

# RayBio® Human c-FOS Transcription Factor Activity Assay Kit

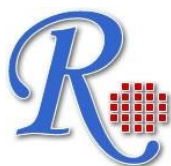
Catalog #: TFEH-CFOS

**User Manual**  
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RayBiotech, Inc.

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## RayBio® Human c-FOS TF Activity Assay Kit Protocol

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Please read the entire manual carefully before starting your experiment.

## I. INTRODUCTION

Activator protein-1 (AP-1) is a sequence-specific transcriptional activator composed of members of the Jun (c-Jun, JunB, and JunD) and Fos (c-FOS, FosB, Fra1, and Fra2) families in formats of homo- and heterodimers. These proteins belong to the bZIP group of DNA binding proteins with the ability to a common consensus sequence-defined AP-1-binding site. Jun and Fos proteins can also dimerize other basic leucine zipper proteins such as ATF, CCAAT enhancer-binding protein, Maf, and NF-E2. Jun-Jun and Jun-Fos dimers bind preferentially to the TPA responsive element (TRE), whose consensus is TGAGTCA, whereas Jun-ATF dimers prefer to bind to the c-AMP-responsive element (CRE), whose consensus is TGAGCTCA. Inside cells, AP-1 activity is induced by an incredible diversity of signals, including growth factors, cellular stress, ionizing and ultraviolet irradiation, DNA damage, oxidative stress, neuronal depolarization antigen binding by T or B lymphocytes, and cytokines. The mechanisms involved in the induction of AP-1 activity are either through changing the expression of AP-1 components or post-translation modification or both to regulate their trans-activity positively or negatively. For example, stimulation by growth factors or by activating mutations in cytoplasmic effectors such as ras and raf, results in AP-1 activation by triggering the ERK signaling pathway. On the other hand, AP-1 responses to proinflammatory cytokines and UV radiation are mostly dependent on two other MAPK cascades, JNK and p38 of MAP kinases. As a result, the AP-1 regulates different target genes executing different biological functions such as cell proliferation, differentiation, apoptosis, or cell death.

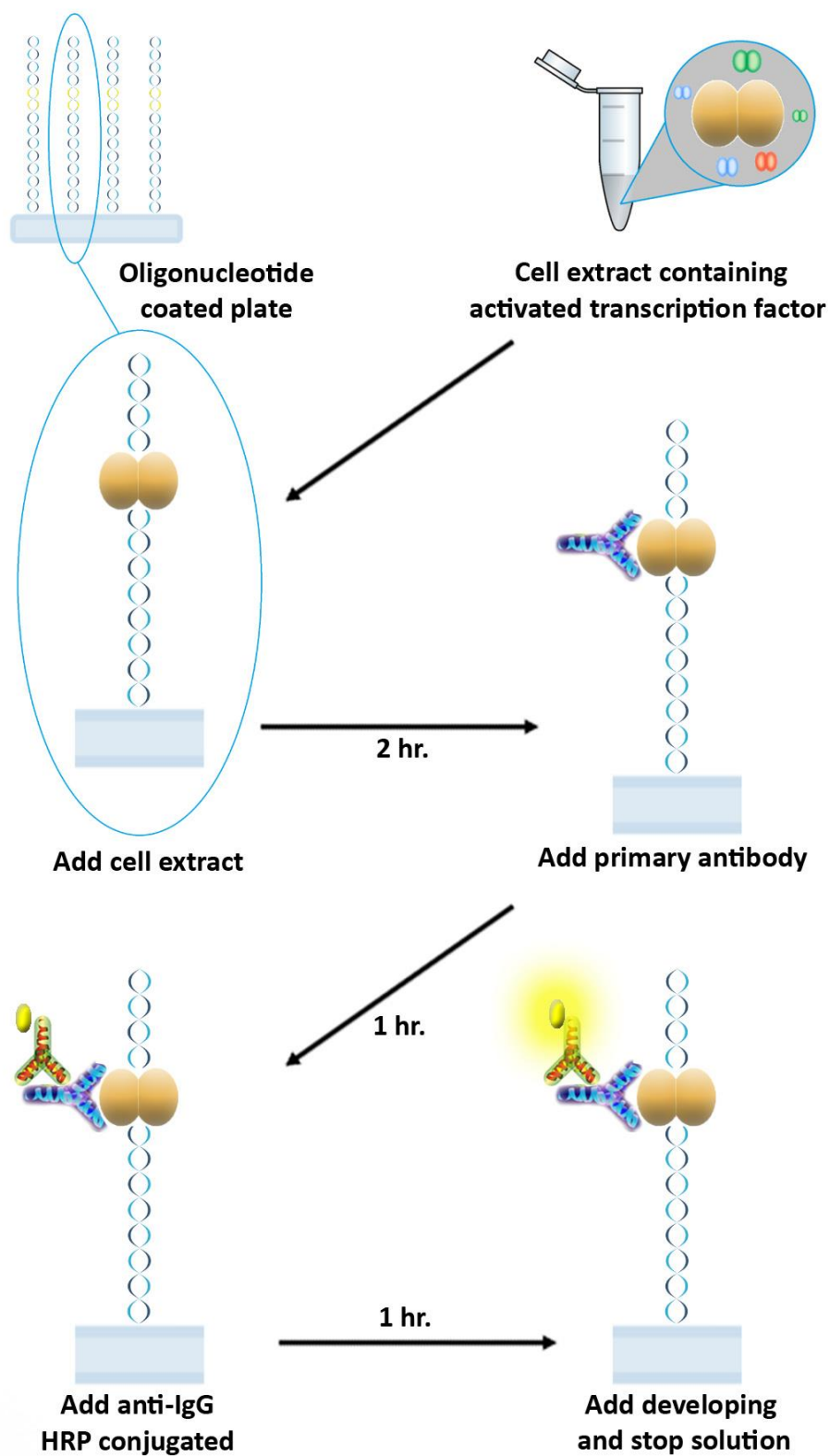
Accurate monitoring of the level of activated c-FOS in cells, tissues or animal models is required for both science research investigating signal transduction pathways and applications such as drug development, and simple, speedy and high-throughput methods are needed for this purpose.

