza viruses.

MAb 3B3 to HA of influenza A/Beijing/262/95 (H1N1) virus
 MAb 1C6 to NP of influenza A/chick/Pennsylvania/1370/83 (H5N1) virus
 MAb 4H7 to HA of influenza B/Panama/45/90 virus

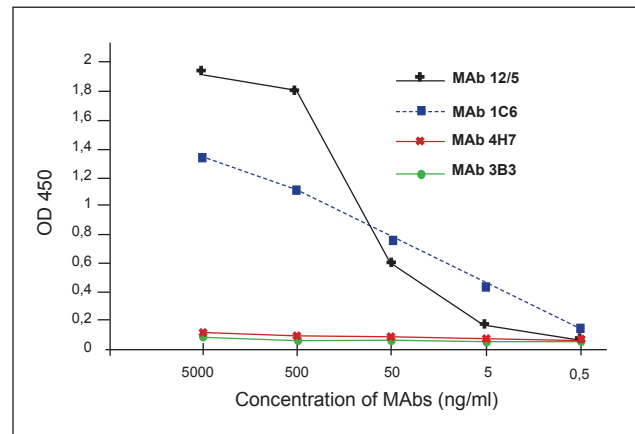


Figure 2. Control of specific activity and cross-reactivity of influenza A/Panama/2007/99 virus in ELISA with monoclonal antibodies to different influenza viruses.

MAb 12/5 to HA of influenza A/Panama/2007/99 (H3N2) virus
 MAb 1C6 to NP of influenza A/chick/Pennsylvania/1370/83 (H5N1) virus
 MAb 4H7 to HA of influenza B/Panama/45/90 virus
 MAb 3B3 to HA of influenza A/Beijing/262/95 (H1N1) virus

Ordering information:

Product	Cat. #	Strain	Remarks
Influenza A (H1N1) virus	8IN73	A/Taiwan/1/86	EIA, HIT, WB
Influenza A (H1N1) virus-2	8IN73-2	A/Beijing/262/95	EIA, HIT, WB
Influenza A (H1N1) virus-3	8IN73-3	A/New Caledonia/20/99	EIA, HIT, WB
Influenza A (H1N1) virus-4	8IN73-4	A/Solomon Islands/03/06	EIA, HIT, WB
Influenza A (H3N2) virus	8IN74	A/Shangdong/9/93	EIA, HIT, WB
Influenza A (H3N2) virus-1	8IN74-1	A/Panama/2007/99	EIA, HIT, WB
Influenza A (H3N2) virus-2	8IN74-2	A/Kiev/301/94	EIA, HIT, WB
Influenza A (H3N2) virus-3	8IN74-3	A/Wisconsin/67/05	EIA, HIT, WB
Influenza A (H3N2) virus-4	8IN74-4	A/Brisbane/10/07	EIA, HIT, WB



2. Influenza A monoclonal antibodies

HyTest offers highly sensitive and specific monoclonal antibodies for detection of Influenza A virus. MAbs can be used in routine immunoassays (direct or indirect ELISA, sandwich immuno-detection systems, Western blotting) and for specific detection of the most important Influenza A anti-

gens, such as Haemagglutinin (HA) and Nucleo-protein (NP) in different biological samples (nasal aspirates and swabs, cell lysates etc.). MAbs do not have cross-reactivity to Influenza B virus so they can be used for differentiation between Influenza A and B.

2.1. Anti-Influenza A Haemagglutinin (HA) monoclonal antibodies

2.1.1. Influenza A haemagglutinin H1 and H3 monoclonal antibodies

Anti-Influenza A virus H1 and H3 monoclonal antibodies

Host Animal: Mice Balb/c
Cell line used for fusion: Sp2/0
Immunogen: Purified influenza virus type A (H1N1) or (H3N2)
Purification method: Protein A or protein G affinity chromatography

Hybridoma clones have been derived from hybridization of Sp2/0 myeloma with the spleen cells of Balb/c mice immunized with purified Influenza A viruses: A/New Caledonia/20/99 (strain H1N1) and

A/Shangdong/9/93 (strain H3N2). Haemagglutinin-specific antibodies selectively detect H1 or H3 haemagglutinins of Influenza A in ELISA and Western blotting.

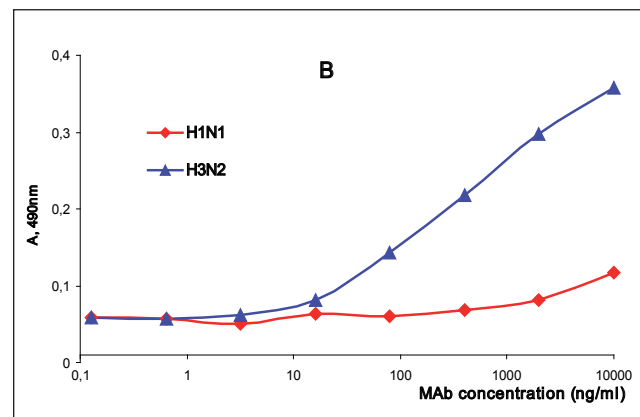
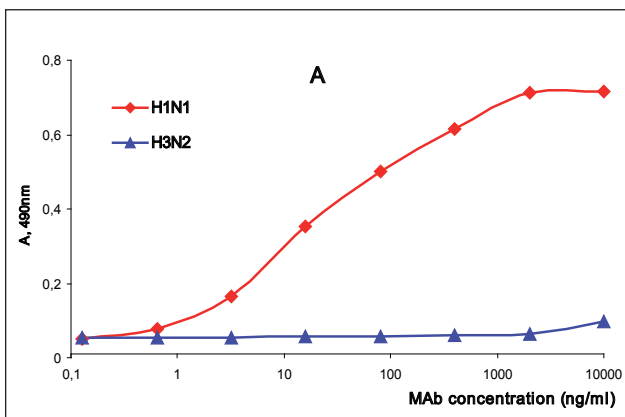
2.1.2. Influenza A H1 and H3 immunodetection in ELISA.

Anti-haemagglutinin MAbs detect specific strain of Influenza A in direct and indirect ELISA. Titration curves of MAb InA4 (H1 specific) and MAb InA246 (H3 specific) are shown of Fig. 3.

Figure 3. Titration curves of MAbs specific to haemagglutinins H1 or H3 of Influenza A virus in indirect ELISA.

A. MAb InA4 (H1 specific)
B. MAb InA246 (H3 specific).

Antigens:
H1N1 – Influenza A/New Caledonia/20/99 - 0.1µg/well.
H3N2 – Influenza A/Shangdong/9/93 - 0.1µg/well





MAb C102 (Fig. 4.) was obtained by use of avian influenza virus strain A (H1N1) as an immunogen and it is directed against relatively conservative H1 epitope. MAb crossreactivity pattern shows that it does not react with H3 and other hemagglutinins but interacts with H1 from human and avian influenza viruses, having indirect ELISA titers not less than 1:128 K. Thus MAb C102 may be used in EIA for subtype differentiation of isolates. MAb C102 can also be used for immunocytochemistry, haemagglutinin inhibition, ELISA and immunofluorescence.

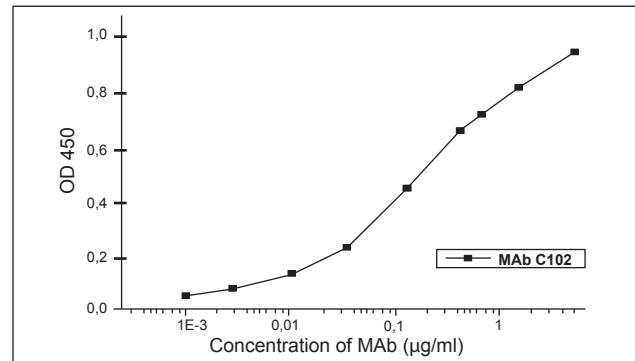


Figure 4. Specific activity of MAb C102 in ELISA with purified virus antigen A (H1N1).

2.1.3. Influenza A quantitative sandwich immunoassay.

MABs were tested in sandwich type fluoroimmunoassay as capture or detection MABs. Pairs of MABs were selected on their ability to detect specific strain of Influenza A with high specificity and sensitivity. Purified strains of Influenza A (H1N1 and H3N2) as well as recombinant H1 and H3 were used as antigens. For specific Influenza A H1 immunodetection following pairs are recommended (capture-detection):

InA4 - InA88
 InA4 - InA134
 InA97 - InA134

All pairs detect virus as well as recombinant haemagglutinin H1 and can be used in Influenza A H1Nx-strain immunodetection systems. Calibration curve for one of the pairs is shown on Fig. 5.

