

Version 2 Last updated 19 November 2021

# ab256391 Human Nodal SimpleStep ELISA<sup>®</sup> Kit

For the quantitative measurement of Nodal in human cell culture supernatant samples.

This product is for research use only and is not intended for diagnostic use.

## Table of Contents

|                                     |           |
|-------------------------------------|-----------|
| 1. Overview                         | 1         |
| 2. Protocol Summary                 | 2         |
| 3. Precautions                      | 3         |
| 4. Storage and Stability            | 3         |
| 5. Limitations                      | 4         |
| 6. Materials Supplied               | 4         |
| 7. Materials Required, Not Supplied | 5         |
| 8. Technical Hints                  | 5         |
| 9. Reagent Preparation              | 7         |
| 10. Standard Preparation            | 8         |
| 11. Sample Preparation              | 9         |
| 12. Plate Preparation               | 10        |
| 13. Assay Procedure                 | 11        |
| 14. Calculations                    | 13        |
| 15. Typical Data                    | 14        |
| 16. Typical Sample Values           | 15        |
| 17. Assay Specificity               | 19        |
| 18. Species Reactivity              | 19        |
| 19. Troubleshooting                 | 20        |
| 20. Notes                           | 21        |
| <b>Technical Support</b>            | <b>22</b> |

## 1. Overview

Nodal *in vitro* SimpleStep ELISA® (Enzyme-Linked Immunosorbent Assay) kit is designed for the quantitative measurement of Nodal protein in human cell culture supernatant

The SimpleStep ELISA® employs an affinity tag labeled capture antibody and a reporter conjugated detector antibody which immunocapture the sample analyte in solution. This entire complex (capture antibody/analyte/detector antibody) is in turn immobilized via immunoaffinity of an anti-tag antibody coating the well. To perform the assay, samples or standards are added to the wells, followed by the antibody mix. After incubation, the wells are washed to remove unbound material. TMB Development Solution is added and during incubation is catalyzed by HRP, generating blue coloration. This reaction is then stopped by addition of Stop Solution completing any color change from blue to yellow. Signal is generated proportionally to the amount of bound analyte and the intensity is measured at 450 nm. Optionally, instead of the endpoint reading, development of TMB can be recorded kinetically at 600 nm.

Human Nodal homolog is a secreted member of the TGF-beta superfamily of proteins encoded by the gene *NODAL*. Nodal binds to Type I and II serine/threonine kinase receptors, which recruits members of the SMAD family of transcription factors. Nodal signaling regulates mesoderm formation and axial patterning during embryonic development.

## 2. Protocol Summary

Prepare all reagents, samples, and standards as instructed



Add 50  $\mu$ L standard or sample to appropriate wells



Add 50  $\mu$ L Antibody Cocktail to all wells



Incubate at room temperature for 1 hour



Aspirate and wash each well three times with 350  $\mu$ L 1X Wash Buffer  
PT



Add 100  $\mu$ L TMB Development Solution to each well and incubate  
for 10 minutes.



Add 100  $\mu$ L Stop Solution and read OD at 450 nm

### 3. Precautions

**Please read these instructions carefully prior to beginning the assay.**

- All kit components have been formulated and quality control tested to function successfully as a kit.
- We understand that, occasionally, experimental protocols might need to be modified to meet unique experimental circumstances. However, we cannot guarantee the performance of the product outside the conditions detailed in this protocol booklet.
- Reagents should be treated as possible mutagens and should be handled with care and disposed of properly. Please review the Safety Datasheet (SDS) provided with the product for information on the specific components.
- Observe good laboratory practices. Gloves, lab coat, and protective eyewear should always be worn. Never pipet by mouth. Do not eat, drink or smoke in the laboratory areas.
- All biological materials should be treated as potentially hazardous and handled as such. They should be disposed of in accordance with established safety procedures.

### 4. Storage and Stability

**Store kit at +4°C immediately upon receipt. Kit has a storage time of 1 year from receipt, providing components have not been reconstituted.**

Refer to list of materials supplied for storage conditions of individual components.

## 5. Limitations

- Assay kit intended for research use only. Not for use in diagnostic procedures.
- Do not mix or substitute reagents or materials from other kit lots or vendors. Kits are QC tested as a set of components and performance cannot be guaranteed if utilized separately or substituted.

