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Human CD31 ELISA KIT

1. Intended use

The OriGeneHuman CD31(PECAM-1) ELISA is a solid phase sandwich ELISA used for the in-vitro qualitative and quantitative determination of CD31 (PECAM-1) in human serum, plasma, buffered solutions or cell culture supernatants. The assay recognizes natural CD31.

This kit has been configured for research use only.

2. Principle of the method

The Human CD31 Kit is a solid phase sandwich Enzyme Linked-Immuno-Sorbent Assay (ELISA). A monoclonal antibody specific for CD31 has been coated onto the wells of the microtiter strip plate provided. Samples, including standards of known CD31 concentrations and unknowns are pipetted into these wells.

During the first incubation, the CD31 antigen and a biotinylated monoclonal antibody specific for CD31 are simultaneously incubated.

After washing, the enzyme (streptavidin-peroxydase) is added. After incubation and washing to remove all the unbound enzyme, a substrate solution is added to induce a coloured reaction product. The intensity of this coloured product is directly proportional to the concentration of CD31 present in the samples.

3. Reagents provided and reconstitution

Reagents (Store@2-8°C)	Quantity 1x48 well kit Cat no. EA101196	Quantity 1x96 well kit Cat no. EA101197	Quantity 2x96 well kit Cat no. EA101198	Reconstitution
96 well microtiter strip plate	1/2	1	2	Ready to use (Pre-coated)
Plastic plate covers	2	2	4	n/a
Standard: 10 ng/ml	1 vial	2 vials	4 vials	Reconstitute as directed on the vial (see Assay preparation, section 8)
Control	1 vial	2 vials	4 vials	Reconstitute as directed on the vial (see Assay preparation, section 8)
Standard Diluent (Buffer)	1 vial (25ml)	1 vial (25ml)	1 vial (25ml)	10x Concentrate, dilute in distilled water (see reagent preparation, section 8)
Biotinylated anti-CD31	1 vial (0.4ml)	1 vial (0.4ml)	2 vials (0.4ml)	Dilute in Biotinylated Antibody Diluent (see Assay preparation, section 8)
Biotinylated Antibody Diluent	1 vial (7ml)	1 vial (7ml)	1 vial (13ml)	Ready to use
Streptavidin-HRP	1 vial (5µl)	2 vials (5µl)	4 vials (5µl)	Add 0.5ml of HRP diluent prior to use (see Assay preparation, section 8)
HRP Diluent	1 vial (23ml)	1 vial (23ml)	1 vial (23ml)	Ready to use
Wash Buffer	1 vial (10ml)	1 vial (10ml)	2 vials (10ml)	200x Concentrate dilute in distilled water (see Assay preparation, section 8)
TMB Substrate	1 vial (11ml)	1 vial (11ml)	1 vial (24ml)	Ready to use
H ₂ SO ₄ stop reagent	1 vial (11ml)	1 vial (11ml)	2 vials (11ml)	Ready to use

4. Materials required but not provided

- Microtiter plate reader fitted with appropriate filters (450nm required with optional 630nm reference filter)
- Microplate washer or wash bottle
- 10, 50, 100, 200 and 1,000µl adjustable single channel micropipettes with disposable tips
- 50-300µl multi-channel micropipette with disposable tips
- Multichannel micropipette reagent reservoirs
- Distilled water
- Vortex mixer
- Miscellaneous laboratory plastic and/or glass, if possible sterile

5. Storage Instructions

Store kit reagents between 2 and 8°C. Immediately after use remaining reagents should be returned to cold storage (2-8°C). Expiry of the kit and reagents is stated on box front labels. The expiry of the kit components can only be guaranteed if the components are stored properly, and if, in case of repeated use of one component, the reagent is not contaminated by the first handling.

Wash Buffer: Once prepared store at 2-8° C for up to 1 week

Standard Diluent Buffer: Once prepared store at 2-8° C for up to 1 week

Standards/ Controls: Once prepared use immediately and do not store

Biotinylated Secondary Antibody: Once prepared use immediately and do not store

Streptavidin-HRP: Once prepared use immediately and do not store

6. Specimen collection, processing & storage

Cell culture supernatants, serum, plasma or other biological samples will be suitable for use in the assay. Remove serum from the clot or red cells, respectively, as soon as possible after clotting and separation.