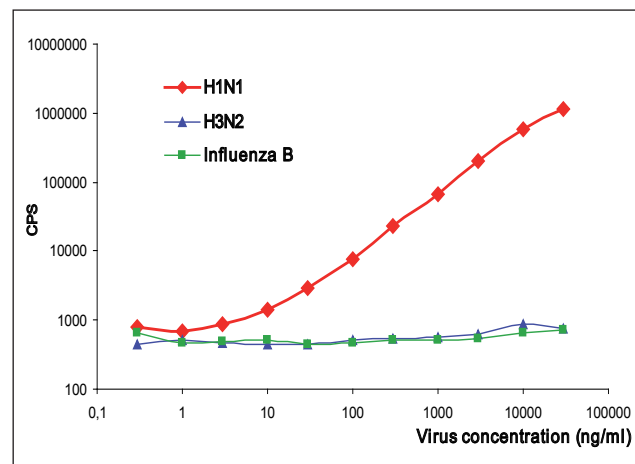


Figure 5. Calibration curve for Influenza A sandwich fluoroimmunoassay using anti haemagglutinin H1 antibodies.

Capture: MAb InA97 – 1 µg/well.

Detection (Eu-chelate labeled): MAb InA134 – 0.2µg/well

Incubation time 45 min.

Antigens:

H1N1 – Influenza A/New Caledonia/20/99

H3N2 – Influenza A/Shangdong/9/93

Influenza B – mixture of Influenza B viruses (strains B/Qingdao/102/91, B/Tokio/53/99, B/Victoria/504/00)



2.1.4. Influenza A H1 and H3 immunodetection in Western blotting.

MABs detect haemagglutinin H1 or H3 in Western blotting after SDS-PAGE in reducing conditions. MABs bind to HA1 chain of processed or non-processed haemagglutinin. Immunodetection of Influenza A haemagglutinins by specific antibodies is shown in Fig. 6.

Figure 6. Immunodetection of Influenza A viruses using anti-haemagglutinin monoclonal antibodies in Western blotting after PAGE in reducing conditions. Anti-mouse IgG conjugated with HRP was used for MAB haemagglutinin complex visualization.

Antigens (1µg/well):

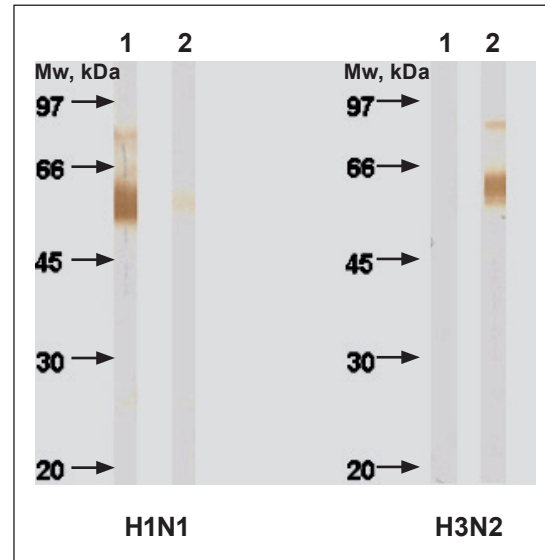
H1N1 – Influenza A/New Caledonia/20/99

H3N2 – Influenza A/Shangdong/9/93

Antibodies (5µg/ml):

1: MAb InA4 – anti-Influenza A haemagglutinin H1

2: MAb InA246 – anti-Influenza A haemagglutinin H3



2.1.5. Influenza A haemagglutinin H5 and H7 monoclonal antibodies

Avian influenza viruses occurring naturally among birds cause avian influenza infection. Usually “avian influenza virus” refers to influenza A viruses found mainly in birds, but infections with these viruses can occur also in humans. Avian influenza was first identified over 100 years ago during an outbreak in Italy. Since then, the disease has cropped up at irregular intervals in all world regions.

There are many different subtypes of type A influenza viruses and they differ because of changes in certain

proteins on the surface of the influenza A virus (haemagglutinin [HA] and neuraminidase [NA] proteins). Many different combinations of HA and NA proteins are possible and each combination represents a different subtype. Of the 16 different haemagglutinin types only strains within the H5 and H7 subtypes cause highly pathogenic avian influenza, which is highly contagious and rapidly fatal in susceptible avian species. When highly pathogenic influenza H5 viruses cause outbreaks, the mortality rate among poultry is usually between 90 %- 100 %.

Anti-Influenza A haemagglutinin H5 and H7 monoclonal antibodies

Host Animal:

Mice Balb/c

Cell line used for fusion:

Sp2/0

Immunogen:

Purified avian influenza virus type A (H5N1) or Influenza virus A/FPV (H7N1)

Purification:

Protein G affinity chromatography



Ordering information:

Product	Cat.#	MAb	Isotype	Remarks
Anti-Influenza A virus haemagglutinin	3IH4	C102	IgG1	H1, EIA, IHC, IF, HIT
Anti-Influenza A virus haemagglutinin H1	3AH1	InA4	IgG1	EIA, WB
Anti-Influenza A virus haemagglutinin H1	3AH1	InA16	IgG2a	EIA, WB
Anti-Influenza A virus haemagglutinin H1	3AH1	InA88	IgG2a	EIA, WB
Anti-Influenza A virus haemagglutinin H1	3AH1	InA97	IgG1	EIA, WB
Anti-Influenza A virus haemagglutinin H1	3AH1	InA134	IgG1	EIA, WB
Anti-Influenza A virus haemagglutinin H1	3AH1	InA139	IgG1	EIA, WB
Anti-Influenza A virus haemagglutinin H3	3HG3	InA227	IgG1	EIA, WB
Anti-Influenza A virus haemagglutinin H3	3HG3	InA246	IgG2a	EIA, WB
Anti-Influenza A virus haemagglutinin H5	3H5N	8D2	IgG2a	HIT, EIA, Dot blot
Anti-Influenza A virus haemagglutinin H5	3H5N	11A9	IgG2a	HIT, EIA, Dot blot
Anti-Influenza A virus haemagglutinin H5	3H5N	15A6	IgG2a	HIT, EIA, Dot blot
Anti-Influenza A virus haemagglutinin H5	3H5N	18D5	IgG2a	HIT, EIA, Dot blot
Anti-Influenza A virus haemagglutinin H5	3H5N	19C11	IgG2a	HIT, EIA, Dot blot
Anti-Influenza A virus haemagglutinin H5	3H5N	6C8	IgG1	HIT, EIA
Anti-Influenza A virus haemagglutinin H5	3H5N	7E6	IgG2a	HIT, EIA
Anti-Influenza A virus haemagglutinin H5	3H5N	1C7	IgG2a	HIT, EIA
Anti-Influenza A virus haemagglutinin H5	3H5N	6B4	IgG2a	HIT, EIA
Anti-Influenza A virus haemagglutinin H5	3H5N	9B3	IgG2a	HIT, EIA
Anti-Influenza A virus haemagglutinin H5	3H5N	2D1	IgG1	EIA
Anti-Influenza A virus haemagglutinin H5	3H5N	7D5	IgG2a	EIA
Anti-Influenza A virus haemagglutinin H5	3H5N	1B4	IgG2a	EIA
Anti-Influenza A virus haemagglutinin H7	3HI7	1H11	IgG2a	EIA, HIT, low c/r to H1 and H3
Anti-Influenza A virus haemagglutinin H7	3HI7	6B5	IgG2b	EIA, HIT, low c/r to H1
Anti-Influenza A virus haemagglutinin H7	3HI7	9A9	IgG2a	EIA, HIT
Anti-Influenza A virus haemagglutinin H7	3HI7	9F2	IgG1	EIA, HIT, low c/r to H1 and H10
Anti-Influenza A virus haemagglutinin H7	3HI7	10C6	IgG2a	EIA, HIT
Anti-Influenza A virus haemagglutinin H7	3HI7	10H9	IgG1	EIA, HIT, low c/r to H1

2.2. Anti-Influenza A Matrix protein M2 monoclonal antibodies

Anti- Influenza A Matrix protein M2 monoclonal antibodies

Host animal: Mice Balb/c
Cell line used for fusion: Sp2/0
Antigen: Purified Influenza A virus
Specificity: Matrix protein M2 of Influenza A virus
Purification method: Protein-A affinity chromatography

Ordering information:

Product	Cat.#	MAb	Isotype	Remarks
Anti-Influenza A Matrix protein M2	3AM21	M2A10	IgG1	Indirect EIA
Anti-Influenza A Matrix protein M2	3AM21	M2D2	IgG2a	Indirect EIA
Anti-Influenza A Matrix protein M2	3AM21	M2D4	IgG2b	Indirect EIA



2.3. Anti-Influenza A Nonstructural (NS) protein monoclonal antibodies

MABs were produced to non-structural antigens of Influenza A H5. MABs can be used to detect antigen in ELISA or others methods, in antibody screening in the competitive ELISA, etc.

