

TransIT[®]-Express Transfection Reagent

Protocol for MIR 2000, 2004, 2005, 2006



The Transfection Experts

INTRODUCTION

TransIT[®]-Express Transfection Reagent is specifically developed for high-throughput transfection of plasmid DNA into mammalian cells. TransIT-Express Reagent provides all the attributes of the trusted TransIT series of transfection reagents: high transfection efficiency, low toxicity, serum compatibility, simplicity of use and reproducibility. Transfection using TransIT-Express does not require any culture medium change after transfection. The TransIT-Express Reagent/plasmid DNA complexes can be formed directly in 96-well plates, and the cells in complete growth medium can subsequently be added.

SPECIFICATIONS

Storage	Store TransIT-Express Reagent at 4°C or -20°C. Before each use , warm to room temperature and vortex gently.
Product Guarantee	1 year from the date of purchase, when properly stored and handled.



Warm TransIT-Express to room temperature and vortex gently before each use.

MATERIALS

Materials Supplied

TransIT-Express Transfection Reagent is supplied in *one* of the following formats.

Product No.	Quantity
MIR 2004	1 × 0.4 ml
MIR 2000	1 × 1.0 ml
MIR 2005	5 × 1.0 ml
MIR 2006	10 × 1.0 ml

Materials required, but not supplied

- Cultured cells
- Appropriate cell culture medium
- Purified plasmid DNA
- Serum-free medium (e.g. Opti-MEM[®] I Reduced-Serum Medium)
- Sterile tube for transfection complex preparation
- Micropipets
- Reporter assay as required
- *Optional:* Selection antibiotic (e.g., G418 or Hygromycin B) for stable transfection

For Research Use Only.

BEFORE YOU START:

Important Tips for Optimal Plasmid DNA Transfection

Optimize reaction conditions for each cell type to ensure successful transfections. The suggestions below yield high efficiency transfection of most cell types using *TransIT*-Express Transfection Reagent. **Table 1** presents recommended starting conditions depending on culture vessel size.

- **Cell density (% confluence) at transfection.** Determine the optimal cell density for each cell type to maximize transfection efficiency. Divide the cells 18–24 hours before transfection to ensure that the cells are actively dividing and reach the appropriate cell density (generally 50–70% confluence) at the time of transfection.
- **DNA purity.** Use highly purified, sterile, and contaminant-free DNA for transfection. Plasmid DNA preparations that are endotoxin-free and have $A_{260/280}$ absorbance ratio of 1.8–2.0 are desirable. DNA prepared using miniprep kits is not recommended as it may contain high levels of endotoxin. We recommend using MiraCLEAN[®] Endotoxin Removal Kit (MIR 5900) to remove endotoxin from your DNA preparation.
- **Ratio of *TransIT*-Express Reagent to DNA.** Determine the best *TransIT*-Express Reagent:DNA ratio for each cell type. Start with 3 μ l of *TransIT*-Express Reagent per 1 μ g of DNA. Vary the concentration of *TransIT*-Express Reagent from 2–8 μ l per 1 μ g DNA to find the optimal ratio. **Table 1** provides recommended starting conditions based on cell culture vessel size.
- **Complex formation conditions.** Prepare *TransIT*-Express Reagent:DNA complexes in serum-free growth medium. Mirus recommends Opti-MEM I Reduced-Serum Medium.
- **Cell culture conditions:** Culture cells in the appropriate medium, with or without serum. There is no need to perform a medium change to remove the transfection complexes.
- **Presence of antibiotics:** Antibiotics may inhibit transfection complex formation and therefore should be excluded from the complex formation step. Transfection complexes can be added directly to cells grown in complete culture medium containing serum and low levels of antibiotics (0.1–1X final concentration of penicillin/streptomycin mixture).
- **Post-transfection incubation time.** Determine the best incubation time post-transfection for each cell type. The optimal incubation time is generally 24–72 hours, but will vary depending on the goal of the experiment, nature of the plasmid, and the half-life of the expressed protein.



Do not use DNA prepared using miniprep kits for transfection.



Do not use serum or antibiotics in the medium during transfection complex formation.

