

**CultreCoat® Laminin I 96 Well
Cell Adhesion Assay**

Catalog # 3491-096-K

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Cell Adhesion Assay**

Reagent kit for investigating cell adhesion

96 samples

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I. Quick Reference Procedure for Trevigen's CultreCoat® Laminin I 96 Well Cell Adhesion Assay:

Read through the complete Instructions for Use prior to using this kit. Determine the optimal seeding density for each cell line used. In general, 15,000 cells per well in 100 µl is a good starting point.

1. Culture cells per manufacturer's recommendation; adherent cells should be cultured to no more than 80% confluence.
2. Warm reagents to room temperature.
3. Prepare Rehydration Buffer, and warm to 37°C.
4. Rehydrate Laminin I 96 Well CA Plate with 100 µl per well of warm Rehydration Buffer for two hours.
5. Label cells with 2 µM Calcein AM for one hour.
6. Harvest cells, and wash with PBS.
7. Suspend cells in Adhesion Buffer, and dilute to optimal seeding concentration.
8. Aspirate Rehydration Buffer from Laminin I 96 Well CA Plates, and seed 100 µl of cells per well.
9. Incubate for 1 hour and 15 minutes at 37°C 5%CO₂.
10. Remove Laminin I 96 Well CA Plate from incubator, and read fluorescence at 485 nm excitation/520 nm emission. The fluorescence intensity is the total RFU per well.
11. Aspirate Laminin I 96 Well CA Plate, and wash 3 times with Wash Buffer.
12. Add 100 µl of Adhesion Buffer per well.
13. Read fluorescence at 485 nm excitation/520 nm emission. The fluorescence intensity is the Relative Fluorescence Units (RFU) per well after Wash.
14. Calculate percent cell adhesion, standard deviation, and non-specific binding.

II. Background

The extracellular matrix (ECM) provides a structural and signaling framework for tissue morphogenesis, homeostasis, and wound healing by regulating cellular activities. These activities are modulated through interactions between specific transmembrane cell surface receptors, which are most commonly integrins, and their coordinate ECM ligands, resulting in cellular adhesion and signal transduction. During this process, the extracellular domain of the integrin binds to the ECM, and the intracellular domain binds to the cytoskeleton, forming a bridge across the plasma membrane. Concurrently, this interaction controls a wide variety of cellular processes, including cell cycle progression [1, 2], differentiation [3, 4], cell migration & invasion [5, 6], and apoptosis [7, 8].

Trevigen's cell adhesion assays provide a simple, standardized, high throughput format for assessing factors that influence cell-matrix interactions. During the assay, cells absorb Calcein AM and convert it to Calcein, providing a fluorescent label for each cell. The stripwells are rehydrated, and the cells are then seeded in the coated stripwells and allowed to adhere to the ECM proteins. The total fluorescence for each stripwell is assessed, providing a loading control for each group, and then the stripwells are washed 3 times to remove non-adherent cells. The final fluorescence for each well is assessed, and the percent cell adhesion is calculated.

This assay provides many advantages over existing kits. The black stripwell format minimizes background, providing greater sensitivity, and it affords flexibility for the number of samples assessed. Multiple experiments can be conducted simultaneously using the same kit. Also, Calcein labeling allows direct comparisons between the number of cells that are loaded and the number that adhere, providing a loading control, unlike dyes that only detect the total number of cells that adhere, such as Cyquant®. In addition, controls are provided for determining background and non-specific binding. The **CultreCoat® Cell Adhesion Assays** have been adapted to multiple formats so that cell adhesion may be evaluated against different extracellular matrices; the assay is available in the following formats:

- Adhesion Protein Array
- Basement Membrane Extract (BME)
- Laminin I
- Collagen IV
- Fibronectin
- Vitronectin
- Collagen I

III. Precautions and Limitations

1. For Research Use Only. Not for use in diagnostic procedures.
2. The physical, chemical, and toxicological properties of these products may not yet have been fully investigated; therefore, Trevigen recommends the use of gloves, lab coats, and eye protection while using these chemical reagents. Trevigen assumes no liability for damage resulting from handling or contact with these products.

3. **CultreCoat® Cell Adhesion Assays** contain reagents that may be harmful if swallowed, or come in contact with skin or eyes. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Material safety data sheets are available on request.