Cell culture supernatants: Remove particulates and aggregates by spinning at approximately 1000 x g for 10 min.

Serum: Avoid any unintentional stimulation of the cells by the procedure. Use pyrogen/endotoxin free collecting tubes. Serum should be removed rapidly and carefully from the red cells after clotting. For that, after clotting, centrifuge at approximately 1000 x g for 10 min and remove serum.

Plasma: EDTA, citrate and heparin plasma can be assayed. Spin samples at 1000 x g for 30 min to remove particulates. Harvest plasma.

Storage: If not analyzed shortly after collection, samples should be aliquoted (250-500µl) to avoid repeated freeze-thaw cycles and stored frozen at -70°C. Avoid multiple freeze-thaw cycles of frozen specimens.

Recommendation: Do not thaw by heating at 37°C or 56°C. Thaw at room temperature and make sure that sample is completely thawed and homogeneous before use. When possible avoid use of badly haemolysed or lipemic sera. If large amounts of particles are present these should be removed prior to use by centrifugation or filtration.

7. Safety & precautions for use

- Handling of reagents, serum or plasma specimens should be in accordance with local safety procedures, e.g. CDC/NIH Health manual : " Biosafety in Microbiological and Biomedical Laboratories" 1984.
- Laboratory gloves should be worn at all times.
- Avoid any skin contact with H₂SO₄ and TMB. In case of contact, wash thoroughly with water.
- Do not eat, drink, smoke or apply cosmetics where kit reagents are used.
- Do not pipette by mouth.
- When not in use, kit components should be stored refrigerated or frozen as indicated on vials or bottles labels.
- All reagents should be warmed to room temperature before use. Lyophilized standards should be discarded after use.
- Once the desired number of strips has been removed, immediately reseal the bag to protect the remaining strips from deterioration.
- Cover or cap all reagents when not in use.
- Do not mix or interchange reagents between different lots.
- Do not use reagents beyond the expiration date of the kit.
- Use a clean disposable plastic pipette tip for each reagent, standard, or specimen addition in order to avoid cross contamination, for the dispensing of H₂SO₄ and substrate solution, avoid pipettes with metal parts.
- Use a clean plastic container to prepare the washing solution.
- Thoroughly mix the reagents and samples before use by agitation or swirling.
- All residual washing liquid must be drained from the wells by efficient aspiration or by decantation followed by tapping the plate forcefully on absorbent paper. Never insert absorbent paper directly into the wells.
- The TMB solution is light sensitive. Avoid prolonged exposure to light. Also, avoid contact of the TMB solution with metal to prevent colour development. Warning TMB is toxic avoid direct contact with hands. Dispose off properly.
- If a dark blue colour develops within a few minutes after preparation, this indicates that the TMB solution has been contaminated and must be discarded. Read absorbance's within 1 hour after completion of the assay.
- When pipetting reagents, maintain a consistent order of addition from well-to-well. This will ensure equal incubation times for all wells.
- Follow incubation times described in the assay procedure.
- Dispense the TMB solution within 15 min of the washing of the microtitre plate.

8. Assay Preparation

Bring all reagents to room temperature before use.

8.1. Assay Design

Determine the number of microwell strips required to test the desired number of samples plus appropriate number of wells needed for running zeros and standards. Each sample, standard and zero should be tested **in duplicate**. Remove sufficient Microwell Strips for testing from the pouch immediately prior to use. Return any wells not required for this assay with desiccant to the pouch. Seal tightly and return to 2-8°C storage.