Traditionally, western blots to detect the expression of c-FOS, electrophoretic mobility shift assays (EMSA) to detect the DNA

binding capacity of c-FOS, or transfection of reporter genes such as luciferase and  $\beta$ -galactosidase with c-FOS binding sites in culture cells are used in evaluation of NF-Y reactivity. However, these methods are time consuming, laborious, and sometimes require the use of radioactivity.

The RayBio® c-FOS TF Activity Assay Kit is a non-radioactive transcription factor assay with an ELISA format. It offers an easy, speedy, sensitive and high-throughput method to detect the activation of transcription factors. In 96-well plates, double stranded oligonucleotides containing c-FOS binding sequence have been coated. These oligonucleotides specifically capture the active c-FOS contained in whole cell lysate or nuclear extracts after a short incubation. Subsequently, the primary antibody against c-FOS recognizes the c-FOS-DNA complex in each well, and a HRP-conjugated secondary antibody is then used for detection. After washing away any unbound antibody, signal can be obtained easily through a colorimetric assay with a spectrophotometric plate reader at 450 nm. The specificity of the reaction between active c-FOS and the DNA probe is additionally stringent because of the establishment of specific competitive DNA and non-specific competitive DNA probes in this reaction system.

## II. HOW IT WORKS



### III. STORAGE

Upon receipt, the positive control should be removed and stored at -20° or -80°C. The remainder of the kit can be stored for up to 6 months at 2-8°C from the date of shipment. Opened Microplate Wells or reagents may be stored for up to 1 month at 2-8°C. Return unused wells to the pouch containing desiccant pack, reseal along entire edge.

Note: The kit can be used within one year if the whole kit is stored at -20°C upon receipt. Avoid repeated freeze-thaw cycles.