IV. Materials Supplied

<u>Component</u>	<u>Quantity</u>	<u>Storage</u>	<u>Catalog#</u>
Laminin I 96 Well CA Plate	one	4°C	3491-096-P
2X CA Assay Buffer	100 ml	Room Temp	3490-096-01
10X CA Blocking Agent	3 ml	4°C	3490-096-02
Calcein AM	50 µg	-20°C	4892-010-01

V. Materials/Equipment Required But Not Supplied

Equipment

1. 1 - 20 µl pipettor, 20 - 200 µl pipettor, and 200 - 1000 µl pipettor
2. Laminar flow hood or clean room
3. 37°C CO₂ incubator
4. Low speed swinging bucket 4°C centrifuge and tubes for cell harvesting
5. Hemocytometer or other means to count cells
6. 4°C storage
7. standard light microscope (or inverted)
8. pipette aid
9. timer
10. 96-well fluorescence plate reader (485 nm excitation/520 nm emission)
11. Computer and graphing software, such as Microsoft® Excel®.

Reagents

1. Cell Harvesting Buffer; EDTA, trypsin, or other cell detachment buffer.
2. Tissue Culture Growth Media, as recommended by cell supplier.
3. Pharmacological agents for addition to culture medium, if necessary.
4. Sterile PBS or HBSS to wash cells.
5. Trypan blue or equivalent viability stain
6. DMSO (Cell Culture Grade or above)

Disposables

1. Cell culture flask, 25 cm² or 75 cm²
2. 50 ml tubes
3. 1 - 200 µl and 200 - 1000 µl pipette tips
4. 1, 5 and 10 ml serological pipettes
5. gloves

VI. Assay Protocol

These procedures should be performed in a biological hood utilizing aseptic technique to prevent contamination.

A. Cell Harvesting

Culture cells per manufacturer's recommendation. The following procedure is suggested and may need to be optimized to suit the cell type(s) being studied.

1. Cells should be passaged 2 or 3 times prior to use in the assay, and adherent cells need to be 80% confluent. 25 and 75 cm² flasks yield at least 1 x 10⁶ and 3 x 10⁶ cells, respectively. Determine the number of cells needed to perform the assay, and plan accordingly.
2. Prior to harvest, visually inspect cells, and record cell health, relative number, and morphology.
3. Wash cells two times with sterile PBS or HBSS. Use 5 ml per wash for a 25 cm² flask and 10 ml per wash for a 75 cm² flask.
4. Harvest cells. For 25 cm² flask or 75 cm² flask, add 1 ml or 2 ml, respectively, of Cell Harvesting Buffer (see Materials Required But Not Supplied), and incubate at 37°C for 5 to 15 minutes until cells have dissociated from the bottom of the flask. Non-enzymatic buffers are recommended if cells are compatible; if not, monitor and minimize enzymatic reactions to reduce loss of cell surface receptors.
5. Transfer cells to a 15 ml conical tube, and add 5 ml of cell culture medium.
6. Centrifuge cells at 200 x g for 3 minutes to pellet cells, remove medium, and resuspend cells in 2 ml of Adhesion Buffer (Step VI.C.6). Cells may need to be gently pipetted up and down with serological pipette to resuspend cells.
7. Count cells, and dilute to optimal seeding concentration in Adhesion Buffer.