Example plate layout(example shown for a 6 point standard curve)

	Standards		Sample Wells									
	1	2	3	4	5	6	7	8	9	10	11	12
A	10	10										
B	5	5										
C	2.5	2.5										
D	1.25	1.25										
E	0.63	0.63										
F	0.31	0.31										
G	Control	Control										
H	zero	zero										

All remaining empty wells can be used to test samples in duplicate

8.2. Preparation of Wash Buffer

Dilute the (200x) wash buffer concentrate 200 fold with distilled water to give a 1x working solution. Pour entire contents (10 ml) of the Washing Buffer Concentrate into a clean 2,000 ml graduated cylinder. Bring final volume to 2,000 ml with glass-distilled or deionized water. Mix gently to avoid foaming. Transfer to a clean wash bottle and store at 2°-8°C for up to 1 week.

8.3. Preparation of Standard Diluent Buffer

Add the contents of the vial (10x concentrate) to 225ml of distilled water before use.

This solution can be stored at 2-8°C for up to 1 week.

8.4. Preparation of Standard

Standard vials must be reconstituted with the volume of standard diluent shown on the vial immediately prior to use. This reconstitution gives a stock solution of 10ng/ml of CD31. **Mix the reconstituted standard gently by inversion only.** Serial dilutions of the standard are made directly in the assay plate to provide the concentration range from 10 to 0.31ng/ml. A fresh standard curve should be produced for each new assay.

- Immediately after reconstitution add 200µl of the reconstituted standard to wells A1 and A2, which provides the highest concentration standard at 10ng/ml.
- Add 100µl of Standard Diluent to the remaining standard wells B1 and B2 to F1 and F2.
- Transfer 100µl from wells A1 and A2 to B1 and B2. Mix the well contents by repeated aspirations and ejections taking care not to scratch the inner surface of the wells.
- Continue this 1:1 dilution using 100µl from wells B1 and B2 through to wells F1 and F2 providing a serial diluted standard curve ranging from 10 to 0.31ng/ml.
- Discard 100µl from the final wells of the standard curve (F1 and F2).

Alternatively these dilutions can be performed in separate clean tubes and transferred directly into the relevant wells.

8.5. Preparation of Control

Control vials must be reconstituted with the volume of Standard Diluent shown on the vial immediately prior to use and will give a concentration as shown on the vial. Allow to stand for 5 min with intermittent gentle swirling before use. Do not store this solution for future use.

8.6. Preparation of Samples

Before testing, serum or plasma samples have to be diluted 1:4 in standard diluent (buffer).

8.7. Preparation of Biotinylated anti-CD31

It is recommended this reagent is prepared immediately before use. Dilute the biotinylated anti-CD31 with the biotinylated antibody diluent in an appropriate clean glass vial using volumes appropriate to the number of required wells. Please see example volumes below:

Number of wells required	Biotinylated Antibody (µl)	Biotinylated Antibody Diluent (µl)
16	40	1060
24	60	1590
32	80	2120
48	120	3180
96	240	6360

8.8. Preparation of Streptavidin-HRP

It is recommended to centrifuge vial for a few seconds in a microcentrifuge to collect all the volume at the bottom.

Dilute the 5 μ l vial with 0.5ml of HRP diluent **immediately before use**. Do not keep this diluted vial for future experiments. Further dilute the HRP solution to volumes appropriate for the number of required wells in a clean glass vial. Please see example volumes below:

Number of wells required	Streptavidin-HRP (μ l)	Streptavidin-HRP Diluent (ml)
16	30	2
24	45	3
32	60	4
48	75	5
96	150	10

9. Method

We strongly recommend that every vial is mixed thoroughly without foaming prior to use except the standard vial which must be mixed gently by inversion only.

Prepare all reagents as shown in section 8.

Note: Final preparation of Biotinylated anti-CD31 (section 8.7) and Streptavidin-HRP (section 8.8) should occur immediately before use.