Ordering information:

Product	Cat.#	MAB	Isotype	Remarks
Anti-Influenza A virus (NS protein)	3NS8	4A1	IgG2a	EIA
Anti-Influenza A virus (NS protein)	3NS8	9F10	IgG2b	EIA

2.4. Anti-Influenza A Nucleoprotein (NP) monoclonal antibodies

For the influenza virus type A determination we have a panel of MABs against the nucleoprotein (NP). Influenza virus A (H1N1) was used as immunogen.

All MABs detect NP of Influenza A with high specificity and have no cross reactivity to NP of Influenza B virus.

Anti-Influenza A virus (nucleoprotein) monoclonal antibodies

MABs: F8, InA108, InA245, InA180, InA224
Host Animal: Mice Balb/c
Cell line used for fusion: Sp2/0
Immunogen: Purified influenza virus type A (H1N1)
Purification method: Protein G affinity chromatography for MAb F8, Protein A affinity chromatography for others
Specificity: MABs react with nucleoprotein (NP), which is common for Influenza A(H1N1), A(H3N2) and other Influenza A viruses.
Applications: Detection of Influenza type A viruses in ELISA, Western blot and IHC.

The investigation of F8 MAB specificity showed that it recognizes the conservative epitope expressed on the nucleoprotein, which is common for type A viruses with different antigenic structure and species origin. We investigated 25 strains of human and avian influenza virus A, isolated during different epidemics in the period from 1934 till 1993 and in all the cases specific reaction was observed. We investigated 265 samples of nasal washings from patients during influenza outbreaks in children's communities by the method of direct immunofluorescence. Sensitivity and specificity of the influenza virus A detection reached 60 % and 98.2 % respectively.

2.4.1. Influenza A NP immunodetection in ELISA.

Anti-NP MABs equally detect different strains of Influenza A in ELISA. Titration curve of MAb InA108 is shown of Fig. 8.

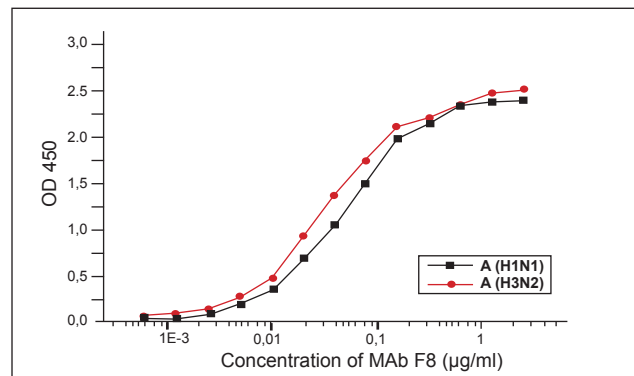


Figure 7. Specific activity of MAB F8 in ELISA with purified virus antigens A (H1N1) and A (H3N2).

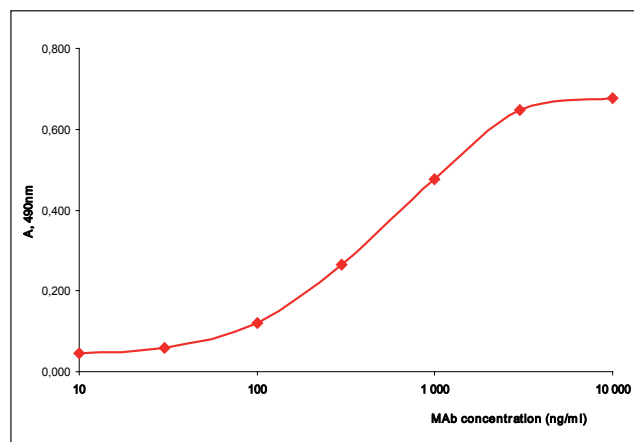


Figure 8. Titration curve of MAb InA108 specific to NP of Influenza A virus in indirect ELISA. Antigen: Influenza A/New Caledonia/20/99 (H1N1) -0.2µg/well.



2.4.2. Influenza A NP immunodetection in Western blotting.

MAbs InA108 and InA245 detect NP of Influenza A virus in Western Blotting after SDS-PAGE in reducing conditions. Immunodetection of Influenza A NP using anti-NP monoclonal antibody InA108 is shown on Fig. 9.

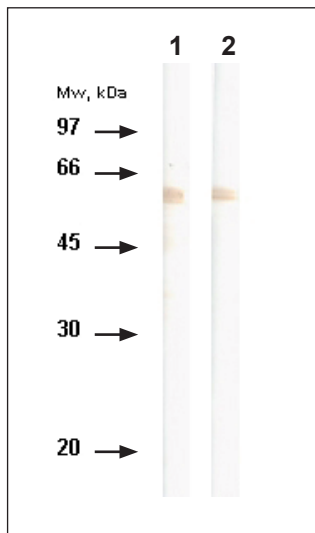


Figure 9. Immunodetection of Influenza A viruses using anti-NP monoclonal antibody 108 in Western blotting after PAGE in reducing conditions. Anti-mouse IgG conjugated with HRP was used for MAb NP complex visualization.
 Antigens (1µg/well):
 1: H1N1 – Influenza A/NewCaledonia/20/99
 2: H3N2 – Influenza A/Shangdong/9/93
 Antibody (5µg/ml):
 MAb InA108 – anti-Influenza A nucleoprotein (NP).

2.4.3. Influenza A NP quantitative sandwich immunoassay.

MAbs were tested in sandwich type immunoassay as capture or detection MAbs. Pairs of MAbs were selected on their ability to detect equally NP of H1N1 and H3N2 strains of Influenza A virus. The best pairs of anti-Influenza A NP MAbs are as follows (capture-detection):

InA108 – InA245
 InA180 – InA245

All pairs detect NP of Influenza A virus of different strains. Calibration curve for one of the pairs is shown on Fig. 10.

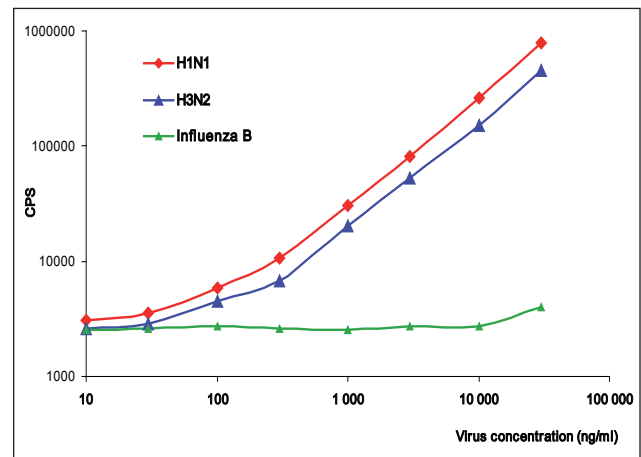


Figure 10. Calibration curve for Influenza A NP immunodetection in sandwich fluoroimmunoassay.
 Capture: MAb InA108 – 1 µg/well.
 Detection (Eu-labeled): MAb InA245 – 0.2µg/well
 Incubation time 45 min.
 Antigens:
 H1N1 – Influenza A/New Caledonia/20/99
 H3N2 – Influenza A/Shangdong/9/93
 Influenza B – mixture of Influenza B viruses (strains B/Qingdao/102/91, B/Tokio/53/99, B/Victoria/504/00)

Ordering information:

Product	Cat.#	MAb	Isotype	Remarks
Anti-Influenza A virus (nucleoprotein)	3IN5	F8	IgG2a	EIA, IHC
Anti-Influenza A virus (nucleoprotein)	3IN5	InA108	IgG1	EIA, WB
Anti-Influenza A virus (nucleoprotein)	3IN5	InA180	IgG3	EIA
Anti-Influenza A virus (nucleoprotein)	3IN5	InA224	IgG1	EIA
Anti-Influenza A virus (nucleoprotein)	3IN5	InA245	IgG2b	EIA, WB



3. Influenza B antigens

HyTest is offering following Influenza B antigens:

- Influenza B virus, strain B/Qingdao/102/91 (See Fig. 11.)***
- Influenza B virus, strain B/Tokio/53/99 (See Fig. 12.)***
- Influenza B virus, strain B/Victoria/504/00 (See Fig. 13.)***
- Influenza B virus, strain B/Malaysia/2506/04***
- Influenza B virus, strain B/Florida/07/04***
- Influenza B virus, strain B/Florida/04/06***

The source is allantoic fluid of 10-12 days old embryonated chicken eggs, inoculated with the appropriate influenza B strain. Purified viruses are inactivated with thimerosal and beta propiolactone treatment. Purity of all products is >90 % and these antigens can be used for detection of antibodies to influenza B viruses in ELISA, HIT and Western blotting.

