

# Pierce™ Gaussia-Firefly Luciferase Dual Assay Kit

16181 16182

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Number	Description
16181	<p><b>Pierce Gaussia-Firefly Luciferase Dual Assay Kit</b>, sufficient reagents to perform 100 assays for <i>Gaussia</i>-firefly luciferase activity in cultured cell lysate</p> <p><b>Kit Contents:</b></p> <p><b>Gaussia-Firefly Dual Assay Buffer</b>, 5mL, store at 4°C</p> <p><b>Coelenterazine (100X)</b>, 50µL, store at -80°C</p> <p><b>D-Luciferin, Lyophilized</b>, 3mg, store at 4°C</p> <p><b>2X Cell Lysis Buffer</b>, 6mL, store at room temperature</p>
16182	<p><b>Pierce Gaussia-Firefly Luciferase Dual Assay Kit</b>, sufficient reagents to perform 1000 assays for <i>Gaussia</i>-firefly luciferase activity in cultured cell lysate</p> <p><b>Kit Contents:</b></p> <p><b>Gaussia-Firefly Dual Assay Buffer</b>, 50mL, store at 4°C</p> <p><b>Coelenterazine (100X)</b>, 0.5mL, store at -80°C</p> <p><b>D-Luciferin, Lyophilized</b>, 30mg, store at 4°C</p> <p><b>2X Cell Lysis Buffer</b>, 60mL, store at room temperature</p> <p><b>Storage:</b> Upon receipt store kit at -80°C or store individual components as indicated above. Kit is shipped on dry ice.</p>

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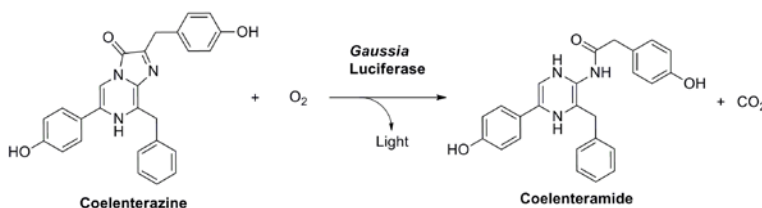
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## Introduction

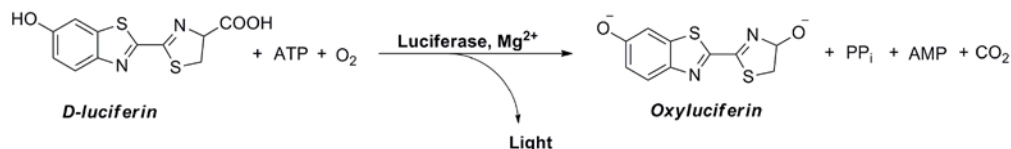
The Thermo Scientific™ Pierce™ Gaussia-Firefly Dual Assay provides a highly sensitive system for detecting intracellular luciferase activity from promoter or pathway activation in mammalian cell culture experiments. The activity of *Gaussia* luciferase expressed from *Gaussia* luc reporter plasmid is normalized by the activity of red firefly luciferase from the red firefly luc control plasmid. Additionally, red firefly luciferase works as a second experimental reporter for monitoring secondary regulatory element activity.

The *Gaussia* luciferase bioluminescent signal has greater stability and brightness than firefly and native *Renilla* luciferase. The bioluminescent signal ( $\lambda_{\text{max}} = 485\text{nm}$ ) produced by *Gaussia* luciferase results from the oxidation of coelenterazine (Figure 1). This reaction does not require adenosine triphosphate (ATP) or other cofactors. The light output correlates with the amount of *Gaussia* protein expressed, which is used to determine activity of the promoter for *Gaussia* expression.