Assay Step		Details
1.	Addition	Prepare Standard curve as shown in section 8.4
2.	Addition	Add 100µl of each standard, sample, control and zero (standard diluent) in duplicate to appropriate number of wells
3.	Addition	Add 50µl of diluted biotinylated anti-CD31 to all wells
4.	Incubation	Cover with a plastic plate cover and incubate at room temperature (18 to 25°C) for 1 hour
5.	Wash	Remove the cover and wash the plate as follows: a) Aspirate the liquid from each well b) Dispense 0.3 ml of 1x washing solution into each well c) Aspirate the contents of each well d) Repeat step b and c another two times
6.	Addition	Add 100µl of Streptavidin-HRP solution into all wells
7.	Incubation	Cover with a plastic plate cover and incubate at room temperature (18 to 25°C) for 30 min
8.	Wash	Repeat wash step 5.
9.	Addition	Add 100µl of ready-to-use TMB Substrate Solution into all wells
10.	Incubation	Incubate in the dark for 10-20 minutes* at room temperature. Avoid direct exposure to light by wrapping the plate in aluminium foil
11.	Addition	Add 100µl of H₂SO₄:Stop Reagent into all wells
<p>Read the absorbance value of each well (immediately after step 11.) on a spectrophotometer using 450 nm as the primary wavelength and optionally 630 nm as the reference wavelength (610 nm to 650 nm is acceptable).</p>		

**Incubation time of the substrate solution is usually determined by the ELISA reader performance. Many ELISA readers only record absorbance up to 2.0 O.D. Therefore the colour development within individual microwells must be observed by the analyst, and the substrate reaction stopped before positive wells are no longer within recordable range.*

10. Data Analysis

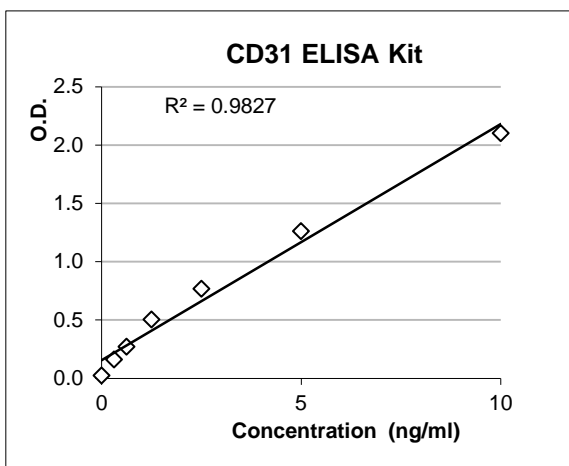
Calculate the average absorbance values for each set of duplicate standards and samples. Ideally duplicates should be within 20% of the mean.

Generate a linear standard curve by plotting the average absorbance of each standard on the vertical axis versus the corresponding human CD31 standard concentration on the horizontal axis.

The amount of CD31 in each sample is determined by extrapolating OD values against CD31 standard concentrations using the standard curve.

Example CD31 curve shown:

Standard	CD31 Conc ng/ml	OD (450nm) Mean	CV (%)
1	10	2,101	1,82
2	5	1,260	0,11
3	2.5	0,766	10,62
4	1.25	0,503	3,94
5	0.62	0,268	5,80
6	0.31	0,160	11,49
Zero	0	0,021	13,47



Note: curve shown above should not be used to determine results. Every laboratory must produce a standard curve for each set of microwell strips assayed.

For sample serum or plasmas which have been diluted 1:4 according to the protocol, the calculated concentration should be multiplied by the dilution factor (x4).

11. Assay limitations

Do not extrapolate the standard curve beyond the maximum standard curve point. The dose-response is non-linear in this region and good accuracy is difficult to obtain. Concentrated samples above the maximum standard concentration must be diluted with Standard diluent or with your own sample buffer to produce an OD value within the range of the standard curve. Following analysis of such samples always multiply results by the appropriate dilution factor to produce actual final concentration.

The influence of various drugs on end results has not been investigated. Bacterial or fungal contamination and laboratory cross-contamination may also cause irregular results.

Improper or insufficient washing at any stage of the procedure will result in either false positive or false negative results. Completely empty wells before dispensing fresh Washing Buffer, fill with Washing Buffer as indicated for each wash cycle and do not allow wells to sit uncovered or dry for extended periods.

Disposable pipette tips, flasks or glassware are preferred, reusable glassware must be washed and thoroughly rinsed of all detergents before use.