### IV. REAGENTS

| Component                         | Description  | Size            |
|-----------------------------------|--|-----------------|
| c-FOS DNA Probe Microplate        | 96 wells (12 strips X 8 wells) coated with c-FOS probes                              | 1 plate         |
| DNA Binding Buffer                | 5X concentrated Buffer   | 4 ml            |
| Positive Control                  | Cell nuclear extracts  | 1 vial (20 µl)  |
| Specific Competitor DNA Probe     | Free DNA probes that compete with the coated probes by binding with activated c-FOS. | 1 vial          |
| Non-specific Competitor DNA Probe | Free DNA probes with mutations of the coated DNA probe. Cannot bind activated c-FOS. | 1 vial          |
| Assay Reagent                     | 1X solution  | 1 vial (200 µl) |
| DTT                               | 300 mM DTT   | 1 vial (200 µl) |
| Wash Buffer Concentrate (20X)     | 20X concentrated solution  | 25 ml           |
| c-FOS Primary Antibody            | Anti- c-FOS antibody   | 1 vial          |
| HRP-conjugated Secondary Antibody | Anti-IgG HRP conjugated antibody   | 1 vial          |
| Antibody Diluent Buffer           | Buffer solution for diluting primary and secondary antibodies                        | 25 ml           |
| TMB One-Step Substrate Reagent    | 3,3,5,5'-tetramethylbenzidine (TMB) in buffer solution                               | 12 ml           |
| Stop Solution                     | 0.2 M sulfuric acid  | 8 ml            |

## V. ADDITIONAL MATERIALS REQUIRED

- 1 Microplate reader capable of measuring absorbance at 450 nm.
- 2 Precision pipettes to deliver 1  $\mu$ l to 1 ml volumes.
- 3 Adjustable 1-25 ml pipettes for reagent preparation.
- 4 100 ml and 1 liter graduated cylinders.
- 5 Absorbent paper.
- 6 Distilled or deionized water.
- 7 Tubes to prepare positive or sample mixtures.

## VI. REAGENT PREPARATION

1. Preparation of samples:  
Prepare nuclear extraction or whole lysate containing targeted protein c-FOS from cell culture or tissue. We recommend using the RayBiotech Nuclear Extraction Kit (Cat#: NE-50) to isolate nuclear proteins for subsequent use in this transcription factor assay.
2. Preparation of transcription factor binding reaction system:  
Bring all reagents to room temperature (18 - 25°C) before use. Thaw the positive control and samples and keep them on ice before adding into wells. Prepare 100  $\mu$ l transcription factor binding reaction system for each well with 5 x TF Activity Assay DNA Binding Buffer, TF Activity Assay Reagent, DTT, Specific Competitor DNA Probe, Non-specific Competitor DNA Probe, and Positive Control or samples containing targeted proteins. Typical examples are shown in the table below.

### Note:

*Each reaction may be prepared in a labeled microfuge tube or directly in the coated plate well. If the reaction system is prepared directly in the coated plate wells, please add the reagents sequentially as shown in the table to get the best results.*

| COMPONENT                               | REACTION   |  |  |  |  |
|---|--|--|--|--|--|
|   | Positive control   | Sample   | Specific competitor  | Non-Specific competitor  | Blank  |
| 5x TF Activity Assay DNA Binding Buffer | 20 $\mu$ l   | 20 $\mu$ l   | 20 $\mu$ l   | 20 $\mu$ l   | 20 $\mu$ l   |
| TF Activity Assay Reagent               | 1.5 $\mu$ l  | 1.5 $\mu$ l  | 1.5 $\mu$ l  | 1.5 $\mu$ l  | 1.5 $\mu$ l  |
| DTT                                     | 1 $\mu$ l  | 1 $\mu$ l  | 1 $\mu$ l  | 1 $\mu$ l  | 1 $\mu$ l  |
| Specific Competitor                     | -  | -  | 10 $\mu$ l   | -  | -  |
| Non-specific Competitor                 | -  | -  | -  | 10 $\mu$ l   | -  |
| Control/Sample containing proteins      | 5 $\mu$ l  | * $\mu$ l  | * $\mu$ l  | * $\mu$ l  | -  |
| Total volume                            | bring final volume to <b>100<math>\mu</math>l</b> with deionized water | bring final volume to <b>100<math>\mu</math>l</b> with deionized water | bring final volume to <b>100<math>\mu</math>l</b> with deionized water | bring final volume to <b>100<math>\mu</math>l</b> with deionized water | bring final volume to <b>100<math>\mu</math>l</b> with deionized water |

\* Please note that the amount of total protein containing the target protein to be used in this test can be optimized and must be determined by the investigator.

### 3. Preparation of primary antibody:

Briefly spin down the TF Activity Assay c-FOS Primary Antibody vial. Add 60  $\mu$ l of Antibody Diluent Buffer into the vial to prepare a primary antibody concentrate. Pipette up and down to mix gently (the concentrate can be stored at 4°C for 5 days). The primary antibody concentrate should then be diluted 100-fold with the Antibody Diluent Buffer and used in step 4 of Part VII Assay Procedure.