Table 1. Recommended starting conditions for DNA transfections with *TransIT*-Express Transfection Reagent.

Culture vessel	384-well plate	96-well plate	48-well plate	24-well plate	12-well plate
Surface area	0.11 cm ²	0.35 cm ²	1.0 cm ²	1.9 cm ²	3.8 cm ²
DNA (1 μ g/ μ l stock)	0.03 μ l*	0.1 μ l*	0.26 μ l*	0.5 μ l	1 μ l
<i>TransIT</i> -Express Reagent	0.09 μ l*	0.3 μ l*	0.78 μ l*	1.5 μ l	3 μ l
Serum-free medium	1.5 μ l	5 μ l	15 μ l	50 μ l	100 μ l
Complete growth medium	29 μ l	92 μ l	263 μ l	0.5 ml	1.0 ml

* If small volumes of *TransIT*-Express and plasmid DNA need to be pipetted, e.g. in a 384 or 96-well format, dilute the required volume of reagent and DNA ten-fold in Opti-MEM I Reduced-Serum Medium before each use to avoid pipetting errors. Please refer to the protocol on Page 3. **Do not** store diluted *TransIT*-Express Reagent and DNA.



Surface areas are based on Greiner tissue culture plates and Falcon 10-cm dishes and T75 flasks. All volumes given are per well (or per dish) for a given culture vessel.

PLASMID DNA TRANSFECTION PROTOCOL

The following procedure describes how to perform plasmid DNA transfections in 96-well plates. The surface areas of other culture vessels are different and transfections must be scaled accordingly. Appropriately increase or decrease the amounts of serum free medium, *TransIT-Express* Reagent, DNA and complete culture medium based on the surface area of the cell culture vessel (please refer to **Table 1** on Page 2).

In the following protocol, the complex formation step is performed directly in the plates and then the cells are split and added to the tissue culture plate just before transfection. This reduces the transfection time for high throughput transfection. If cells need to be plated prior to transfection, simply prepare transfection complexes in another tube and transfer to the cells plated in 96-well plates. For some cell lines, this will result in slightly higher transfection efficiency.

High throughput plasmid DNA transfection protocol in a 96-well plate

A. Prepare *TransIT-Express* Reagent:DNA complex (Immediately before transfection)

1. Warm *TransIT-Express* Reagent to room temperature and vortex gently before using.
2. For convenient pipetting, prepare a ten-fold dilution of *TransIT-Express* Reagent in OptiMEM I Reduced Serum Medium. Prepare approximately 5% extra volume for the number of wells required to allow for pipetting errors, e.g. when transfecting 96 wells, prepare enough dilution for 100 wells. Dilute 30 μ l of *TransIT-Express* Reagent in 270 μ l Opti-MEM I Reduced-Serum Medium. Pipet gently to mix completely.
2. Add 3.0 μ l *TransIT-Express* Reagent directly into each well of the 96-well plate.
3. Dilute the required amount of plasmid DNA ten-fold in Opti-MEM I Reduced-Serum Medium, e.g. for 96 wells, dilute 10 μ l of 1 μ g/ μ l plasmid DNA stock solution into 90 μ l of Opti-MEM I Reduced-Serum Medium. Pipet gently to mix completely.
4. Add 1 μ l diluted DNA to each well of the 96-well plate containing the diluted *TransIT-Express* Reagent. Pipet gently to mix completely.
3. Add 5 μ l of Opti-MEM I Reduced-Serum Medium to each well of a 96-well plate. Pipet gently to mix completely.
4. Incubate at room temperature for 15–30 minutes to allow sufficient time for complexes to form.

C. Add cells to the *TransIT-Express* Reagent:DNA complexes

1. While the complexes are incubating, split the cells directly into the wells containing the *TransIT-Express* Reagent: DNA complexes at a density of 2–4 x 10⁴ cells/well in a volume of 92 μ l complete growth medium per well. The final volume per well of a 96-well plate should be approximately 100 μ l.
2. Gently rock the culture vessel back-and-forth and from side-to-side to evenly distribute the *TransIT-Express* Reagent:DNA complexes.
3. Incubate for 24–72 hours. It is not necessary to replace the complete growth medium with fresh medium.
4. Harvest cells and assay as required.