As with most biological assays conditions may vary from assay to assay therefore **a fresh standard curve must be prepared and run for every assay.**

12. Performance Characteristics

12.1. Sensitivity

The minimum detectable dose of humanCD31 using this OriGeneCD31 ELISA kit was found to be **0.04ng/ml**. This was determined by adding 3 standard deviations to the mean OD obtained when the zero standard was assayed 40times.

12.2. Specificity

The assay recognizes natural CD31.

To define the specificity of this ELISA, several proteins were tested for cross-reactivity. There was no cross reactivity observed for any protein tested (IL-2R/CD25, IL-4R/CD124, IL-6R/CD126, CD62P, Fas/CD95, CD117, CD141, TRAIL/CD253, TRAIL R1/CD261, gp130/CD130).

12.3. Precision

Intra-Assay

Reproducibility within the assay was evaluated in three independent experiments. Each assay was carried out with 6 replicates (3 duplicates) in 2 human pooled serum, 2 in culture media and 2 in standard diluent with samples containing different concentrations of CD31. 2 standard curves were run on each plate **The overall intra-assay coefficient of variation has been calculated to be 4.0%.**

Session	Sample	Mean CD31 ng/ml	SD	CV
Session 1	Sample 1	8,16	0,48	5,9
	Sample 2	2,88	0,09	3,1
	Sample 3	7,23	0,29	4,0
	Sample 4	2,05	0,14	6,6
	Sample 5	6,88	0,27	3,9
	Sample 6	1,82	0,05	2,5
Session 2	Sample 1	7,97	0,26	3,3
	Sample 2	2,74	0,06	2,2
	Sample 3	6,93	0,16	2,3
	Sample 4	2,06	0,24	11,6
	Sample 5	6,61	0,19	2,8
	Sample 6	1,99	0,04	1,8
Session 3	Sample 1	8,58	0,31	3,6
	Sample 2	2,98	0,03	1,1
	Sample 3	7,12	0,36	5,1
	Sample 4	2,05	0,04	2,1
	Sample 5	6,63	0,46	7,0
	Sample 6	1,60	0,05	3,0

Inter-Assay

Assay to assay reproducibility within one laboratory was evaluated in three independent experiments by two technicians. Each assay was carried out with 6 replicates (3 duplicates) in 2 human pooled serum, 2 in culture media and 2 in standard diluent with samples containing different concentrations of CD31. 2 standard curves were run on each plate. **The calculated overall coefficient of variation was 5.7%.**

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
Mean CD31ng/ml	8,24	2,86	7,09	2,05	6,71	1,80
SD	0,42	0,12	0,28	0,14	0,31	0,17
CV	5,0	4,1	3,9	6,8	4,6	9,5

12.4. Dilution Parallelism

Two serum samples spiked in BSA or in RPMI with different levels of CD31 and a serum were analysed at three serial two fold dilutions (1:2-1:8) with two replicates each. Recoveries ranged from 91% to 123% with an overall mean recovery of 110%.

12.5. Recovery

The spike recovery was evaluated by spiking two concentrations of CD31 in human serum and cell culture media in three experiments. Recoveries ranged from 85% to 120% with an overall mean recovery of 105% in serum and ranged from 103% to 132% with an overall mean recovery of 118% in RPMI.

12.6. Normal Serum Values

The average concentration of CD31 measured in 40 normal serum is 12+/-5.4 ng/ml, ranging from 6.5 to 29.7 ng/ml.

13. References

Laurance, S. et al. Differential modulation of adhesion molecule expression by hydroxycarbamide in human endothelial cells from the micro- and macrocirculation: potential implications in sickle cell disease vasoocclusive events. *Haematologica*, 2011; 96(4): 534-542

14. Assay Summary

Total procedure length :1h45mn

Add 100µl sample/control and diluted standard
and 50µl Biotinylated anti-CD31



Incubate 1 hour at room temperature



Wash three times



Add 100µl of Streptavidin-HRP



Incubate 30min at room temperature



Wash three times



Add 100 µl of ready-to-use TMB
Protect from light. Let the color develop for 10-20 min.



Add 100 H₂SO₄



Read Absorbance at 450 nm

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