### 4. Preparation of secondary antibody:

Briefly spin down the TF Activity Assay HRP-conjugated Secondary Antibody vial before use. Add 100  $\mu$ l of Antibody Diluent Buffer into the vial to prepare a detection antibody



concentrate. Pipette up and down to mix gently (the concentrate can be stored at 4°C for 5 days). The detection antibody concentrate should then be diluted 100-fold with the Antibody Diluent Buffer and used in step 6 of Part VII Assay Procedure.

5. Preparation of 1x Wash Buffer:

Dilute 25 ml of the 20x Wash Buffer Concentrate into deionized or distilled water to yield 500 ml of 1x Wash Buffer. If the Wash Buffer Concentrate (20x) contains visible crystals, warm to room temperature and mix gently until dissolved.

Note:

*All reagents containing protein (positive control, samples) should be kept on ice to maintain protein stability.*

*If the reaction system is prepared directly in the coated plate wells, please add the reagents sequentially as shown in the table to get the best results.*

*To observe the specificity of the DNA binding activity, the amount of protein used in wells of sample, specific competitor and non-specific competitor must be the same.*

*A positive control should be included every time to confirm correct operation of experiment, however it is not necessary to run specific competitor and non-specific competitor for each sample and every time.*

## **VII. ASSAY PROCEDURE:**

1. Bring the 96-well plate to room temperature (18 - 25°C) before use. If the whole plate will not be used in this assay, place remaining wells back to 2 to 8°C or -20°C. It is recommended that all positive control and samples be run at least in duplicate.

2. Add 100  $\mu$ l of each prepared transcription factor binding reaction system (see Reagent Preparation step 2) including positive control, specific competitor, non-specific competitor and sample into appropriate wells. Cover wells and incubate for 2 hours at room temperature or overnight at 4°C with gentle shaking.
3. Discard the solution and wash 4 times by filling each well with 300  $\mu$ l of 1x Wash Buffer (Reagent Preparation step 5) using a multi-channel pipette or autowasher. Complete removal of liquid at each step is essential to good performance. After the last wash, remove any remaining Wash Buffer by aspirating or decanting. Invert the plate and blot it against clean paper towels.
4. Add 100  $\mu$ l of prepared TF Activity Assay c-FOS Primary Antibody (Reagent Preparation step 3) to each well. Incubate for 1 hour at room temperature with gentle shaking.
5. Discard the solution. Repeat the wash as in step 3.
6. Add 100  $\mu$ l of prepared TF Activity Assay HRP-conjugated Secondary Antibody (see Reagent Preparation step 4) to each well. Incubate for 1 hour at room temperature with gentle shaking.
7. Discard the solution. Wash as directed in step 3.
8. Add 100  $\mu$ l of TMB One-Step Substrate Reagent (Item H) to each well. Incubate for 30 minutes at room temperature in the dark with gentle shaking.
9. Add 50  $\mu$ l of Stop Solution (Item I) to each well. Read at 450 nm immediately

## VII. ASSAY PROCEDURE SUMMARY

1. Prepare all reagents, samples, and controls as instructed.



2. Add 100  $\mu$ l reaction mixture to each well to each well.  
Incubate 2 hours at room temperature or overnight at 4°C.