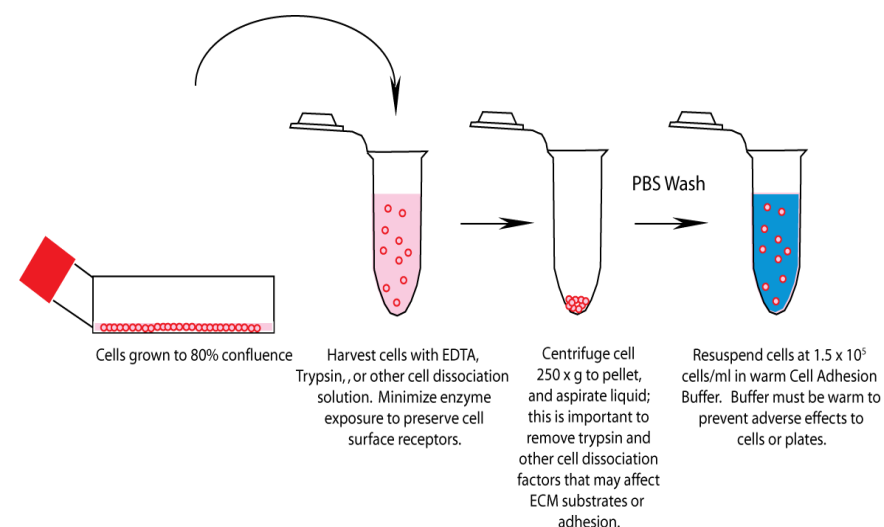


Figure 1. Harvesting and resuspending cells for CultreCoat® Cell Adhesion Assays.

B. Prior to Starting the Assay

1. Determine optimal seeding density for each cell line used. In general, 15,000 cells per well in 100 μ l cell culture medium is a good starting point.
2. Culture cells per manufacturer's recommendation; adherent cells should be cultured to no greater than 80% confluence.

C. Cell Adhesion Assay

1. Prepare Rehydration Buffer:

Component	One Strip = 8 wells	One Plate = 96 wells
2X CA Assay Buffer	500 μ l	6 ml
10X CA Blocking Agent	100 μ l	1.2 ml
diH ₂ O	400 μ l	4.8 ml
Total	1 ml	12 ml

2. Invert tube to mix, and warm to 37°C.
3. Dispense 100 μ l of Rehydration Buffer into the required number of stripwells from the Laminin I 96 Well CA Plate, and incubate for one hour at 37°C in a CO₂ incubator (total rehydration time will be 2 hours). This step provides for protein rehydration and blocks non-specific binding, so buffer is needed in every well. Store unused stripwells desiccated at 4°C.

	1	2	3	4	5	6	7	8	9	10	11	12
A	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I
B	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I
C	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I
D	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I
E	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I
F	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I
G	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I	LN I
H	None	None	None	None	None	None	None	None	None	None	None	None

Figure 2. Pre-Coating for Laminin I 96 Well (LN I) CA Plate.

4. Prepare 2 mM Calcein AM by adding 25 μ l of DMSO to the 50 μ g lyophilized Calcein AM. Store unused Calcein AM at -20°C.
5. After one hour, add Calcein AM to cells at a final concentration of 2 μ M (1:1000), and incubate for one hour at 37°C in a CO₂ incubator.
6. Prepare Adhesion Buffer:

Component	One Strip = 8 wells	One Plate = 96 wells
2X CA Assay Buffer	1500 μ l	18 ml
10X CA Blocking Agent	100 μ l	1.2 ml
diH ₂ O	1400 μ l	16.8 ml
Total	3 ml	36 ml

7. Invert tube to mix, and warm to 37°C. Save one third volume of this solution for step 20.
8. After one hour, harvest and count labeled cells, as directed in section VI, A.
9. Centrifuge cells at 200 x g for 3 min, remove supernatant, and wash with PBS.
10. Resuspend cells in Adhesion Buffer, and count cells.
11. Dilute labeled cells to the desired concentration in Adhesion Buffer. Cells may be treated with test compounds at this point.
12. Upon completion of rehydration (Step 5), aspirate Rehydration Buffer, and add 100 μ l of cells to each well. Add 100 μ l of Adhesion Buffer without cells to Row A to account for background fluorescence.

	1	2	3	4	5	6	7	8	9	10	11	12
A	No Cells - Background Control											
B	Calcein-Labeled Cells											
C												
D												
E												
F												
G												
H												

Figure 3. Cell Seeding for the CultreCoat Laminin I 96 Stripwell Cell Adhesion Assay.

13. Incubate stripwells for one hour and 15 minutes at 37°C in a CO₂ incubator; optimal incubation periods may vary with cell line.

