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iGEM Calibration Protocol - Red Fluorescent Proteins in Plate Readers

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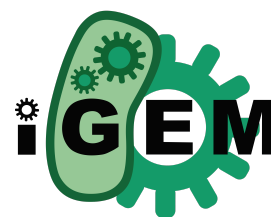
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Protocol status: Working

We use this protocol and it's working

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Protocol Integer ID: 32907

Keywords: measuring red fluorescence, many red fluorescent protein, emission properties to many red fluorescent protein, red fluorescent protein, red fluorescence, red fluorescent proteins in plate readers plate reader, concentration of fluorescent protein, fluorescence value, fluorescent protein, amount of fluorescence, fluorescence output, fluorescence output of test device, fluorescence, readings to an equivalent texas red concentration, absolute fluorescence value, fluorescence values in arbitrary unit, standard fluorescence curve, standard curve of fluorescence, equivalent texas red concentration, dilution series of texas red, spectra for texas red, igem calibration protocol, dye texas red, texas red concentration, texas red, microspheres calibration method, calibration protocol, calibration protocol with microspheres calibration method, recommended spectra, data from that calibration, protein, calibration, fluorescence setting, stability of these protein

Abstract

Plate readers report fluorescence values in arbitrary units that vary widely from instrument to instrument. Therefore absolute fluorescence values cannot be directly compared from one instrument to another. In order to compare fluorescence output of test devices between teams, it is necessary for each team to create a standard fluorescence curve. Although distribution of a known concentration of fluorescent protein would be an ideal way to standardize the amount of fluorescence in our *E. coli* cells, the stability of these proteins and the high cost of their purification are problematic. We therefore use the dye Texas Red, which has similar excitation and emission properties to many red fluorescent proteins, but is cost-effective and easy to prepare.

You will prepare a dilution series of Texas Red in four replicates and measure the fluorescence in a 96 well plate in your plate reader. By measuring these in your plate reader, you will generate a standard curve of fluorescence for Texas Red concentration. You will be able to use this to convert your cell based readings to an equivalent Texas Red concentration. Before beginning this protocol, ensure that you are familiar with the fluorescence settings and measurement modes of your instrument. You will need to know what filters your instrument has for measuring red fluorescence, making sure it can adequately excite and record emission. Recommended spectra for Texas Red are excitation at 596 nm and emission at 620 nm.

Note: The iGEM Abs600 (OD) calibration protocol with microspheres calibration method is a pre-requisite for carrying out this protocol. You will need data from that calibration to analyse the results of this protocol.

Attachments



iGEM Data Analysis T...

37KB

Guidelines

For a full set of calibrations, you should run two protocols: this fluorescence calibration curve with Texas Red, and the Abs600 (OD) calibration with microspheres.

Before beginning these protocols, please ensure that you are familiar with the measurement modes and settings of your instrument. For all of these calibration measurements, you must use the same plates and volumes that you will use in your cell-based assays. You must also use the same settings (e.g., filters or excitation and emission wavelengths) that you will use in your cell-based assays. If you do not use the same plates, volumes, and settings, the calibration will not be valid.

Make sure to record all information about your instrument to document your experiment. If your instrument has variable temperature settings, the instrument temperature should be set to room temperature (approximately 20-25 C) for all measurements.



Materials

MATERIALS

 96 well plate

 PBS

 Texas Red

STEP MATERIALS

 PBS

 PBS

 PBS

 Texas Red

Texas Red is provided in the iGEM Measurement Kit. The 96-well plate should preferably be black with a clear flat bottom.

Protocol materials

 96 well plate

 PBS

 Texas Red

Before start

Read through this entire protocol carefully before you start your experiment and prepare any materials you may need.

Note: The iGEM Abs600 (OD) calibration protocol with microspheres calibration method is a pre-requisite for carrying out this protocol. You will need data from that calibration to analyse the results of this protocol.

Prepare the Texas Red stock solution

- 1 Spin down Texas Red kit tube to make sure pellet is at the bottom of tube

 Texas Red

- 2 Make a Texas Red 10X reference stock solution (20 μM) by resuspending the dye powder in 1mL of 1X PBS.

Note

It is important that the Texas Red is properly dissolved. To check this, after the resuspension you should pipette up and down and examine the solution in the pipette tip – if any particulates are visible in the pipette tip continue to mix the solution until they disappear.