Warm *TransIT-Express* to room temperature and vortex gently before each use.



For high-throughput transfection, prepare a ten-fold dilution of *TransIT-Express* and DNA in OptiMEM I Reduced-Serum Medium before each use to avoid pipetting errors. **Do not** store diluted *TransIT-Express* Reagent and DNA.



For generating stable cell transfectants, passage the cells 24–48 hours post-transfection in complete growth medium containing the appropriate selection antibiotic such as G418 or Hygromycin B. Maintain selection for 1–2 weeks, allowing selection of cells that have undergone stable integration of DNA.

TROUBLESHOOTING GUIDE

Problem	Solution
LOW PLASMID DNA TRANSFECTION EFFICIENCY	
<i>TransIT</i> -Express Reagent was not mixed properly	Warm <i>TransIT</i> -Express to room temperature and vortex gently before each use.
Suboptimal <i>TransIT</i> -Express Reagent:DNA ratio	Determine the best <i>TransIT</i> -Express Reagent:DNA ratio for each cell type. Titrate the <i>TransIT</i> -Express Reagent from 2–8 µl per 1 µg DNA. Refer to “Before You Start” on Page 2.
Suboptimal DNA concentration	Confirm DNA concentration and purity. Use plasmid DNA preps that have an A _{260/280} absorbance ratio of 1.8–2.0. The optimal DNA concentration generally ranges between 0.05–0.1 µg/well of a 96-well plate. Start with 0.1 µg/well of a 96-well plate. Consider testing more or less DNA while scaling the amount of <i>TransIT</i> -Express Transfection Reagent accordingly.
Low-quality plasmid DNA	Use highly purified, sterile, endotoxin and contaminant-free DNA for transfection. We recommend using Mirus Bio’s MiraCLEAN Endotoxin Removal Kit (MIR 5900) for removal of endotoxin from your DNA preparation. Alternatively, use cesium chloride gradient or anion exchange purified DNA which contains levels of endotoxin that do not harm most cells. Do not use DNA prepared using miniprep kits as it may contain high levels of endotoxin.
Inhibitor present during transfection	Serum and antibiotics inhibit transfection complex formation. Prepare <i>TransIT</i> -Express Reagent:DNA complexes in serum-free growth medium. We recommend Opti-MEM I Reduced-Serum Medium. Once transfection complexes are formed, cells cultured in complete growth medium containing serum and 0.1–1X antibiotics can be added directly to transfection complexes. Polyanions such as dextran sulfate or heparin can inhibit transfection. Use culture medium that does not contain these polyanions. If necessary, the transfection medium can be replaced with polyanion containing medium 24 hours post transfection.
Incorrect vector sequence	If you do not observe expression of your target insert, verify the sequence of the plasmid DNA.
Transfection incubation time	Determine the optimal transfection incubation time for each cell type and experiment. Test a range of incubation times (e.g. 12–72 hours). The best incubation time is generally 24–48 hours.
Cells not actively dividing at the time of transfection	Divide the culture at least 18–24 hours before transfection to ensure that the cells are actively dividing and reach optimal cell density at time of transfection.
Precipitate formation during transfection complex formation	During complex formation, scale all reagents according to Table 1 on page 2 including serum-free medium, <i>TransIT</i> -Express and plasmid DNA. Precipitation may be observed when excess DNA is used during complex formation. This may negatively impact transfection efficiency. To avoid precipitation when using high concentrations of DNA, increase the volume of serum-free medium during complex formation by two-fold.
Proper experimental controls were not included	To verify efficient transfection, use <i>TransIT</i> -Express Reagent to deliver a positive control such as a luciferase, beta-galactosidase or green fluorescent protein (GFP) encoding plasmid. To assess delivery efficiency of plasmid DNA, use Mirus’ <i>Label IT</i> [®] Tracker™ Intracellular Nucleic Acid Localization Kit to label the target plasmid or Mirus’ pre-labeled <i>Label IT</i> Plasmid Delivery Controls (please refer to Related Products on Page 6).