Influenza B antigens do not have cross-reactivity in ELISA with panel of MAbs to HA of heterological subtype of influenza A (H3N2) viruses and MAbs to HA of influenza A (H1N1) viruses and in hemagglutination inhibition test with antisera to influenza A (H3N2) and influenza A (H1N1) viruses (See table 2).

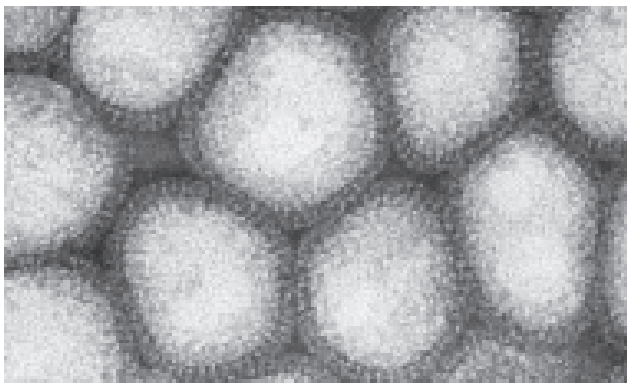


Figure 11. Electron microscopic image of influenza B virus. (Influenza B virus particles 100-120 nm in diameter, magnification 1x 110 000).

Table 2. Control investigation of influenza B antigens in hemagglutination inhibition test.

Virus:	Antibodies titers in strain specific immune rabbit and rat sera to:				
	Influenza A virus			Influenza B virus	
	SH1	Ssw1	SH3	SB1	SB2
B/Tokio/53/99	<10	<10	<10	320	<10
B/Victoria/504/00	<10	<10	<10	<10	320
A/New Caledonia/20/99 (H1N1)	640	<10	<10	<10	<10
A/sw/1976/31 (Hsw1N1)	<10	160	<10	<10	<10
A/St.Petersburg/186/00 (H3N2)	<10	<10	640	<10	<10

SH1: antiserum to strain A/New Caledonia/20/99 (H1N1)
 SH3: antiserum to strain A/St.Petersburg/186/00 (H3N2)
 Ssw1: antiserum to strain A/sw/1976/31 (Hsw1N1)
 SB1: antiserum to strain B/Tokio/53/99 (B/Victoria/2/87 lineage)
 SB2: antiserum to strain B/Victoria/504/00 (B/Yamagata/16/88 lineage)

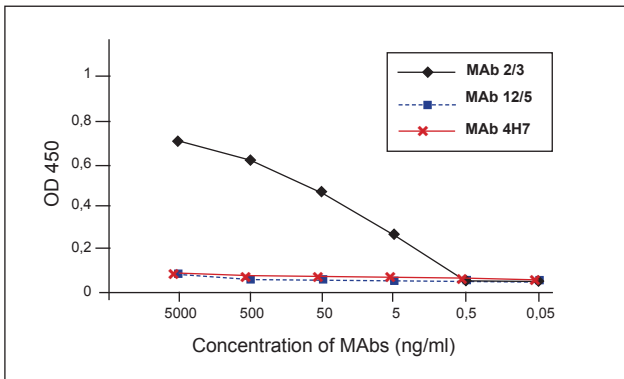


Figure 12. Control of specific activity and cross-reactivity of influenza B/Tokio/53/99 virus in ELISA with monoclonal antibodies to different influenza viruses.

MAb 2/3 to NP of influenza B/Beijing/184/93 virus
 MAb 4H7 to HA of influenza B/Panama/45/90 virus (Yamagata/16/88 lineage)
 MAb 12/5 to HA of influenza A/Panama/2007/99 (H3N2) virus

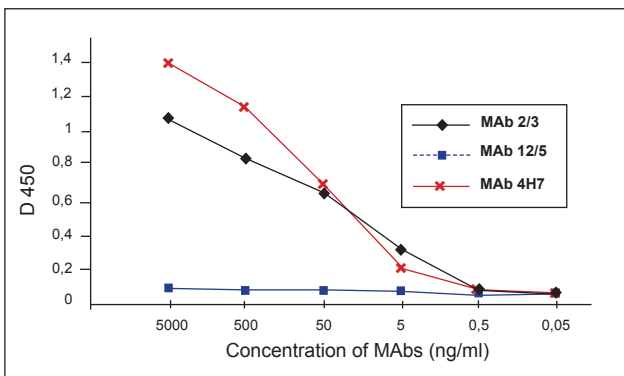


Figure 13. Control of specific activity and cross-reactivity of influenza B/Victoria/504/00 virus in ELISA with monoclonal antibodies to different influenza viruses.

MAb 2/3 to NP of influenza B/Beijing/184/93 virus
 MAb 4H7 to HA of influenza B/Panama/45/90 virus (Yamagata/16/88 lineage)
 MAb 12/5 to HA of influenza A/Panama/2007/99 (H3N2) virus

Ordering information:

Product	Cat. #	Strain	Remarks
Influenza B virus	8IN75	B/Qingdao/102/91	EIA, HIT, WB
Influenza B virus-2	8IN75-2	B/Tokio/53/99	EIA, HIT, WB
Influenza B virus-3	8IN75-3	B/Victoria/504/00	EIA, HIT, WB
Influenza B virus-4	8IN75-4	B/Malaysia/2506/04	EIA, HIT, WB
Influenza B virus-5	8IN75-5	B/Florida/07/04	EIA, HIT, WB
Influenza B virus-6	8IN75-6	B/Florida/04/06	EIA, HIT, WB



4. Influenza B monoclonal antibodies

HyTest offers a panel of monoclonal antibodies specific to nucleoprotein (NP), haemagglutinin (HA) and matrix protein M1 of Influenza B virus. MAbs work with high affinity and specificity in different immunoassays: direct or indirect ELISA, Sandwich immunodetection systems and in Western blotting.

Anti-NP MAbs are highly specific to Influenza B nucleoprotein and do not bind to NP of Influenza A virus or any other viral proteins. Low detection limit of our MAbs allows detection of Influenza B virus in different samples with low Influenza B titer. According to

high specificity and affinity they are recommended to be used in rapid Influenza B immunodetection systems.

Anti-HA MAbs are specific to Influenza B haemagglutinin HA₂ and detect equally different strains of Influenza B virus.

Anti-matrix protein MAbs are highly sensitive to M1 matrix protein of Influenza B viruses and detect M1 of different Influenza B strains in EIA and Western blotting

4.1. Anti-Influenza B Nucleoprotein (NP) monoclonal antibodies

Anti-Influenza B virus monoclonal antibodies

MAbs: IB633, IB42, 2/3, InB12, InB27, InB36, InB64, InB114, InB204, InB210, InB213
Host Animal: Mice SJL/J for MAb 2/3, mice Balb/c for other MAbs
Cell line used for fusion: Px for MAb 2/3, Sp2/0 for other MAbs
Immunogen: Purified influenza virus type B
Purification method: Protein G or Protein A affinity chromatography
Specificity: Nucleoprotein of influenza virus type B.

4.1.1. Influenza B immunodetection in ELISA.

All anti-NP MAbs detect different strains of Influenza B in direct and indirect ELISA. Titration curves of selected MAb are shown of Fig. 14.

Figure 14. Titration curves of MAb 114 specific to NP of Influenza B virus in indirect (A) and direct (B) ELISA.

A. MAb InB114 titration in indirect ELISA.

Antigens:

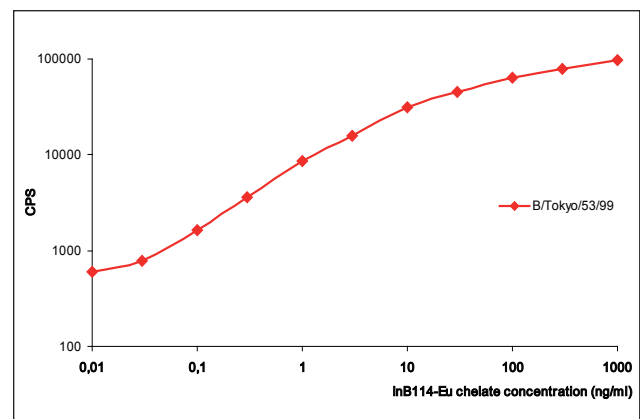
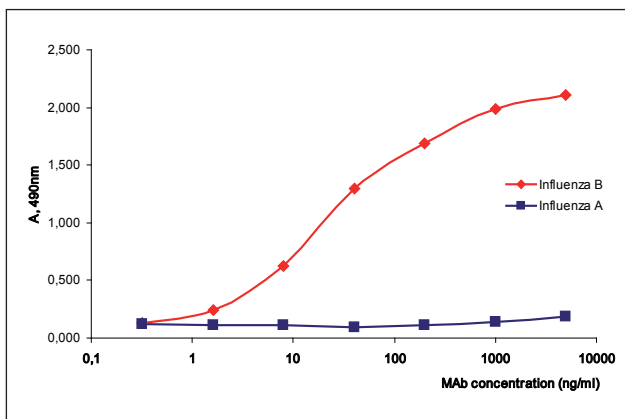
Influenza B: Influenza B/Tokyo/53/99 - 0.5µg/well.