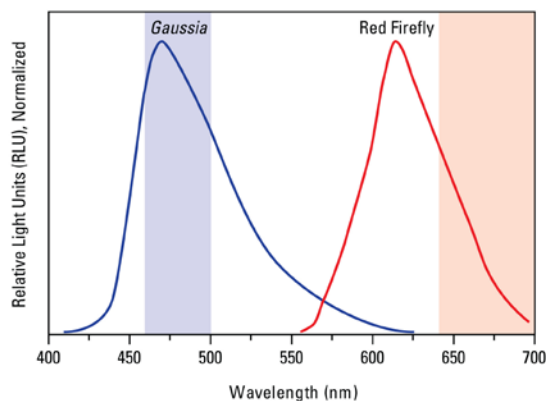
The second assay uses red firefly luciferase, which is a mutant form of the Italian firefly luciferase from *Luciola cruciata*. This luciferase produces a red-shifted emission spectrum ( $\lambda_{\text{max}} = 613\text{nm}$ ) that results from the oxidation of D-luciferin in the presence of ATP (Figure 2). Red firefly and *Gaussia* luciferases are used in the dual assay because the light output is spectrally resolvable (Figure 3). *Gaussia* luciferase plasmid acts as an experimental reporter coupled with red firefly expression plasmid (CMV-Red Firefly) as a normalization control. This reporter and control combination enables simultaneous monitoring of experimental reporter and control luciferase activity in a single-read assay without the need for two-step addition of substrate reagents or quenching (Figure 3). Specificity analysis of the two luciferase emissions has less than 1% of *Gaussia* light crossover to the 640nm LP channel (Figure 4).



**Figure 1. Chemical reaction of coelenterazine and *Gaussia* luciferase.** Light, with an emission maximum of 485nm, is produced from the oxidation of coelenterazine by *Gaussia* luciferase.



**Figure 2. Chemical reaction of luciferin and red firefly luciferase.** Light, with an emission maximum of 613nm, is produced from the oxidation of D-luciferin by red firefly luciferase in an ATP-dependent reaction.

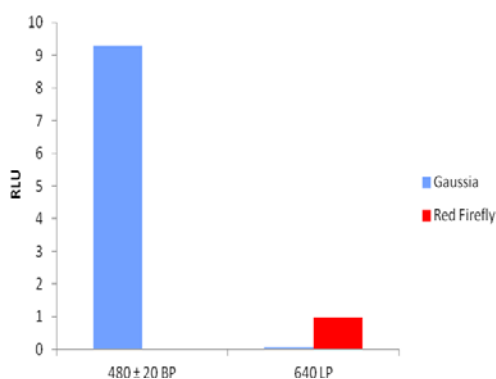


**Figure 3. Thermo Scientific Pierce Gaussia-Firefly Dual Luciferase Assay emission spectra profile.** The shaded boxes represent the filter ranges. See Table 1 for the filter details.

**Table 1. Filter requirement for the Thermo Scientific Pierce Gaussia-Firefly Luciferase Dual Assay Kit.**

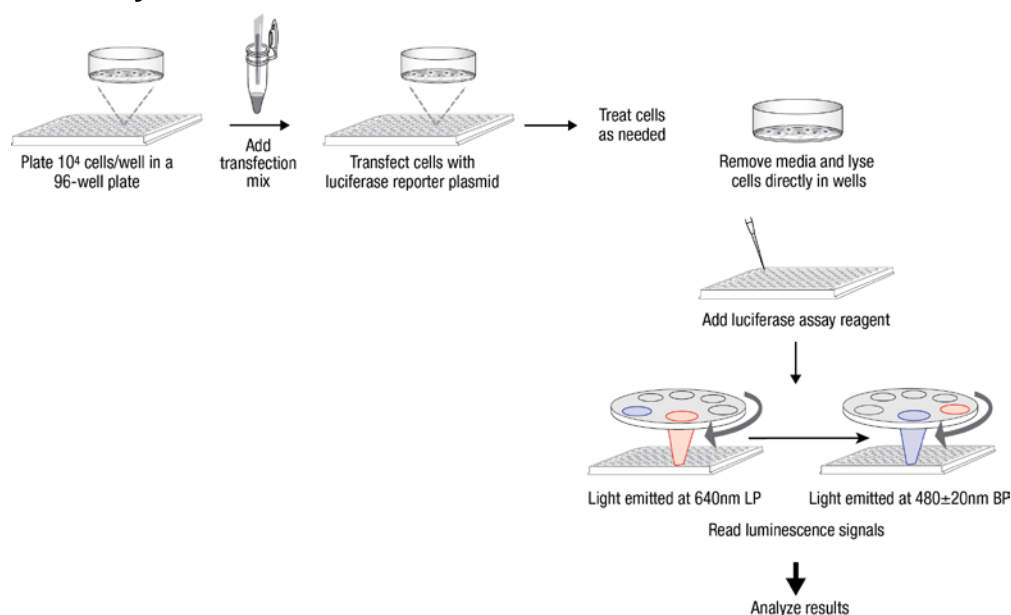
<b>Luciferase</b>	<b>Emission Range (nm)</b>	<b>Emission Maximum (nm)</b>	<b>Recommended Filter*</b>
<i>Gaussia</i>	440-600	485	480±20 BP
Red Firefly	560-700	613	640 LP