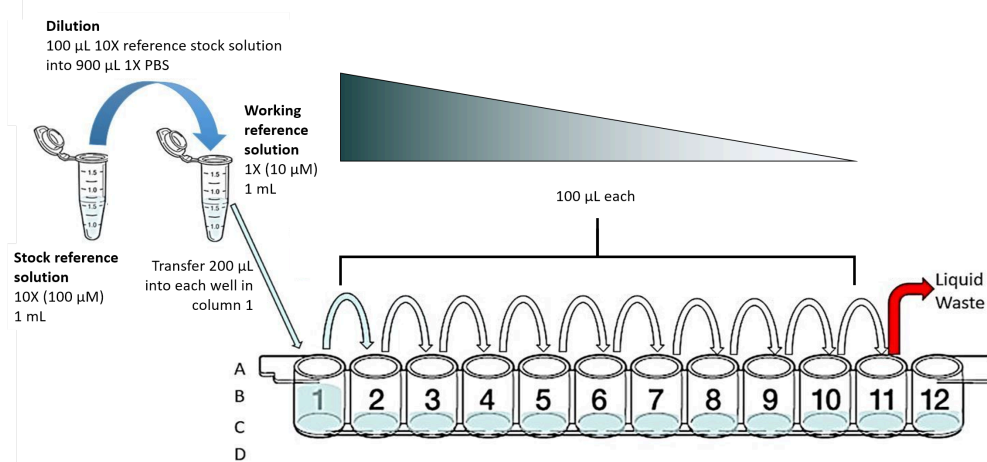
 PBS

- 3 **[OPTIONAL]** If you have access to a spectrophotometer, you can calculate the concentration of your Texas Red reference stock solution even more accurately using the Beer-Lambert law.
 - 3.1 Measure the stock solution's absorbance at 586 nm and calculate concentration using an extinction coefficient of $82.786 \text{ mM}^{-1} \text{ cm}^{-1}$.
 - 3.2 Change the starting concentration value in the spreadsheet in step 21 to reflect your more accurate measurement when doing this. This value is defined in cell B1 in the "Texas Red Std curve" sheet. The rest of the document will update automatically after you make this change.
- 4 Dilute the 10X reference stock solution with 1X PBS to make a 1X reference working solution with a concentration of 10 μM . E.g. dilute 100 μL of 10X Texas Red reference stock into 900 μL of 1X PBS.

Prepare the serial dilutions of Texas Red in a 96-well plate

- 5 Accurate pipetting is essential. Serial dilutions will be performed across columns 1-11. **Column 12 must contain PBS buffer only.** Initially you will setup the plate with the reference working solution in column 1 and an equal volume of 1X PBS in columns 2 to 12.

You will perform a serial dilution by consecutively transferring 100 μ L from column to column with good mixing.



- 6 Add 100 μ L of 1X PBS into wells A2, B2, C2, D2....A12, B12, C12, D12
- 7 Add 200 μ L of Texas Red reference working solution (1X) into A1, B1, C1, D1
- 8 Transfer 100 μ L of Texas Red reference working solution from A1 into A2
- 9 Mix A2 by pipetting up and down 3x and transfer 100 μ L into A3
- 10 Mix A3 by pipetting up and down 3x and transfer 100 μ L into A4
- 11 Mix A4 by pipetting up and down 3x and transfer 100 μ L into A5
- 12 Mix A5 by pipetting up and down 3x and transfer 100 μ L into A6

- 13 Mix A6 by pipetting up and down 3x and transfer 100 μ L into A7
- 14 Mix A7 by pipetting up and down 3x and transfer 100 μ L into A8
- 15 Mix A8 by pipetting up and down 3x and transfer 100 μ L into A9
- 16 Mix A9 by pipetting up and down 3x and transfer 100 μ L into A10
- 17 Mix A10 by pipetting up and down 3x and transfer 100 μ L into A11
- 18 Mix A11 by pipetting up and down 3x and transfer 100 μ L into liquid waste

Note

Take care not to continue serial dilution into column 12

- 19 Repeat dilution series for rows B, C, D

Measure fluorescence

- 20 Measure the fluorescence of all samples in your plate reader . Ensure that any automatic gain setting is off (if your instrument has one).

If you will be using your data in conjunction with measurements from the Plate Reader Abs600 (OD) Calibration protocol, make sure you use the same instrument settings for both protocols.

Please also be aware you may need to change the wavelength at which you are taking your OD reading when using red fluorescence. If your red fluorescent protein is absorbing at 600 nm, this will interfere with your Abs600 reading. We recommend measuring your OD at 660 nm instead, if this is beyond the excitation spectrum of your protein. You can check the excitation of many commonly use fluorescent proteins at fpbase.org. Please note OD readings at 600 and 660 nm cannot be directly compared.



Protocol



NAME

**Calibration Protocol - Plate Reader Abs600 (OD)
Calibration with Microsphere Particles**

CREATED BY

Paul Rutten

[Preview](#)

Note

Remember to set your plate reader's excitation and emission settings correctly for red fluorescence.

- 20.1 Obtain the tube labeled "Silica Beads" from the Measurement Kit and vortex vigorously for 30 seconds.