14. Prepare Wash Buffer:

Component	One Strip = 8 wells	One Plate = 96 wells
2X CA Assay Buffer	2 ml	24 ml
diH ₂ O	2 ml	24 ml
Total	4 ml	48 ml

15. Invert to mix, and warm to 37°C.
16. Place Laminin I 96 Well CA Plate in fluorescence plate reader, and assess fluorescence at 485 nm excitation/ 520 nm emission. This is the Total RFU. Record your gain setting.
17. Wash each well with 100 µl of warm Wash Buffer using a multichannel pipette, and aspirate wash. Repeat 2 times.
18. Add 100 µl of warm Adhesion Buffer to each well.
19. Place Laminin I 96 Well CA Plate in fluorescence plate reader, and assess fluorescence at 485 nm excitation/ 520 nm emission. This is RFU per well after Wash. **Use the same Gain setting as used in step 16.**
20. For each well, calculate Percent Adhesion:

$$= (\text{RFU after Wash} - \text{Background}) / (\text{Total RFU} - \text{Background})$$

	1	2	3	4	5	6	7	8	9	10	11	12
A	No Cells - Background Control											
B	Assay Samples											
C												
D												
E												
F												
G												
H	No Coating - Non-specific Adhesion Control											

Figure 4. Samples and Controls for the CultreCoat Laminin I 96 Stripwell Cell Adhesion Assay.

VII. Data Interpretation

1. For each sample, subtract background.
2. Determine Percent Adhesion for each sample by dividing RFU after Wash by Total RFU.

3. Average Percent Adhesion for each sample and determine standard deviations. Also determine non-specific binding.
4. Graph data.

Sample Data:

Raw Data (RFU):

Row	Total RFU	RFU After Wash	Coating
A	1327	1784	Background
B	49663	28628	Laminin IBME
CC	49076	27868	
DD	50910	27938	
EE	48143	27404	
FF	45228	24152	
GG	46134	26150	
H	55124	3301	None

Subtract Background from Each Well (RFU):

Row	Total RFU	RFU After Wash	Coating
B	48336	26844	Samples
CC	47749	26084	
DD	49583	26154	
EE	46816	25620	
FF	43901	22368	
GG	44807	24366	
H	53797	1517	None

Calculate Cell Adhesion for Each Well (%):

Row	Percent Adhesion	Coating
B	56%	Samples
CC	55%	
DD	53%	
EE	55%	
FF	51%	
GG	54%	
H	3%	None

Summarize Data:

Average Percent Adhesion	54%
Standard Deviation	1.7%
Non-Specific Binding	3%

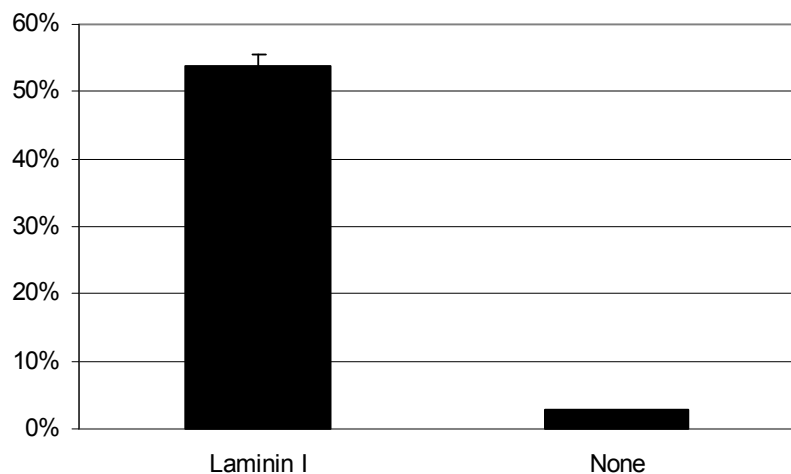


Figure 5. Percent adhesion for MG63, human osteosarcoma, to Laminin I. Samples were assessed in sextuple using 15,000 cells/well for an adhesion period of 1 hour and 15 minutes.

VIII. Troubleshooting

Problem	Cause	Solution
Low/no signal	Instrument not set up properly.	Read fluorescence at 495 nm excitation/ 520 nm emission; adjust gain for optimal sensitivity, if applicable.
	Insufficient cell number.	Determine optimal cell number needed for detection using Calcein AM. Smaller or less metabolically active cells may require higher seeding concentrations.
	Poor cell viability; Calcein AM is a metabolic substrate.	Do not perform assay with viability below 90%.
High background	Instrument not set up properly.	Read fluorescence at 495 nm excitation/ 520 nm emission; adjust gain for optimal sensitivity, if applicable.
	Contamination - proteases released by bacteria or mold may affect Calcein AM	Start a new culture from seed stocks, and re-assay. If seed stock is contaminated, then it may be prudent to get new cells.
Lower than expected/ published percent adhesion	The cell seeding concentration is too high; cells exceed binding capacity of the ECM.	Decrease/ optimize seeding concentration.
	Poor cell health or over-trypsinization.	Examine cells for viability at the onset of assay, and minimize exposure to trypsin.
	The incubation period is suboptimal.	Assess multiple incubation periods to determine optimal parameters.
Well to well variability	Inconsistent pipetting	Calibrate pipettors, and monitor pipet tips for air bubbles.