\*The 480±20nm bandpass (BP) is designed to capture light wavelengths ranging from 460 to 500nm (Figure 3). Similarly, the 640nm longpass (LP) filter collects wavelengths above 640nm. Each luminometer requires specific filters; filter availability and dimensions are available from Omega Optical, Inc. or Chroma Technology Corp.



**Figure 4. Specificity analysis of the two luciferase emissions.** *Gaussia* luciferase was measured using a 480±20nm BP filter and red firefly luciferase was measured using a 640nm LP filter on a Thermo Scientific™ Luminoskan™ Ascent Luminometer.

## Procedure Summary



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## Important Product Information

- For long-term use, store Coelenterazine (100X) at -80°C and D-Luciferin (lyophilized) at 4°C.
- Briefly centrifuge tubes of Coelenterazine (100X) before use. Coelenterazine (100X) is volatile; seal tube tightly after use.
- Gaussia-Firefly Luciferase Dual Assay Working Solution (Working Solution), Coelenterazine (100X) and D-Luciferin must always be stored protected from light.
- *Gaussia* luciferase protein is significantly more stable than red firefly luciferase protein in cell culture lysate. Red firefly luciferase in cell lysate is subject to degradation. When working with red firefly luciferase in cell lysates, store the container on ice and perform luciferase assays immediately after cell lysis. Adding protease inhibitors (see Related Thermo Scientific Products) to the cell lysis buffer increases the stability of red firefly luciferase.
- To avoid cross-contamination, use a new disposable pipette tip for each transfer. If using a multichannel pipette, always use a new disposable reagent reservoir.
- Avoid exposing reagents to excessive heat or light during storage and incubation.
- Do not mix reagents from different lots. Do not discard unused working solutions after assay completion. Do not combine leftover reagents with those reserved for additional plates.
- Individual components might contain corrosives and/or preservatives. Wear gloves while performing the assay to avoid contact with samples and reagents. Please follow proper disposal procedures.
- Dispense and equilibrate to room temperature only the reagent volumes needed for the number of plates being used.

## Additional Materials Required

- Reagents and equipment for propagating mammalian cells in culture
- Reagents (e.g., Thermo Scientific™ TurboFect™ Transfection Reagent, Product No. R0533) and equipment for transfecting plasmid DNA into mammalian cells
- Laboratory platform shaker
- Pipettes and/or liquid handling equipment
- Luminometer or other luminescence-monitoring instrument equipped with reagent injectors and filter wheel
- 480±20nm BP and 640nm LP filters (see Figure 3 and Table 1)
- White or black opaque, 96- or 384-well microplates

## Material Preparation

100X D-Luciferin Stock Solution	Reconstitute lyophilized D-Luciferin pellet in 50µL (100 reaction kit) or 0.5mL (1000 reaction kit) of Gaussia-Firefly Luciferase Dual Assay Buffer. Store at -20°C for up to two months.
Working Solution	For 100 reactions, add 50µL of 100X Coelenterazine and 50µL of 100X reconstituted D-Luciferin to 5mL of Gaussia-Firefly Luciferase Dual Assay Buffer. Use 50µL of the Working Solution per reaction. Use within 4 hours or store in single-use volumes at -20°C for up to two months.
1X Cell Lysis Buffer	Dilute 2X Cell Lysis Buffer with an equal volume of ultrapure water.

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## Assay Protocol

### A. Cell Transfection

1. Plate ~10,000 cells/well in a 96-well plate. Incubate cells overnight at 37°C in 5% CO<sub>2</sub>. If using a different plate size, adjust the cell number accordingly. Use only cells growing in log phase at a passage number ≤ 15.

**Note:** Plate sufficient wells to perform the experiment in triplicate; include appropriate controls, such as nonspecific signal (i.e., non-transfected cells).

