



# Transfecting Stealth™ RNAi or siRNA into HEK293 Cells Using Lipofectamine™ RNAiMAX

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## Introduction

Lipofectamine™ RNAiMAX Reagent is a proprietary formulation specifically developed for highly efficient delivery of Stealth™ RNAi or short interfering RNA (siRNA) to mammalian cells for RNAi analysis. This reference provides a recommended procedure to transfect Stealth™ RNAi or siRNA into human HEK293 embryonic kidney cells (ATCC, Cat. No. CRL-1573) using Lipofectamine™ RNAiMAX (Cat. Nos. 13778-075, 13778-150). Lipofectamine™ RNAiMAX has a broad range of activity, enabling achievement of maximal knockdown levels with a minimum of optimization required.

## Important Guidelines for Transfection

Follow these important guidelines when transfecting Stealth™ RNAi or siRNA into HEK293 cells using Lipofectamine™ RNAiMAX:

- Both **Reverse Transfection** and **Forward Transfection** protocols (page 2) can be used for transfecting HEK293 cells.
- To assess transfection efficiency, we recommend using a KIF11 Stealth™ Select RNAi, as described in **Assessing Transfection Efficiency** (page 3).
- We recommend using 10 nM RNAi duplex and indicated procedures. However, the efficacy of the RNAi sequence chosen, the transcription rate of the target gene, and the stability of the resulting protein influence the degree of target gene knockdown observed. You may need to adjust the RNAi concentration used (1-50 nM can be used) and assay time (up to 72 hours) to establish optimal knockdown of your target gene.
- We recommend Opti-MEM® I Reduced Serum Medium (Cat. No. 31985-062) to dilute RNAi duplexes and Lipofectamine™ RNAiMAX before complexing.
- **Do not** add antibiotics to media during transfection as this causes cell death.
- Test serum-free media for compatibility with Lipofectamine™ RNAiMAX.
- Lipofectamine™ RNAiMAX has a broad peak of activity; for a range of cell densities and volumes of transfection reagent suitable for use, see **Acceptable Range for Maximal Activity** (page 3).

## Materials Needed

Have the following reagents on hand before beginning:

- HEK293 cells maintained in MEM with Earle's salts (Cat. No. 11090-081) supplemented with 10% heat-inactivated fetal bovine serum (Cat. No. 16140-071), 2 mM glutamine (Cat. No. 25030-149), 0.1 mM MEM non-essential amino acids (Cat. No. 11140-050), 1 mM sodium pyruvate (Cat. No. 11360-070), 1.5 g/L sodium bicarbonate (Cat. No. 25080-094), and penicillin/streptomycin (Cat. No. 15070-063)  
**Note:** Use low-passage cells; make sure that cells are healthy and greater than 90% viable before transfection.
- Stealth™ RNAi (or siRNA) of interest
- Lipofectamine™ RNAiMAX Reagent (store at +4°C until use)
- Opti-MEM® I Reduced Serum Medium
- Appropriate tissue culture plates and supplies

## Reverse Transfection

Use this procedure to reverse transfect Stealth™ RNAi or siRNA into HEK293 cells in a **24-well format** (for other formats, see **Scaling Up or Down Transfections**, page 3). In reverse transfections, the complexes are prepared inside the wells, after which cells and medium are added. Reverse transfections are faster to perform than forward transfections, and are the method of choice for high-throughput transfection. All amounts and volumes are given on a per well basis.

1. **For each well to be transfected**, prepare RNAi duplex-Lipofectamine™ RNAiMAX complexes as follows.
  - a. Dilute 6 pmol RNAi duplex in 100 µl Opti-MEM® I Medium without serum in the well of the tissue culture plate. Mix gently.  
**Note:** If the volume of your RNAi duplex solution is too small to dispense accurately (less than 1 µl), and you cannot pool dilutions, predilute your RNAi duplex 10-fold in 1X RNA Annealing/Dilution Buffer (or dilution buffer recommended by your RNAi duplex manufacturer), and dispense a 10-fold higher amount (should be at least 1 µl per well). For example, to get 6 pmol of RNAi duplex from a 20 µM RNAi duplex stock solution, dilute your RNAi duplex 10-fold to a concentration of 2 µM, and dispense 3 µl.
  - b. Mix Lipofectamine™ RNAiMAX gently before use, then add 1 µl Lipofectamine™ RNAiMAX to each well containing the diluted RNAi molecules. Mix gently and incubate for 10-20 minutes at room temperature.
2. Dilute HEK293 cells in complete growth medium **without antibiotics** so that 500 µl contains 50,000 cells (cell density should be 30-50% confluent 24 hours after plating).
3. To each well with RNAi duplex-Lipofectamine™ RNAiMAX complexes, add 500 µl of the diluted cells. This gives a final volume of 600 µl and a final RNA concentration of 10 nM. Mix gently by rocking the plate back and forth.
4. Incubate the cells 24-72 hours at 37°C in a CO<sub>2</sub> incubator until you are ready to assay for gene knockdown.

## Forward Transfection

Use this procedure to forward transfect Stealth™ RNAi or siRNA into HEK293 cells in a **24-well format** (for other formats, see **Scaling Up or Down Transfections**, page 3). In forward transfections, cells are plated in the wells, and the transfection mix is generally prepared and added the next day. All amounts and volumes are given on a per well basis.