Influenza A: mixture of two strains - A/Shangdong/9/93 and A/New Caledonia/20/99 - 0.5µg/well

B. MAb InB114 conjugated with Eu-chelate titration in direct ELISA.

Antigen:

Influenza B/Tokyo/53/99 - 0.2µg/well.





4.1.2. Influenza B quantitative sandwich immunoassay.

MABs were tested in Sandwich type immunoassay as the capture or detection MABs. Pairs of MABs were selected on their ability to detect all tested strains of Influenza B with equal specificity and high sensitivity. Different strains of Influenza B (Influenza B/Leningrad/86/93, Influenza B/Tokyo/53/99, Influenza B/Victoria/504/00) as well as recombinant NP of Influenza B were used as antigens. For specific Influenza B NP immunodetection following pairs are recommended (capture-detection):

- InB12 – InB27
- InB12 – InB64
- InB36 – InB64

All pairs detect NP of influenza B and can be used in Influenza B immunodetection systems. Calibration curve for one pair is shown on Fig. 15.

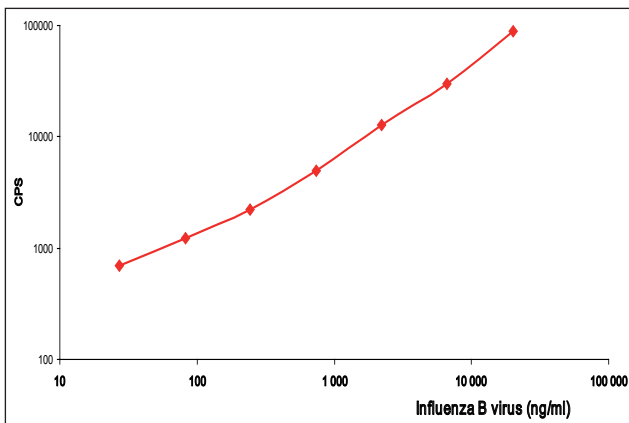


Figure 15. Calibration curve for Influenza B sandwich fluoroimmunoassay using anti NP antibodies.
 Capture: MAb InB36 – 1 µg/well.
 Detection (Eu-chelate labeled): MAb InB64 – 0.2µg/well
 Incubation time 45 min.
 Antigen:
 Influenza B/Tokio/53/99.

MABs are specific to different parts of NP molecule. For sensitive NP immunoassay MABs that bind to diverse epitopes are recommended. Epitope specificity of all MABs is shown in Table 3.

Table 3. Epitope specificity of NP-specific MABs.

Epitope	MABs
Fragment 1: (1-80 a.a.r.)	InB12, InB36
Fragment 2: (120-200 a.a.r.)	InB27, InB64
Fragment 3: (240-320 a.a.r.)	InB204, InB210, 2/3
Fragment 4: (480-560a.a.r.)	InB114, InB213

4.1.3. Influenza B immunodetection in Western blotting.

MABs detect NP of Influenza B in Western blotting after SDS-PAGE in reducing and non-reducing conditions. Immunodetection of Influenza B NP by selected antibodies is shown on Fig. 16.

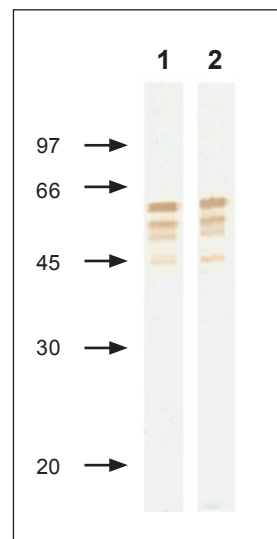


Figure 16. NP of Influenza B virus immunodetection using anti-NP monoclonal antibodies in Western blotting after PAGE in reducing conditions. Anti-mouse IgG conjugated with HRP was used for MAb NP complex visualization.
 Antigen: Influenza B/Tokio/53/99 - 1µg/well.
 Antibodies - 5µg/ml:
 1: MAb InB27
 2: MAb InB64

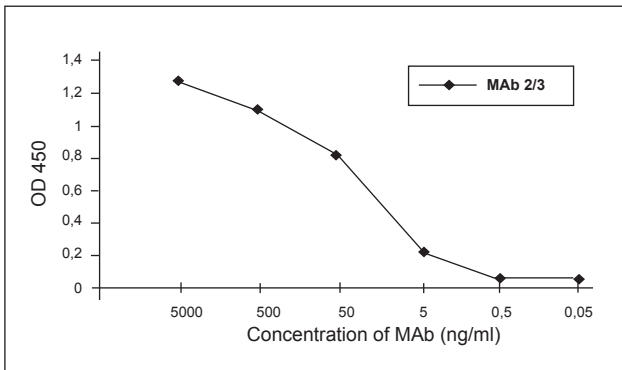


Figure 17. Specific activity of MAb 2/3 in ELISA with purified virus antigen B/Beijing/184/93.

Ordering information:

Product	Cat. #	MAb	Isotype	Remarks
Anti-Influenza Virus B (nucleoprotein)	3IF18	IB633	IgG1	WB
Anti-Influenza Virus B (nucleoprotein)	3IF18	IB42	IgG2a	EIA, WB
Anti-Influenza Virus B (nucleoprotein)	3IF18	InB12	IgG2b	EIA, WB
Anti-Influenza Virus B (nucleoprotein)	3IF18	InB27	IgG1	EIA, WB
Anti-Influenza Virus B (nucleoprotein)	3IF18	InB36	IgG1	EIA, WB
Anti-Influenza Virus B (nucleoprotein)	3IF18	InB64	IgG1	EIA, WB
Anti-Influenza Virus B (nucleoprotein)	3IF18	InB114	IgG1	EIA, WB
Anti-Influenza Virus B (nucleoprotein)	3IF18	InB204	IgG1	EIA, WB
Anti-Influenza Virus B (nucleoprotein)	3IF18	InB210	IgG1	EIA, WB
Anti-Influenza Virus B (nucleoprotein)	3IF18	InB213	IgG1	EIA, WB
Anti-Influenza Virus B (nucleoprotein)	3IF18	2/3	IgG2a	EIA, WB, IF
Anti-Influenza Virus B (nucleoprotein)	3IF18	8-5	IgG2a	EIA, WB
Anti-Influenza Virus B (nucleoprotein)	3IF18	13-9	IgG2a	EIA, WB
Anti-Influenza Virus B (nucleoprotein)	3IF18	14-12	IgG2a	EIA, WB
Anti-Influenza Virus B (nucleoprotein)	3IF18	15-12	IgG2a	EIA, WB



4.2. Anti-Influenza B Haemagglutinin (HA) monoclonal antibodies

Anti-Influenza B virus monoclonal antibodies

MAbs: InB18, InB190
 Host animal: Mice Balb/c
 Cell line used for fusion: Sp 2/0
 Antigen: purified influenza B virus
 Specificity: Specific to haemagglutinin HA₂ of Influenza B
 Purification method: Protein A affinity chromatography

4.2.1. Influenza B HA immunodetection in ELISA

All of anti-haemagglutinin MAbs equally detect HA of different strains of Influenza B virus in direct and indirect ELISA. Titration curves of MAb InB190 is shown of Fig. 18.

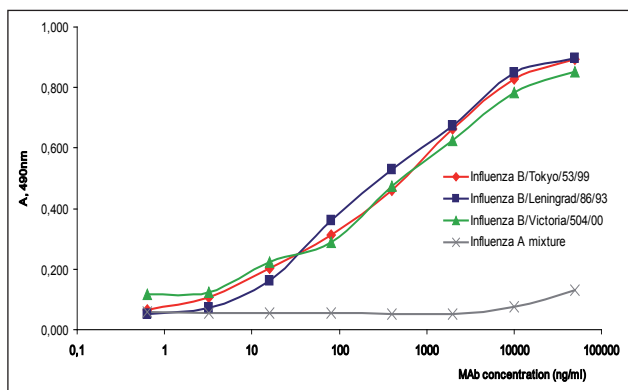


Figure 18. Titration curves of MAb InB190 specific to HA of Influenza B virus in indirect ELISA.

A. MAb InB190 titration in indirect ELISA.

Antigens - 0.5µg/well:
 Influenza B/Tokyo/53/99
 Influenza B/Leningrad/86/93
 Influenza B/Victoria/504/00
 Influenza A: mixture of two strains - A/Shangdong/9/93 and A/New Caledonia/20/99

4.2.2. Influenza B HA immunodetection in Western blotting

All MAbs detect Influenza B haemagglutinin HA₂ chain of different strains in Western Blotting after SDS PAGE in reducing conditions (Fig. 19).