## 6. Materials Supplied

| Item  | Quantity | Storage Condition |
|---|----------|-------------------|
| Human Nodal Capture Antibody 10X            | 600 µL   | +4°C              |
| Human Nodal Detector Antibody 10X           | 600 µL   | +4°C              |
| Human Nodal Lyophilized Recombinant Protein | 2 Vials  | +4°C              |
| Antibody Diluent 5BI                        | 6 mL     | +4°C              |
| Sample Diluent NS                           | 12 mL    | +4°C              |
| Wash Buffer PT 10X                          | 20 mL    | +4°C              |
| TMB Development Solution                    | 12 mL    | +4°C              |
| Stop Solution                               | 12 mL    | +4°C              |
| SimpleStep Pre-Coated 96-Well Microplate    | 96 Wells | +4°C              |
| Plate Seal                                  | 1        | +4°C              |

## 7. Materials Required, Not Supplied

These materials are not included in the kit, but will be required to successfully perform this assay:

- Microplate reader capable of measuring absorbance at 450 or 600 nm.
- Method for determining protein concentration (BCA assay recommended).
- Deionized water.
- Multi- and single-channel pipettes.
- Tubes for standard dilution.
- Plate shaker for all incubation steps.
- Optional: Phenylmethylsulfonyl Fluoride (PMSF) (or other protease inhibitors).

## 8. Technical Hints

- Samples generating values higher than the highest standard should be further diluted in the appropriate sample dilution buffers.
- Avoid foaming or bubbles when mixing or reconstituting components.
- Avoid cross contamination of samples or reagents by changing tips between sample, standard and reagent additions.
- Ensure plates are properly sealed or covered during incubation steps.
- Complete removal of all solutions and buffers during wash steps is necessary to minimize background.
- As a guide, typical ranges of sample concentration for commonly used sample types are shown below in Sample Preparation (section 11).
- All samples should be mixed thoroughly and gently.
- Avoid multiple freeze/thaw of samples.
- Incubate ELISA plates on a plate shaker during all incubation steps.
- When generating positive control samples, it is advisable to change pipette tips after each step.

- To avoid high background always add samples or standards to the well before the addition of the antibody cocktail.
- This kit is sold based on number of tests. A 'test' simply refers to a single assay well. The number of wells that contain sample, control or standard will vary by product. Review the protocol completely to confirm this kit meets your requirements. Please contact our Technical Support staff with any questions.



## 9. Reagent Preparation

- Equilibrate all reagents to room temperature (18-25°C) prior to use. The kit contains enough reagents for 96 wells. The sample volumes below are sufficient for 48 wells (6 x 8-well strips); adjust volumes as needed for the number of strips in your experiment.
- Prepare only as much reagent as is needed on the day of the experiment. Capture and Detector Antibodies have only been tested for stability in the provided 10X formulations.

### 9.1 1X Wash Buffer PT:

Prepare 1X Wash Buffer PT by diluting Wash Buffer PT 10X with deionized water. To make 50 mL 1X Wash Buffer PT combine 5 mL Wash Buffer PT 10X with 45 mL deionized water. Mix thoroughly and gently.

### 9.2 Antibody Cocktail:

Prepare Antibody Cocktail by diluting the capture and detector antibodies in Antibody Diluent 5BI. To make 3 mL of the Antibody Cocktail combine 300  $\mu$ L 10X Capture Antibody and 300  $\mu$ L 10X Detector Antibody with 2.4 mL Antibody Diluent 5BI. Mix thoroughly and gently.

## 10. Standard Preparation

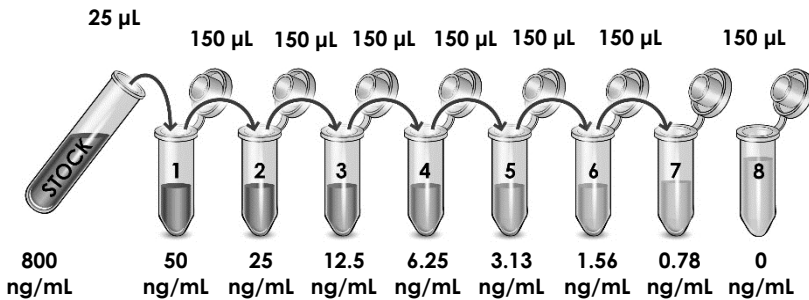
- Always prepare a fresh set of standards for every use.
- Discard working standard dilutions after use as they do not store well.
- The following section describes the preparation of a standard curve for duplicate measurements (recommended).