 300µl Silica beads

Note

Microspheres should NOT be stored at 0°C or below, as freezing affects the properties of the microspheres. If you believe your microspheres may have been frozen, please contact the iGEM Measurement Committee for a replacement (measurement@igem.org).

- 20.2 Immediately pipet 100 µL microspheres into a 1.5 mL eppendorf tube

- 20.3 Add 900 µL of ddH₂O to the microspheres

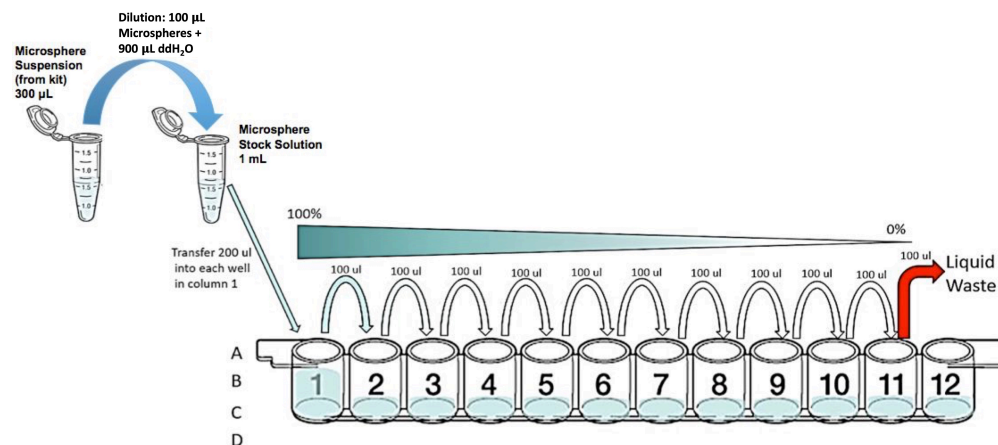
 ddH2O

- 20.4 Vortex well. This is your Microsphere Stock Solution

- 20.5 Accurate pipetting is essential. Serial dilutions will be performed across columns 1-11. **Column 12 must contain ddH₂O only.**

Initially you will setup the plate with the microsphere stock solution in column 1 and an equal volume of 1x ddH₂O in columns 2 to 12.

You will perform a serial dilution by consecutively transferring 100 µl from column to column with good mixing.



- 20.6 Add 100 µl of ddH₂O into wells A2, B2, C2, D2....A12, B12, C12, D12
- 20.7 Vortex the tube containing the stock solution of microspheres vigorously for 10 seconds
- 20.8 Immediately add 200 µl of microspheres stock solution into A1
- 20.9 Transfer 100 µl of microsphere stock solution from A1 into A2
- 20.10 Mix A2 by pipetting up and down 3x and transfer 100 µl into A3
- 20.11 Mix A3 by pipetting up and down 3x and transfer 100 µl into A4



- 20.12 Mix A4 by pipetting up and down 3x and transfer 100 µl into A5
- 20.13 Mix A5 by pipetting up and down 3x and transfer 100 µl into A6
- 20.14 Mix A6 by pipetting up and down 3x and transfer 100 µl into A7
- 20.15 Mix A7 by pipetting up and down 3x and transfer 100 µl into A8
- 20.16 Mix A8 by pipetting up and down 3x and transfer 100 µl into A9
- 20.17 Mix A9 by pipetting up and down 3x and transfer 100 µl into A10
- 20.18 Mix A10 by pipetting up and down 3x and transfer 100 µl into A11
- 20.19 Mix A11 by pipetting up and down 3x and transfer 100 µl into liquid waste

Note

Take care not to continue serial dilution into column 12

- 20.20 Repeat dilution series for rows B, C, D

20.21 **IMPORTANT!**

Re-Mix (pipette up and down) each row of your plate **immediately before** putting in the plate reader! (This is important because the beads begin to settle to the bottom of the wells within about 10 minutes, which will affect the measurements.)

**Note**

Take care to mix gently and avoid creating bubbles on the surface of the liquid

20.22 Measure OD₆₀₀ of all samples in instrument. Disable any path length correction setting on your instrument, if it has one.

If you will be using your data in conjunction with measurements from the **Fluorescence standard curve** protocol, make sure you use the same instrument settings for both protocols.

20.23 Record the data in your notebook. Please note your standard curve should still work well even if a few of your measurements are saturating the instrument

20.24 Import data into this Excel sheet:



iGEM Data Analysis Template - Part...

20.25 You have now completed this calibration protocol

21 Record the data in your notebook. Also record the gain setting that you used in your instrument, if available. Please note your standard curve should still work well even if a few of your measurements are saturating the instrument

22 Import data into this Excel sheet provided (Texas Red standard curve tab):



iGEM 2019 Plate Reader Fluoresce...

Congratulations!

23 You have now completed this calibration protocol