3. Add 100  $\mu$ l prepared primary antibody to each well.  
Incubate 1 hour at room temperature.



4. Add 100  $\mu$ l prepared secondary antibody.  
Incubate 1 hour at room temperature.



5. Add 100  $\mu$ l TMB One-Step Substrate Reagent to each well.  
Incubate 30 minutes at room temperature.



6. Add 50  $\mu$ l Stop Solution to each well.  
Read at 450 nm immediately.

## VIII. TYPICAL DATA

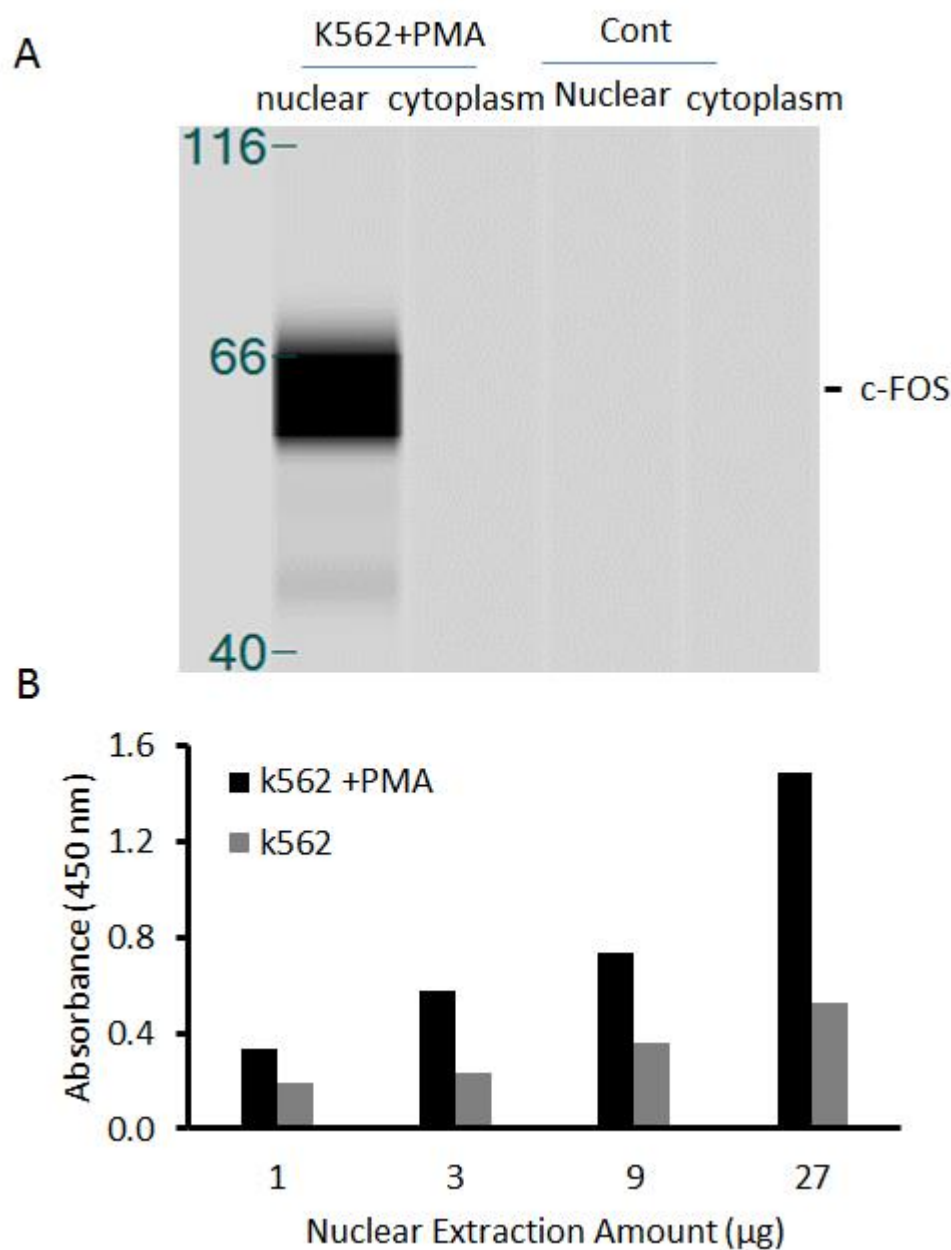


Figure 1: Transcription factor assay of c-FOS from nuclear extracts of K562 cells or K562 cells treated with PMA (50 ng/ml) for 3 hr. A. Western-blot result of c-FOS from cytoplasmic and nuclear fractions. B. Transcription factor assay of c-FOS from nuclear fractions with the RayBio® Activity Assay Kit (cat # TFEH-CFOS).