**10.1 IMPORTANT:** If the protein standard vial has a volume identified on the label, reconstitute the Nodal by adding that volume of Sample Diluent NS indicated on the label. Alternatively, if the vial has a mass identified, reconstitute the Nodal standard by adding 500  $\mu\text{L}$  Sample Diluent NS. Hold at room temperature for 10 minutes and mix gently. This is the 800 ng/mL **Stock Standard Solution**.

10.1.1 Label eight tubes, Standards 1– 8.

10.1.2 Add 375  $\mu\text{L}$  Sample Diluent NS into tube number 1 and 150  $\mu\text{L}$  of Sample Diluent NS into numbers 2-8.

10.1.3 Use the Stock Standard to prepare the following dilution series. Standard #8 contains no protein and is the Blank control:



## 11. Sample Preparation

| Typical Sample Dynamic Range          |           |
|---------------------------------------|-----------|
| Sample Type                           | Range     |
| F9 cell culture supernatant           | 12.5-100% |
| RPMI with 10% FBS Cell culture media* | 12.5-100% |

\*Based on spiked sample

### 11.1 Cell Culture Supernatants:

Centrifuge cell culture media at 2,000 x g for 10 minutes to remove debris. Collect supernatants and assay. Or dilute samples at least 100% into Sample Diluent NS and assay. Store un-diluted samples at -20°C or below. Avoid repeated freeze-thaw cycles.

## 12. Plate Preparation

- The 96 well plate strips included with this kit are supplied ready to use. It is not necessary to rinse the plate prior to adding reagents.
- Unused plate strips should be immediately returned to the foil pouch containing the desiccant pack, resealed and stored at 4°C.
- For each assay performed, a minimum of two wells must be used as the zero control.
- For statistical reasons, we recommend each sample should be assayed with a minimum of two replicates (duplicates).
- Differences in well absorbance or “edge effects” have not been observed with this assay.

## 13. Assay Procedure

- Equilibrate all materials and prepared reagents to room temperature prior to use.
  - We recommend that you assay all standards, controls and samples in duplicate.
- 13.1** Prepare all reagents, working standards, and samples as directed in the previous sections.
  - 13.2** Remove excess microplate strips from the plate frame, return them to the foil pouch containing the desiccant pack, reseal and return to 4°C storage.
  - 13.3** Add 50 µL of all sample or standard to appropriate wells.
  - 13.4** Add 50 µL of the Antibody Cocktail to each well.
  - 13.5** Seal the plate and incubate for 1 hour at room temperature on a plate shaker set to 400 rpm.
  - 13.6** Wash each well with 3 x 350 µL 1X Wash Buffer PT. Wash by aspirating or decanting from wells then dispensing 350 µL 1X Wash Buffer PT into each well. Wash Buffer PT should remain in wells for at least 10 seconds. Complete removal of liquid at each step is essential for good performance. After the last wash invert the plate and tap gently against clean paper towels to remove excess liquid.
  - 13.7** Add 100 µL of TMB Development Solution to each well and incubate for 10 minutes in the dark on a plate shaker set to 400 rpm.

*Given variability in laboratory environmental conditions, optimal incubation time may vary between 5 and 20 minutes.*

*Note: The addition of Stop Solution will change the color from blue to yellow and enhance the signal intensity about 3X. To avoid signal saturation, proceed to the next step before the high concentration of the standard reaches a blue color of O.D.600 equal to 1.0.*
  - 13.8** Add 100 µL of Stop Solution to each well. Shake plate on a plate shaker for 1 minute to mix. Record the OD at 450 nm. This is an endpoint reading.
  - 13.9** Alternative to 13.7 – 13.8: Instead of the endpoint reading at 450 nm, record the development of TMB Substrate kinetically. Immediately after addition of TMB Development Solution begin recording the blue color development with elapsed

time in the microplate reader prepared with the following settings:

| <b>Mode</b> | <b>Kinetic</b>         |
|-------------|------------------------|
| Wavelength: | 600 nm                 |
| Time:       | up to 20 min           |
| Interval:   | 20 sec - 1 min         |
| Shaking:    | Shake between readings |

Δ **Note:** that an endpoint reading can also be recorded at the completion of the kinetic read by adding 100 µL Stop Solution to each well and recording the OD at 450 nm.