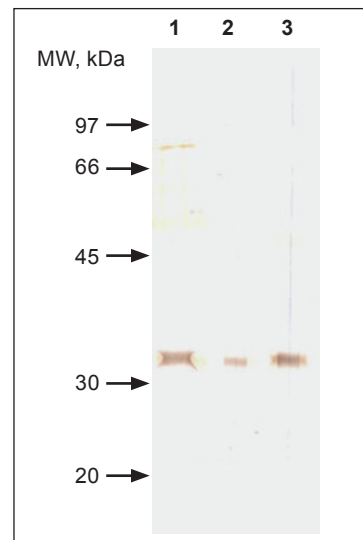


Figure 19. Influenza B HA₂ immunodetection after Western blotting. Anti-mouse IgG conjugated with HRP was used for MAb HA complex visualization.

Antigens - 1µg/well:
 1 - Influenza B/Tokio/53/99
 2 - Influenza B/Leningrad/86/93
 3 - Influenza B/Victoria/504/00
 Antibody: MAb InB190 – 3 µg/ml.

Ordering information:

Product	Cat. #	MAb	Isotype	Remarks
Anti-Influenza Virus B (haemagglutinin)	3BH9	InB18	IgG2a	HA2, EIA, WB
Anti-Influenza Virus B (haemagglutinin)	3BH9	InB190	IgG2b	HA2, EIA, WB



4.3. Anti-Influenza B Matrix protein M1 monoclonal antibodies

Anti- Influenza B virus Matrix protein M1 monoclonal antibodies

MAbs: InB4, InB15
 Host animal: mice Balb/c
 Cell line used for fusion: Sp 2/0
 Antigen: Purified Influenza B virus
 Specificity: Matrix protein M1 of Influenza B virus
 Purification method: Protein-A affinity chromatography

4.3.1. Influenza B M1 immunodetection in ELISA

MAbs InB4 and InB15 detect matrix M1 protein of Influenza B virus in direct and indirect ELISA. Titration curve of MAb InB4 is shown of Fig. 20.

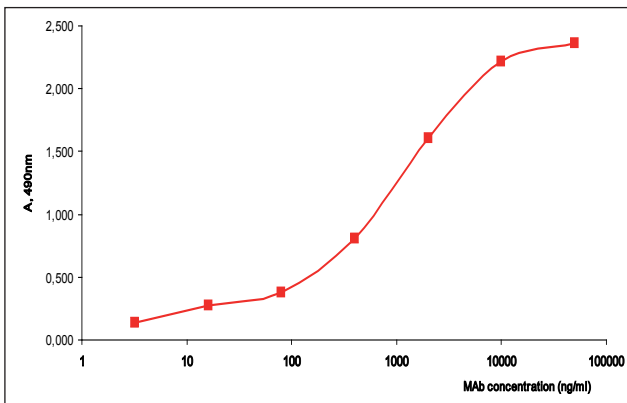


Figure 20. Titration curve of MAb InB4 specific to matrix protein M1 of Influenza B virus in indirect ELISA.
 A. MAb InB4 titration in indirect ELISA.
 Antigen: Influenza B/Tokyo/53/99 - 0.5µg/well.

4.3.2. Influenza B matrix protein M1 immunodetection in Western blotting

All MAbs detect Influenza B matrix protein M1 in Western blotting after SDS PAGE in reducing conditions (Fig. 21). MAbs InB4 and InB15 equally detect M1 protein of different strains of Influenza B.

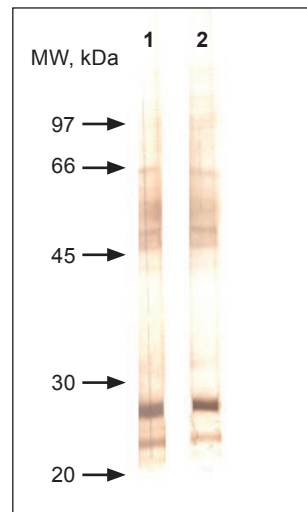


Figure 21. Influenza B matrix protein M1 immunodetection after Western blotting. Anti-mouse IgG conjugated with HRP was used for MAb M1 complex visualization.
 Antigen: Influenza B/Tokio/53/99 - 1µg/well.
 MAbs: - 3 µg/ml.
 1 - InB4
 2 - InB15

Ordering information:

Product	Cat. #	MAb	Isotype	Remarks
Anti-Influenza Virus B (Matrix protein M1)	3BM17	InB4	IgG1	EIA, WB
Anti-Influenza Virus B (Matrix protein M1)	3BM17	InB15	IgG1	EIA, WB



Respiratory Syncytial Virus (RSV)

Respiratory syncytial virus is one of the most important respiratory pathogens in infants and children provoking considerable morbidity, which often requires bed care. Severe diseases caused by Respiratory Syncytial virus are most common among infants during the first six months of life and patients with immunodeficiency. Serious lesions of the lower respiratory

tract induced by Respiratory Syncytial virus (bronchitis, bronchiolitis, pneumonia) are one of the important causes of mortality in infants. 60-70 % of infants less than six months of age fail to induce detectable antibody response to natural infection. Repeated infections with Respiratory Syncytial virus are common and result in neutralizing antibody formation.

1. Respiratory Syncytial virus (RSV) antigen

Respiratory Syncytial virus (RSV), strain Long

Source: MA-104 cells, inoculated with Respiratory Syncytial virus, strain Long.
Purity: > 90 %
Inactivation: Viruses are inactivated with thimerosal and beta propiolactone treatment.
Specificity: The identity of viral antigens, absence of contamination by other viruses (adenovirus, influenza A and B viruses and parainfluenza viruses) and immunoreactivity were checked in ELISA. See Fig. 23.
Morphology: In investigation using electron microscopy: RS-virus particles 150 – 300 nm in diameter were observed. See Fig. 22.
Applications: Detection of antibodies to Respiratory Syncytial virus in ELISA. Recommended concentration for ELISA is 2.5 – 5 µg/ml.

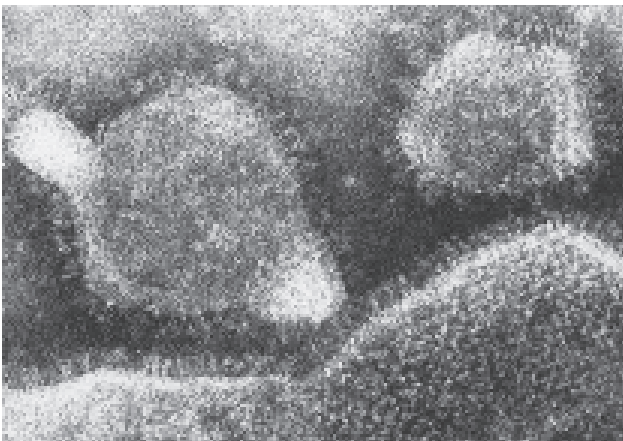


Figure 22. Electron microscopic image of Respiratory Syncytial virus (Virus particles 150-300 nm in diameter were observed, magnification 1x110 000).

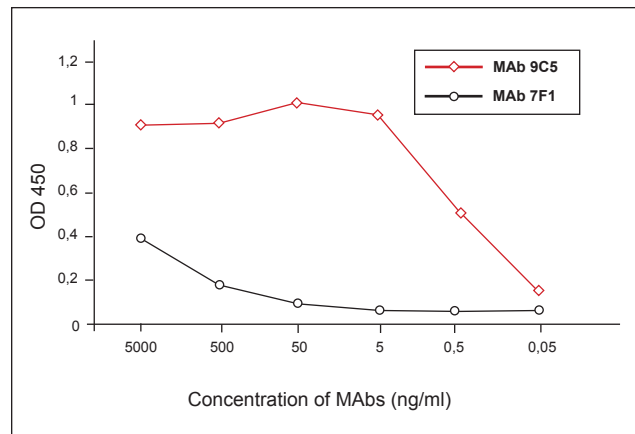


Figure 23. Control of specific activity and cross-reactivity of Respiratory Syncytial virus in ELISA with monoclonal antibodies to different viruses MAb 9C5 to F-protein of Respiratory Syncytial virus. MAb 7F1 to hexon antigen of adenoviruses.