TROUBLESHOOTING GUIDE continued

Problem	Solution
HIGH CELLULAR TOXICITY	
Transfection complexes and cells not mixed thoroughly after complex addition	After adding cells to the <i>TransIT</i> -Express Reagent:DNA complexes, gently rock the dish back-and-forth and from side-to-side to distribute the complexes evenly. Do not swirl or rotate the dish, as this may cause uneven distribution.
Transfection complexes added to cells cultured in serum-free medium	Allow <i>TransIT</i> -Express Reagent:DNA complexes to form in serum-free medium, then add cells cultured in complete growth medium to these complexes. The presence of serum in the growth medium improves transfection efficiency and reduces cytotoxicity. No culture medium change is required after the addition of cells to transfection complexes.
Endotoxin-contaminated plasmid DNA	Use highly purified, sterile, endotoxin and contaminant-free DNA for transfection.
	We recommend using Mirus Bio's MiraCLEAN Endotoxin Removal Kit (MIR 5900) for removal of any traces of endotoxin from your DNA preparation. Alternatively, use cesium chloride gradient or anion exchange purified DNA which contains levels of endotoxin that do not harm most cells.
Expressed target gene is toxic to cells	Do not use DNA prepared using miniprep kits as it may contain high levels of endotoxin.
	Compare toxicity levels against a cells alone control and cells transfected with an empty vector to assess the cytotoxic effects of the target protein being expressed. If lower levels of target gene expression are desired in your transfection experiments, consider reducing the amount of target plasmid. Maintain the optimal <i>TransIT</i> -Express:DNA ratio by using carrier DNA such as an empty cloning vector.
Cell density not optimal at time of transfection	Determine the best cell density for each cell type to maximize transfection efficiency. Use this cell density in subsequent experiments to ensure reproducibility. For most cell types, 50–70% confluence is recommended at transfection, but use of higher or lower densities may increase cell viability depending on cell type.
Cell morphology has changed	Mycoplasma contamination can alter cell morphology and affect transfection efficiency. Check your cells for Mycoplasma contamination. Use a fresh frozen stock of cells or use appropriate antibiotics to eliminate Mycoplasma.
	A high or low cell passage number can make cells more sensitive and refractory to transfection. Maintain a similar passage number between experiments to ensure reproducibility.

RELATED PRODUCTS

- Ingenio[®] Electroporation Solution and Kits
- Label IT[®] Plasmid Delivery Controls
- Label IT[®] Tracker[™] Intracellular Nucleic Acid Localization Kits
- MiraCLEAN[®] Endotoxin Removal Kits
- TransIT[®]-3D Transfection Reagent
- TransIT[®]-2020 Transfection Reagent
- TransIT-PRO[®] Transfection Kit
- TransIT[®]-LT1 Transfection Reagent
- TransIT[®] Cell Line Specific Transfection Reagents and Kits
- TransIT[®]-QR and TransIT[®]-EE Delivery Solutions and Kits



Reagent Agent[®]

Reagent Agent[®] is an online tool designed to help determine the best solution for nucleic acid delivery based on in-house data, customer feedback and citations.

Learn more at:

www.TheTransfectionExperts.com/reagentagent

For details on our products, visit www.mirusbio.com or www.TheTransfectionExperts.com.

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Use of Mirus Bio TransIT[®] polyamine transfection reagents are covered by U.S. Patent No. 5,744,335, No. 6,180,784, No. 7,101,995, No. 7,601,367 and patents pending. The use of certain Mirus Bio transfection products are the subject of one or more of U.S. Patents No. 7,335,509, No. 7,655,468 and/or other pending U.S. patent applications. Mirus Bio Label IT[®] nucleic acid labeling and modifying reagents are covered by U.S. Patent No. 6,262,252, No. 6,593,465, No. 7,049,142, No. 7,326,780 and No. 7,491,538. Cy[™]3 and Cy[™]5 products or portions thereof are manufactured under license from Carnegie Mellon University and are covered by U.S. Patent No. 5,268,486.

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