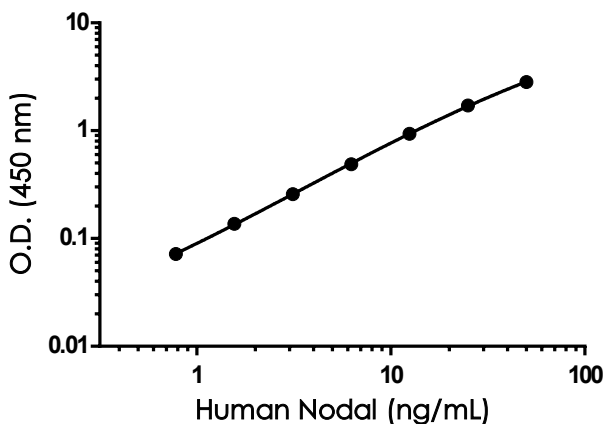
**13.10** Analyze the data as described below.

## 14. Calculations

- 14.1 Calculate the average absorbance value for the blank control (zero) standards. Subtract the average blank control standard absorbance value from all other absorbance values.
- 14.2 **Create a standard curve** by plotting the average blank control subtracted absorbance value for each standard concentration (y-axis) against the target protein concentration (x-axis) of the standard. Use graphing software to draw the best smooth curve through these points to construct the standard curve.
  - Δ **Note:** Most microplate reader software or graphing software will plot these values and fit a curve to the data. A four-parameter curve fit (4PL) is often the best choice; however, other algorithms (e.g. linear, semi-log, log/log, 4-parameter logistic) can also be tested to determine if it provides a better curve fit to the standard values.
- 14.3 Determine the concentration of the target protein in the sample by interpolating the blank control subtracted **absorbance values against the standard curve**. Multiply the resulting value by the appropriate sample dilution factor, if used, to obtain the concentration of target protein in the sample.
- 14.4 Samples generating absorbance values greater than that of the highest standard should be further diluted and reanalyzed. Similarly, samples which measure at an absorbance values less than that of the lowest standard should be retested in a less dilute form.

## 15. Typical Data

Typical standard curve – data provided for demonstration purposes only. A new standard curve must be generated for each assay performed.



| Standard Curve Measurements |            |       |             |
|-----------------------------|------------|-------|-------------|
| Concentration<br>(ng/mL)    | O.D 450 nm |       | Mean<br>O.D |
|                             | 1          | 2     |             |
| 0                           | 0.060      | 0.060 | 0.060       |
| 0.781                       | 0.129      | 0.135 | 0.132       |
| 1.563                       | 0.195      | 0.199 | 0.197       |
| 3.125                       | 0.321      | 0.315 | 0.318       |
| 6.25                        | 0.542      | 0.556 | 0.549       |
| 12.5                        | 0.999      | 0.999 | 0.999       |
| 25                          | 1.780      | 1.762 | 1.771       |
| 50                          | 2.870      | 2.907 | 2.889       |

**Figure 1.** Example of human Nodal standard curve in Sample Diluent NS. The Nodal standard curve was prepared as described in Section 10. Raw data values are shown in the table. Background-subtracted data values (mean +/- SD) are graphed.



## 16. Typical Sample Values

### SENSITIVITY –

The calculated minimal detectable dose (MDD) is 0.32 ng/mL. The MDD was determined by calculating the mean of zero standard replicates (n=16) and adding 2 standard deviations then extrapolating the corresponding concentration.

### RECOVERY –

Three concentrations of Nodal F9 cell culture supernatant were spiked in duplicate to the indicated biological matrix to evaluate signal recovery in the working range of the assay.

| Sample Type                          | Average % Recovery | Range (%) |
|--------------------------------------|--------------------|-----------|
| F9 Cell culture supernatant, 50%     | 88                 | 86 - 91   |
| RPMI 10% FBS Cell culture media, 50% | 97                 | 95 - 99   |

\*Media is RPMI 1640 containing 10% fetal calf serum.

## Linearity of Dilution

Linearity of dilution is determined based on interpolated values from the standard curve. Linearity of dilution defines a sample concentration interval in which interpolated target concentrations are directly proportional to sample dilution.