2. Use a standard protocol to transfect mammalian cells with two plasmids: *Gaussia* luciferase driven by an experimental promoter and red firefly luciferase driven by a strong constitutive promoter (CMV).

**Note:** Empirically determine the optimum ratio for the two plasmids. When using TurboFect Transfection Reagent (Product No. R0533), use an equal molar ratio of two plasmids up to 100ng total per well of a 96-well plate (e.g., 50ng of *Gaussia* luc reporter plasmid: 50ng red firefly luc control plasmid).

**Note:** For optimal results, use a visual transfection control. For example, transfect cells in a separate well with a constitutively expressed GFP plasmid and observe GFP expression using a fluorescence microscope.

3. Incubate cells for 16-72 hours at 37°C in 5% CO<sub>2</sub> in a cell culture incubator.
4. Proceed with the individual experimental protocol for cell treatment.

### B. Cell Lysis

1. Aspirate media from the cells, rinse once with 50-100µL/well of 1X DPBS buffer (Thermo Scientific™ BupH™ Modified Dulbecco's PBS, Product No. 28374), aspirate DPBS and add 100µL/well of 1X Cell Lysis Buffer. Do not disturb the cell monolayer during the DPBS rinse.
2. Shake the plate on a platform shaker at moderate speed for 15 minutes. Check for complete cell lysis using a light microscope. If lysis is incomplete, continue shaking the plate for 15 additional minutes.

### C. Luciferase Dual Assay

1. Program the luminometer and injector and prime the system with Working Solution.
2. Add 10-20µL of cell lysate to a black flat-bottomed 96-well plate.
3. Using the luminometer's injectors, inject 50µL of Working Solution into each well containing cell lysate.  
**Note:** For best results, use injectors for >24 wells.
4. Immediately after adding the reagent, program the luminometer to detect the light output using a 640nm LP filter to capture the red firefly luciferase signal; then immediately read the sample again using a 480±20nm BP filter to capture the *Gaussia* luciferase signal.
5. Repeat Steps 3 and 4 for all samples in the plate. Use the red firefly luciferase signal as a normalization control for the *Gaussia* luciferase signal.

**Note:** Follow the manufacturer's recommendations for using injector velocity to obtain a uniform coating of liquid in the well. Adjust the detector's integration time to achieve a signal within the linear range of the instrument.

## Troubleshooting

Problem	Possible Cause	Solution
No signal	Low transfection efficiency	Optimize transfection conditions using a visual transfection control (e.g., a plasmid over-expressing a fluorescent protein)
		Verify plasmid DNA quality using restriction digestion and agarose gel electrophoresis <b>Note:</b> Most high-quality plasmid DNA should be supercoiled.
		Use actively dividing, low-passage cells
		Use a different cell type
	No promoter induction	Incubate cells using promoter-specific inducing conditions
		Incubate cells for a longer time after treatment
		Change growth conditions to improve expression
		Use a different promoter
	Coelenterazine or D-Luciferin auto-oxidized	Protect substrate from light and air
		Maintain 100X Coelenterazine at -80°C and D-Luciferin at -20°C
Low signal in lysate	Low luciferase expression	Lyse cells in a smaller volume of 1X Cell Lysis Buffer
		Use a different promoter or growth conditions to improve expression
		Increase the integration time on the instrument
		Scale-up the sample volume and reagent per well
High signal	High luciferase expression	Reduce incubation time before collecting samples
		Decrease the integration time on the instrument
		Dilute the sample <b>Note:</b> A low sample volume can increase assay variability. Dilute the sample and use the recommended volume of 10-20µL per assay.
High background signal	Nonspecific oxidation of Coelenterazine and D-Luciferin	Avoid repeated freezing and thawing of the sample
	Control sample was contaminated	Change pipette tips after each well
		Reduce shaker speed during the cell lysis step to avoid contaminating the wells

## Related Thermo Scientific Products

See our website for a complete list of related luciferase products.

16146	pMCS-Gussia Luc
16147	pCMV-Gussia Luc
16155	pMCS-Red Firefly Luc
16156	pCMV-Red Firefly Luc
16148	pTK-Gussia Luc
16157	pTK-Red Firefly Luc
16189	Pierce Luciferase Cell Lysis Buffer (2X), 250mL
28374	BupH Modified Dulbecco's PBS Packs, 40 packs