IX. References

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X. Appendix: Reagent and Buffer Composition

1. Laminin I 96 Well CA Plate

Laminin I is derived from murine EHS sarcoma cells. The Laminin I is coated to rows A-G of a black, 96 stripwell plate, and row H is left uncoated as a control for non-specific binding. See Figure 2 for plate layout.

2. 2X CA Assay Buffer

Physiological buffer solution.

3. 10X CA Blocking Agent

Blocking agent that prevents non-specific interactions between ECM proteins and cells.

4. Calcein AM

A non-fluorescent, hydrophobic compound that easily permeates intact, live cells. Once in the cell, Calcein AM is hydrolyzed by intracellular esterases to produce Calcein, a hydrophilic, strongly fluorescent compound that is retained in the cell cytoplasm.

XI. Related products available from Trevigen.

Catalog#	Description	Size
3455-024-K	Cultrex [®] 24 Well BME Cell Invasion Assay	24 inserts
3480-024-K	CultreCoat [®] 24 Well BME-Coated Cell Invasion Assay	24 inserts
3465-024-K	Cultrex [®] 24 Well Cell Migration Assay	24 inserts
3455-096-K	Cultrex [®] BME Cell Invasion Assay	96 samples
3456-096-K	Cultrex [®] Laminin I Cell Invasion Assay	96 samples
3457-096-K	Cultrex [®] Collagen I Cell Invasion Assay	96 samples
3458-096-K	Cultrex [®] Collagen IV Cell Invasion Assay	96 samples
3465-096-K	Cultrex [®] 96 Well Cell Migration Assay	96 samples
3471-096-K	Cultrex [®] In Vitro Angiogenesis Assay	96 samples
	Endothelial Cell Invasion	

Accessories:

Catalog#	Description	Size
3400-010-01	Cultrex [®] Mouse Laminin I	1 mg
3400-010-02	PathClear [®] Mouse Laminin I	1 mg
3440-100-01	Cultrex [®] Rat Collagen I	100 mg
3442-050-01	Cultrex [®] Bovine Collagen I	50 mg
3410-010-01	Cultrex [®] Mouse Collagen IV	1 mg
3430-005-02	Cultrex [®] BME with Phenol Red, PathClear [®]	5 ml
3431-005-02	Cultrex [®] BME with Phenol Red, Growth Factor Reduced, PathClear [®]	5 ml
3432-005-02	Cultrex [®] BME, No Phenol Red, PathClear [®]	5 ml
3433-005-02	Cultrex [®] BME, No Phenol Red, Growth Factor Reduced, PathClear [®]	5 ml
3430-005-01	Cultrex [®] BME with Phenol Red	5 ml
3432-005-01	Cultrex [®] BME; no Phenol Red	5 ml
3431-005-01	Cultrex [®] BME with Phenol Red; Reduced Growth Factors	5 ml
3433-005-01	Cultrex [®] BME; no Phenol Red; Reduced Growth Factors	5 ml
3416-001-01	Cultrex [®] Bovine Fibronectin NZHD	1 mg
3417-001-01	Cultrex [®] Bovine Vitronectin NZHD	50 µg
3438-100-01	Cultrex [®] Poly-L-Lysine	100 ml
3443-050-03	Cultrex [®] Murine VEGF	1 µg
3443-050-02	Cultrex [®] Human FGF-2	5 µg
3443-050-01	Cultrex [®] Human EGF	50 µg
3443-050-04	Cultrex [®] Human β-NGF	2 µg
3437-100-K	Cultrex [®] Cell Staining Kit	100 ml
3439-100-01	Cultrex [®] Cell Recovery Solution	100 ml
3450-048-05	CellSpense [™]	15 ml

The product accompanying this document is intended
for research use only and is not intended for
diagnostic purposes or for use in humans.

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