Native Nodal was measured in the following biological samples in a 2-fold dilution series. Sample dilutions are made in Sample Diluent NS.

| Dilution Factor | Interpolated value      | 100% F9 cell supernatant |
|-----------------|-------------------------|--------------------------|
| Undiluted       | ng/mL                   | 9.2                      |
|                 | <b>% Expected value</b> | 100                      |
| 2               | ng/mL                   | 4.5                      |
|                 | <b>% Expected value</b> | 98                       |
| 4               | ng/mL                   | 2.5                      |
|                 | <b>% Expected value</b> | 110                      |
| 8               | ng/mL                   | 1.5                      |
|                 | <b>% Expected value</b> | 113                      |

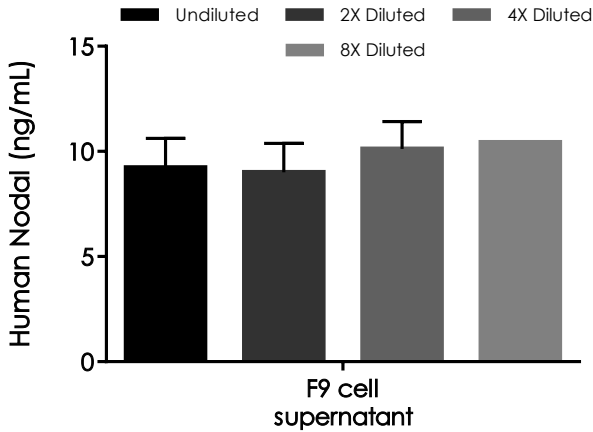
Recombinant Nodal was spiked into the following biological samples and diluted in a 2-fold dilution series in Sample Diluent NS.

| Dilution Factor | Interpolated value      | 100% RPMI 10% FBS media |
|-----------------|-------------------------|-------------------------|
| Undiluted       | ng/mL                   | 25.4                    |
|                 | <b>% Expected value</b> | 100                     |
| 2               | ng/mL                   | 11.3                    |
|                 | <b>% Expected value</b> | 88                      |
| 4               | ng/mL                   | 6.0                     |
|                 | <b>% Expected value</b> | 94                      |
| 8               | ng/mL                   | 3.1                     |
|                 | <b>% Expected value</b> | 97                      |
| 16              | ng/mL                   | 1.5                     |
|                 | <b>% Expected value</b> | 93                      |

### PRECISION –

Mean coefficient of variations of interpolated values of Nodal from three concentrations of mouse F9 cell supernatant within the working range of the assay.

|       | Intra-Assay | Inter-Assay |
|-------|-------------|-------------|
| n =   | 8           | 3           |
| CV(%) | 8.4         | 8.9         |



**Figure 2.** Interpolated concentrations of native Nodal in mouse cell culture supernatant samples. The concentrations of Nodal were measured in duplicates, interpolated from the Nodal standard curves and corrected for sample dilution. Undiluted samples are as follows: F9 cell supernatant 100%. The interpolated dilution factor corrected values are plotted (mean +/- SD, n=2). The mean Nodal concentration was determined to be 9.7 ng/mL in F9 supernatant.

## 17. Assay Specificity

This kit recognizes native human Nodal protein in cell culture supernatant samples only.

This kit is incompatible with serum and plasma samples.

Saliva, milk, urine, cellular and tissue extract samples have not been tested with this kit.

## 18. Species Reactivity

This kit recognizes human Nodal protein.

Reactivity was determined for the following species:

- Mouse

Other species reactivity not determined.

Please contact our Technical Support team for more information.

## 19. Troubleshooting

| Problem                       | Reason   | Solution   |
|-------------------------------|--|--|
| <b>Poor standard curve</b>    | Inaccurate Pipetting   | Check pipettes   |
|                               | Improper standard dilution   | Prior to opening, briefly spin the stock standard tube and dissolve the powder thoroughly by gentle mixing                       |
| <b>Low Signal</b>             | Incubation times too brief   | Ensure sufficient incubation times; increase to 2 or 3 hour standard/sample incubation   |
|                               | Inadequate reagent volumes or improper dilution                    | Check pipettes and ensure correct preparation  |
|                               | Incubation times with TMB too brief                                | Ensure sufficient incubation time until blue color develops prior addition of Stop solution                                      |
| <b>Large CV</b>               | Plate is insufficiently washed                                     | Review manual for proper wash technique. If using a plate washer, check all ports for obstructions.                              |
|                               | Contaminated wash buffer   | Prepare fresh wash buffer  |
| <b>Low sensitivity</b>        | Improper storage of the ELISA kit                                  | Store your reconstituted standards at -80°C, all other assay components 4°C. Keep TMB Development Solution protected from light. |
| <b>Precipitate in Diluent</b> | Precipitation and/or coagulation of components within the Diluent. | Precipitate can be removed by gently warming the Diluent to 37°C.  |

# 20. Notes

## Technical Support

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