1. One day before transfection, plate 50,000 cells in 500 µl of growth medium without antibiotics. The cell density should be 30-50% confluent at the time of transfection.
2. **For each well to be transfected**, prepare RNAi duplex-Lipofectamine™ RNAiMAX complexes as follows:
  - a. Dilute 6 pmol RNAi duplex in 50 µl Opti-MEM® I Reduced Serum Medium without serum. Mix gently.  
**Note:** If the volume of your RNAi duplex solution is too small to dispense accurately (less than 1 µl), and you cannot pool dilutions, predilute your RNAi duplex 10-fold in 1X RNA Annealing/Dilution Buffer (or dilution buffer recommended by your RNAi duplex manufacturer), and dispense the proper higher amount (should be at least 1 µl per well). For example, to get 6 pmol of RNAi duplex from a 20 µM RNAi duplex stock solution, dilute your RNAi duplex 10-fold to a concentration of 2 µM, and dispense 3 µl.
  - b. Mix Lipofectamine™ RNAiMAX gently before use, then dilute 1 µl in 50 µl Opti-MEM® I Reduced Serum Medium. Mix gently.
  - c. Combine the diluted RNAi duplex with the diluted Lipofectamine™ RNAiMAX. Mix gently and incubate for 10-20 minutes at room temperature.
3. Add the RNAi duplex-Lipofectamine™ RNAiMAX complexes to each well containing cells. This gives a final volume of 600 µl and a final RNA concentration of 10 nM. Mix gently by rocking the plate back and forth.
4. Incubate the cells 24-48 hours at 37°C in a CO<sub>2</sub> incubator until you are ready to assay for gene knockdown. Medium may be changed after 4-6 hours, but this is not required.

## Assessing Transfection Efficiency

To qualitatively assess transfection efficiency, we recommend using a KIF11 Stealth™ Select RNAi (available through [www.invitrogen.com/rnaiexpress](http://www.invitrogen.com/rnaiexpress); for human cells, oligo HSS105842 is a good choice). Adherent cells in which KIF11/Eg5 is knocked down exhibit a “rounded-up” phenotype after 24 hours due to a mitotic arrest (Weil, D. et al., *Biotechniques* (2002), 33: 1244-1248); slow growing cells may take up to 72 hours to display the rounded phenotype. Alternatively, growth inhibition can be assayed after 48-72 hours.

**Note:** The BLOCK-iT™ Fluorescent Oligo (Cat. No. 2013) is optimized for use with Lipofectamine™ 2000, and is not recommended for use with Lipofectamine™ RNAiMAX.

## Acceptable Range for Maximal Activity

Due to the broad range of maximal activity exhibited by Lipofectamine™ RNAiMAX, a range of cell densities and volumes of Lipofectamine™ RNAiMAX can be used for transfection. For transfecting HEK293 cells in 24-well format, 0.75-1.5 µl Lipofectamine™ RNAiMAX and 40,000 – 75,000 cells per well is suitable. For extended time course experiments (72 hours), consider using the lower cell number; for short-term experiments (24 hours), consider the higher cell number.

The final concentration of RNAi duplex can be varied between 1-50 nM. A concentration of 10 nM RNAi duplex is suitable to knockdown many target genes. However, the optimal concentration of RNAi duplex will vary depending on the efficacy of the duplex, and should be determined empirically.

## Recommended Reagent Amounts and Volumes

To transfect HEK293 cells in different tissue culture formats, vary the amounts of Stealth™ RNAi or siRNA, Lipofectamine™ RNAiMAX, cells, and medium used in proportion to the relative surface area, as shown below.

**Note:** 20 µM Stealth™ RNAi or siRNA = 20 pmol/µl.

Culture vessel	Rel. surf. area <sup>1</sup>	Volume of plating medium	Cells plated per well		Dilution medium		RNAi duplex amount		Final RNAi duplex conc.		Lipofectamine™ RNAiMAX <sup>2</sup>	
			Start point	Acceptable Range	Reverse transf. (µl)	Forward transf. (µl)	Start point (pmol)	Acc. Range (pmol)	Start point (nM)	Acc. Range (nM)	Start point (µl)	Acc. Range (µl)
96-well	0.2	100 µl	10,000	7,500-15,000	20	2 x 10	1.2	0.12-6	10	1-50	0.2	0.15-0.3
48-well	0.4	200 µl	20,000	15,000-30,000	40	2 x 20	2.4	0.24-12	10	1-50	0.4	0.3-0.6
24-well	1	500 µl	50,000	40,000-75,000	100	2 x 50	6	0.6-30	10	1-50	1	0.75-1.5
6-well	5	2.5 ml	250,000	200,000-375,000	500	2 x 250	30	3-150	10	1-50	5	3.75-7.5

<sup>1</sup>Surface areas may vary depending on the manufacturer.

<sup>2</sup>If the volume of Lipofectamine™ RNAiMAX is too small to dispense accurately, and you cannot pool dilutions, predilute Lipofectamine™ RNAiMAX 10-fold in Opti-MEM® I Reduced Serum Medium, and dispense a 10-fold higher amount (should be at least 1.0 µl per well). Discard any unused diluted Lipofectamine™ RNAiMAX.

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