Ordering information:

Product	Cat. #	Strain	Remarks
Respiratory Syncytial virus	8RSV79	Long	EIA



2. Anti-Respiratory Syncytial virus (RSV) monoclonal antibodies

We developed a panel of MAbs against RSV. Two MAbs out of this panel, 8C5 and 9C5, are recommended for immunoassay. In Western blot MAb 8C5 reacts with protein having Mr 90 K, that corresponds in mobility to protein G. MAb 9C5 specificity was determined by competitive ELISA with MAbs 131-2A and 92-11C (CDC, Atlanta): they are directed to the same F1a epitope, localized on F-protein. MAbs 8C5 and 9C5 may be used in sandwich ELISA for RSV

detection both with themselves and in a mixed combination, taking into account that 9C5 is especially suitable for conjugation.

MAbs 8C5 and 9C5 have virus-neutralizing activity, 8C5 blocks RSV-target cells binding, 9C5 hampers the virus penetration into the cell. A new MAb 8B10 is suitable for ELISA and could be used to detect incomplete virus assembly.

Anti-Respiratory Syncytial virus

MAbs: 8C5, 9C5 and 8B10
Host Animal: Mice SJL/J
Cell line used for fusion: Px
Immunogen: Purified Respiratory Syncytial virus
Purification method: Protein G affinity chromatography
Specificity: Surface glycoprotein G (MAb 8C5), surface glyco protein F (MAb 9C5), nucleoprotein N (MAb 8B10) of RSV. MAb 9C5 is highly reactive with the surface domains of both mature RSV virions and «empty» virion envelopes without formed inner nucleocapsid structures. MAb 8B10 is reacting well only with mature virions with completely assembled nucleocapsids. No cross-reactivity with influenza A and B viruses, adenovirus and parainfluenza type 1 and 2 viruses.
Applications: Detection of RSV in ELISA. Fig. 24, 25 and 26.

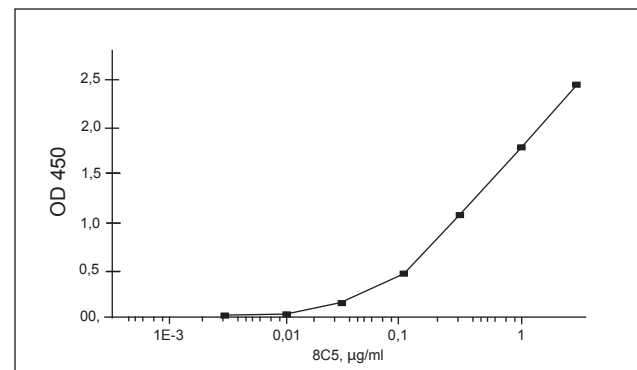


Figure 24. Specific activity of MAb 8C5 in ELISA with purified RSV antigen.

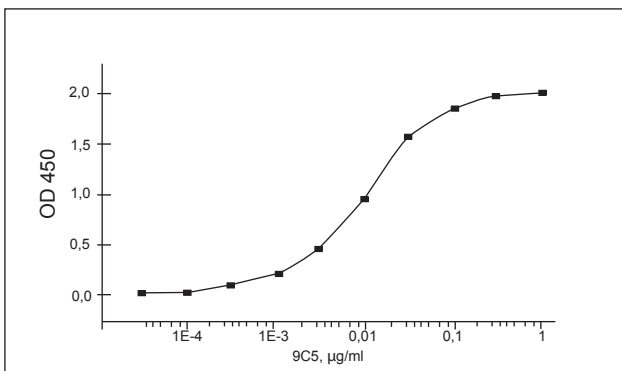


Figure 25. Specific activity of MAb 9C5 in ELISA with purified RSV antigen.

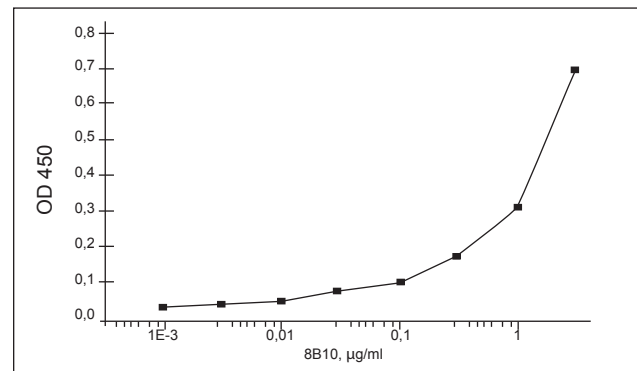


Figure 26. Specific activity of MAb 8B10 in ELISA with purified RSV antigen.

Ordering information:

Product	Cat. #	MAb	Isotype	Remarks
Anti-Respiratory Syncytial virus	3Res21	8C5	IgG2b	G protein, EIA
Anti-Respiratory Syncytial virus	3Res21	9C5	IgG2b	F protein, EIA
Anti-Respiratory Syncytial virus	3Res21	8B10	IgG1	Nucleoprotein, EIA



Adenovirus

Adenoviruses are a large group (more than 80 types) of agents, which induce respiratory infections among human beings, animals and birds. Clinical pattern of adenoviral infection is characterized by pronounced pharyngitis, conjunctivitis, general intoxication and pulmonary lesions with high fever in children. Adenovirus types 3, 4, 7, 14 and 21 often spread in mili-

tary units and account for 72 % of ARDs among recruits. A considerable part of these diseases results in hospitalization. Adenovirus types 3, 4, 7, 8 and 19 are known as causative agents of epidemic keratoconjunctivitis. Some types of adenoviruses provoke outbreaks of gastroenteritis with long (more than 2 months) carriage of viruses.

1. Adenovirus antigen

Adenovirus, type 6, strain Tonsil 99

Source: HeLa cells, inoculated with Adenovirus, type 6, strain Tonsil 99

Purity: > 90 %

Inactivation: Viruses are inactivated with thimerosal and beta propiolactone treatment.

Specificity: The identity of viral antigens, absence of contamination by other viruses (RSV, influenza A and B viruses and parainfluenza viruses) and immunoreactivity were checked in ELISA. See Fig. 28.

Morphology: In investigation using electron microscopy - typical adenovirus particles 80 nm in diameter were observed. See Fig. 27.

Applications: Detection of antibodies to Adenovirus in ELISA. Recommended concentration for ELISA is 2.5 - 5 µg/ml.

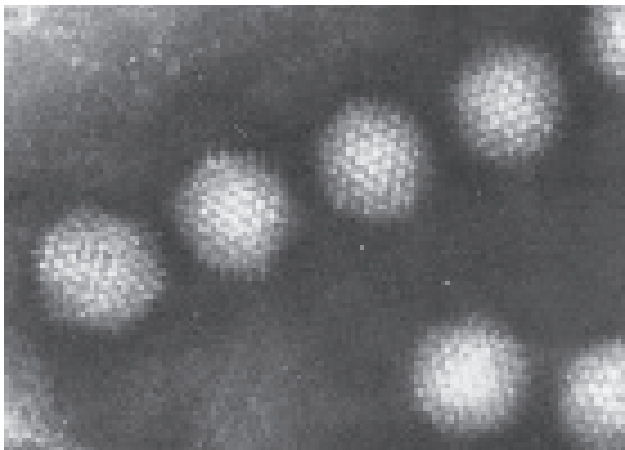


Figure 27. Electron microscopic image of Adenovirus, type 6 (Virus particles 80 nm in diameter were observed, magnification 1x110 000).

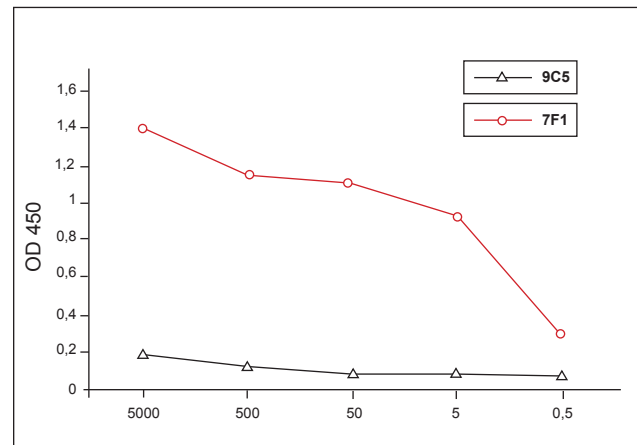


Figure 28. Control of specific activity and cross reactivity of adenovirus in ELISA with monoclonal antibodies to different viruses.

MAb 9C5 to F-protein of RS-virus
MAb 7F1 to hexon antigen of adenoviruses

Ordering information:

Product	Cat. #	Strain	Remarks
Adenovirus, type 6	8AV13	Tonsil 99	EIA



2. Anti-Adenovirus monoclonal antibodies

Anti-Adenovirus monoclonal antibodies

MAbs: 7C11, 1E11 and 8C4
 Host Animal: Mice Balb/C
 Cell line used for fusion: Sp2/0
 Immunogen: Purified human and canine adenoviruses (type 1)
 Purification method: Protein A affinity chromatography
 Specificity: MAbs react with Hexon antigen of at least human, canine, bovine, monkey and rat adenoviruses.
 Applications: MAbs can be used in ELISA, immunodiffusion and immunohistochemistry.
 Pair 8C4 (coating) – 1E11 (conjugate) is recommended for sandwich ELISA.