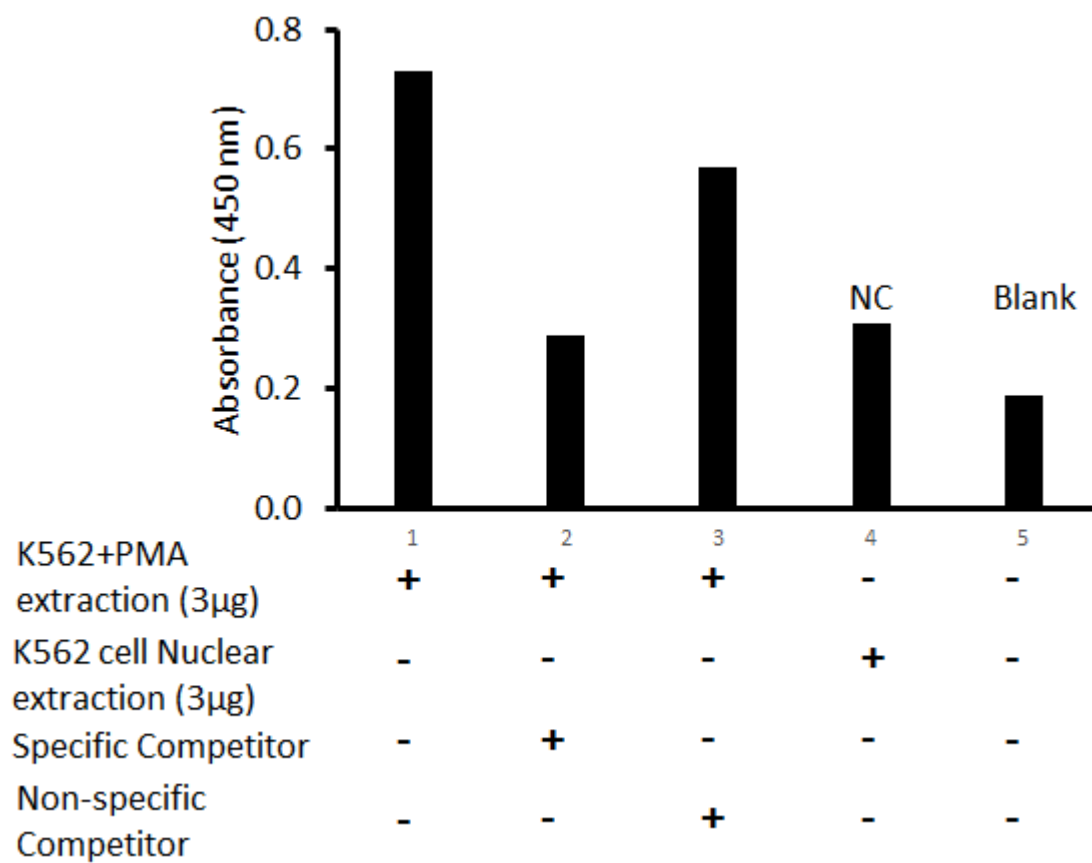


Fig. 2: Transcription factor assay of c-FOS from nuclear extracts of K562 cells or K562 cells treated with PMA (50 ng/ml) for 3 hr with the specific competitor or non-specific competitor. The result shows specific binding of c-FOS to the conserved binding site detected by using the RayBio® C-FOS TF Activity Assay Kit (cat # TFEH-CFOS).

## TROUBLESHOOTING GUIDE

| Problem            | Cause   | Solution   |
|--------------------|---|--|
| 1. Low signal      | <ol style="list-style-type: none"> <li>1. Too brief incubation times</li> <li>2. Missed key reagent, inadequate reagent volumes or improper dilution</li> <li>3. Not enough targeted protein per well</li> <li>4. Inadequate development in colorimetric assay</li> </ol> | <ol style="list-style-type: none"> <li>1. Ensure sufficient incubation time; assay procedure step 2 change to overnight</li> <li>2. Check all reagents have been added and check pipettes to ensure correct preparation</li> <li>3. Check positive control wells and increase the amount of sample.</li> <li>4. Ensure correct developing buffer and enough time used</li> </ol> |
| 2. Large CV        | <ol style="list-style-type: none"> <li>1. Inaccurate pipetting</li> <li>2. Wells cross contamination</li> </ol>   | <ol style="list-style-type: none"> <li>1. Check pipettes</li> <li>2. Be careful when preparing samples between wells</li> </ol>  |
| 3. High background | <ol style="list-style-type: none"> <li>1. Plate is insufficiently washed</li> <li>2. Contaminated wash Buffer</li> <li>3. Incorrect antibody dilution</li> </ol>  | <ol style="list-style-type: none"> <li>1. Review the manual for proper wash. If using a plate washer, check that all ports are unobstructed</li> <li>2. Make fresh wash buffer</li> <li>3. Check antibody dilutions</li> </ol>   |

## RayBio® TF Activity Assay Kits:

Choose TF Activity Assay kits with more targets for human, mouse, rat and a variety of other species. Visit [www.raybiotech.com](http://www.raybiotech.com) for the complete list.

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