Ordering information:

Product	Cat. #	MAb	Isotype	Remarks
Anti-Adenovirus hexon	3AV13	7C11	IgG2a + IgM	EIA, ID, IHC
Anti-Adenovirus hexon	3AV13	1E11	IgG2a + IgM	EIA (conjugate), ID, IHC
Anti-Adenovirus hexon	3AV13	8C4	IgG2a	EIA (coating), ID, IHC

Parainfluenza

Parainfluenza virus types 1-3 are common agents of acute respiratory infections predominating among children less than 5 years old. They induce about 15 % of acute respiratory infections. They are mostly

causative agents of severe croup, bronchitis, bronchiolitis and pneumonia (Parainfluenza virus type 3) in infants. Children can be infected with Parainfluenza virus several times during one year.

1. Parainfluenza antigens

We produce extra purity grade parainfluenza virus type I (strain Sendai), parainfluenza type 2 (strain II-ALTB cc2056) and parainfluenza virus type 3 (strain 3v29) viral antigens for serology tests such as indirect EIA, HIT (hemagglutinin inhibition test), CFT (complement fixation test) and for the use as immunogens in polyclonal antibody production.

B, but parainfluenza virus types 2 and 3 were grown in a monolayer of cells MA-104. Viruses are inactivated with thimerosal.

The quality control was made by electron microscopy, SDS-PAGE and protein concentration measurement by BCA (Pierce) assay. The identity of viral antigens, absence of contamination by other viruses and immunoreactivity were checked in indirect ELISA and HIT. Purity of the antigens is >90 %.

The purification technology is in general similar to the one described earlier for influenza virus types A and

Parainfluenza virus type 1, strain Sendai

Parainfluenza virus type 2, strain II ALTB cc 2056 (See Table 4 and Fig. 29.)

In investigation using electron microscopy parainfluenza virus type 2 particles 150-300 nm in diameter were observed. Low level of cross-reactivity with parainfluenza virus type 3 was observed in ELISA.

Parainfluenza virus type 3, strain III v 2932 (See Table 4 and Fig. 30.)

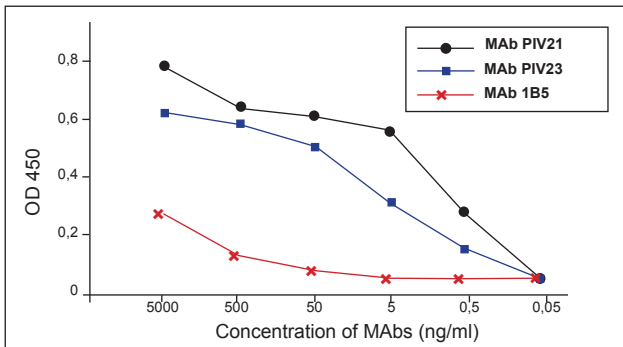


Figure 29. Control of specific activity and cross-reactivity of parainfluenza virus type 2 in ELISA with monoclonal antibodies to parainfluenza viruses.

PIV21: MAb to F-protein of parainfluenza virus type 2
 PIV23: MAb to F-protein of parainfluenza virus type 2
 1B5: MAb to parainfluenza virus type 3

Table 4. Results of the control investigation of parainfluenza virus types 2 and 3 in hemagglutination inhibition test.

Parainfluenza viruses:	Antibody titers in strain specific immune rabbit sera to:		
	S1	S2	S3
PIV type 1 (Sendai strain)	320	<20	<20
PIV type 2	<20	320	<20
PIV type 3	<20	<20	640

S1: antiserum to PIV type 1 (Sendai strain)
 S2: antiserum to PIV type 2
 S3: antiserum to PIV type 3

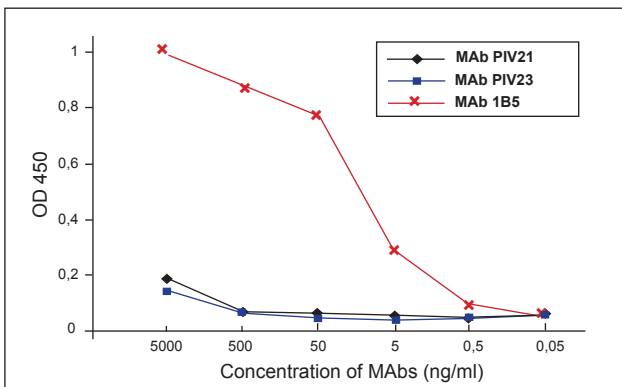


Figure 30. Control of specific activity and cross-reactivity of parainfluenza virus type 3 in ELISA with monoclonal antibodies to parainfluenza viruses.

PIV21: MAb to F-protein of parainfluenza virus type 2
 PIV23: MAb to F-protein of parainfluenza virus type 2
 1B5: MAb to parainfluenza virus type 3

Ordering information:

Product	Cat. #	Strain	Remarks
Parainfluenza virus, type 1	8P76	Sendai	EIA, HIT
Parainfluenza virus, type 2	8P76-2	II ALTB cc 2056	EIA, HIT
Parainfluenza virus, type 3	8P76-3	III v 2932	EIA, HIT



Newcastle disease virus (NDV)

Newcastle disease (ND) is a highly contagious and sometimes fatal illness affecting many domestic and wild bird species. The causal agent, Newcastle disease virus (NDV), is a negative-sense single-stranded RNA virus. NDV affects the respiratory, nervous, and digestive systems. Clinical signs are extremely variable depending on the strain of virus, species and age of bird, concurrent disease, and pre-existing immunity. NDV is so virulent that many birds die without showing any clinical signs.

Transmission occurs by exposure to faecal and other excretions from infected birds, and through contact with contaminated food, water, equipment and clothing. Virus-bearing material can be picked up on shoes and clothing and carried from an infected flock to a healthy one. Exposure of humans to infected birds (for example in poultry processing plants) can cause mild conjunctivitis and influenza-like symptoms, but NDV otherwise poses no hazard to human health. MAbs are negative with parainfluenza type 3 and avian influenza hemagglutinins.

Ordering information:

Product	Cat. #	MAb	Isotype	Remarks
Anti-Newcastle disease virus	3ND5	9F7	IgG1	EIA, WB, HIT
Anti-Newcastle disease virus	3ND5	11F12	IgG2a	EIA, WB, HIT
Anti-Newcastle disease virus	3ND5	13H3	IgG2a	EIA, WB, HIT
Anti-Newcastle disease virus	3ND5	9C6	IgG2a	EIA, WB, HIT
Anti-Newcastle disease virus	3ND5	1C10	IgG2a	EIA, WB, HIT
Anti-Newcastle disease virus	3ND5	2H4	IgM	EIA, HIT
Anti-Newcastle disease virus	3ND5	8H2	IgG2a	EIA



Klebsiella pneumoniae

Klebsiella pneumoniae is a Gram-negative, non-motile, facultative anaerobic, rod shaped bacterium found in the normal flora of the mouth, skin, and intestines. It is clinically the most important member of the *Klebsiella* genus of *Enterobacteriaceae*. It naturally occurs in the soil and about 30% of strains can fix nitrogen in anaerobic condition.

Members of the *Klebsiella* genus typically express 2 types of antigens on their cell surface. The first, O antigen, is a lipopolysaccharide of which 9 varieties exist. The second is K antigen, a capsular polysaccharide with more than 80 varieties. Both contribute to pathogenicity and form the basis for subtyping.

K. pneumoniae can cause bacterial pneumonia, typically due to aspiration, though it is more commonly implicated in hospital-acquired urinary tract and wound infections, particularly in immunocompromised individuals (e.g. alcoholics). *Klebsiella* ranks second to *E. coli* for urinary tract infections in older persons. It is also an opportunistic pathogen for patients with chronic pulmonary disease, enteric pathogenicity, nasal mucosa atrophy, and rhinoscleroma.

Monoclonal anti-*Klebsiella pneumoniae* antibodies were produced from hybridoma clones derived from hybridization of Sp2/0 myeloma cells with spleen cells of Balb/c mice immunized with lyophilized *Klebsiella pneumoniae*, strain 204.

Ordering information:

Product	Cat. #	MAb	Isotype	Remarks
Anti- <i>Klebsiella pneumoniae</i> 204	3KP4	KpE7	IgG2a	Indirect EIA
Anti- <i>Klebsiella pneumoniae</i> 204	3KP4	KpE10	IgG2a	Indirect EIA
Anti- <i>Klebsiella pneumoniae</i> 204	3KP4	KpH11	IgG2a	Indirect EIA



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