



Viral Applications

M ViroMag RL™

Transduction enhancer reagent
For Lentivirus and retrovirus

Protocol

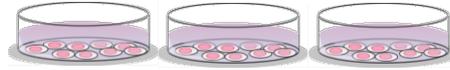
- M** Magnetofection Technology
This reagent needs to be used with a magnetic plate

ViroMag R/L Quick Protocol

To find the ideal conditions, **ViroMag R/L** must be tested at several amounts according to the type of culture dish/plate independently to the MOI used. Adapt your MOI depending of your viral vector and the type of cells used.

Seed cells to be at 70% confluent the day of transfection*

1



Prepare 4 identical tubes of viral particles (example for MOI of 1)



2

96 well plate

24 well plate

6 well plate

For 1×10^4 cells per well,
dilute 1×10^4 infectious units in $50 \mu\text{L}$
serum-free medium or buffer* x4

For 1×10^5 cells per well,
dilute 1×10^5 infectious units in serum-
free medium or buffer* $100 \mu\text{L}$ x4

For 5×10^5 cells per well,
dilute 5×10^5 infectious units in serum-
free medium or buffer* $200 \mu\text{L}$ x4

**Prepare 4 tubes of ViroMag R/L (with different amounts of magnetic beads)*
The volumes of ViroMag R/L to be tested is fixed and is the same for any MOI**



3

96 well plate

24 well plate

6 well plate

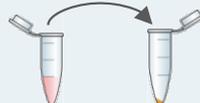
$0.5 \mu\text{L}/1 \mu\text{L}/1.5 \mu\text{L}/2 \mu\text{L}$
in an empty microtube

$1.5 \mu\text{L}/3 \mu\text{L}/6 \mu\text{L}/9 \mu\text{L}$
in an empty microtube

$7.5 \mu\text{L}/15 \mu\text{L}/30 \mu\text{L}/45 \mu\text{L}$
in an empty microtube

Mix each tube of viral particles (step 2) to each tube of ViroMag R/L (step 3)*

4



Incubate 5 to 20 min at room temperature or on ice

5



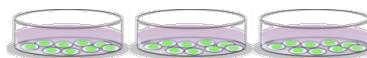
**Distribute each mix drop by drop onto the cells to insure uniform distribution
& then incubate the cells 20 min. on the magnetic plate**

6



**Remove the cells from the magnetic plate and incubate cells for 24 to 72h at 37°C until evaluation of
transgene expression***

7



Choose the best ratio virus:ViroMag R/L

8



These conditions might require some further optimizations depending on your cells, virus types, MOI, etc.

* Please refer to the following section "Important Notes"

IMPORTANT NOTES – Before you begin

- ✓ For cell lines, seed the cells 24h before transfection in a 96-well plate, 24-well plate or 6-well plate in respectively 150 μ L, 400 μ L and 2 mL of complete culture medium.
- ✓ For more information on cell in suspension - such as primary T cells - please refer to the following papers
 - Sacha JB et al. *Nat Protoc.* 2010 Feb;5(2):239-46. doi: 10.1038/nprot.2009.227
 - Barsov EV. *Methods Mol Biol.* 2009;511:143-58. doi: 10.1007/978-1-59745-447-6_6
- ✓ Allow reagents to reach RT and gently vortex them before use.
- ✓ Adapt the MOI depending on the viral vector and the type of cells used. MOI can usually vary from 0.5 up to 100.
- ✓ Virus Preparation. Medium or buffer without serum & supplement must be used for the dilution of the virus and the preparation of the virus/ViroMag RL complexes. Culture media such as DMEM or OptiMEM or salt-containing buffers such as HBS or PBS are recommended. Alternatively, you can directly use an aliquot of the culture supernatant from a producer cell line.
- ✓ For doses of ViroMag RL less than 1 μ L, dilute the reagent exclusively with deionized water.
- ✓ We recommend respecting the order of addition of reagents: add the virus suspension to the ViroMag RL tube.
- ✓ For most cell types, a medium change is not required after Magnetofection. However, it may be necessary for some cells that are sensitive to serum/supplement concentration or for transduction synchronization. This can be done immediately after the 20min. incubation on the magnetic plate while keeping the cells onto the magnetic device, or 4 to 6 hours post-Magnetofection.

IMPORTANT NOTES

- Do not freeze the magnetic nanoparticles!
- Polybrene or other additives must NOT be used in combination with ViroMag RL
- **The suggested volume of ViroMag RL is related to infectious particles and not physical viral particles.** ViroMag RL is designed to enhance infection efficiency, thus it is recommended to start with low MOI from 0.5 to 10 with several ViroMag RL volumes.

ViroMag RL Reagent | Specifications

Package content	RL40100: 100 µL of ViroMag RL RL40200: 200 µL of ViroMag RL RL41000: 1mL of ViroMag RL KC30700: ViroMag R/L Starting Kit - 200 µL of ViroMag RL reagent + Super Magnetic Plate
Shipping conditions	Room Temperature
Storage conditions	Store the ViroMag RL reagent at +4°C upon reception
Shelf life	1 year from the date of purchase when properly stored and handled.
Product Descriptions	ViroMag RL is a magnetic nanoparticles formulation optimized for Retroviruses and Lentiviruses.
Important notice	For research use only. Not for use in diagnostic procedures.

Protocol | Lentiviral transduction enhancement in adherent cells

1. Cells preparation

It is recommended to seed or plate the cells the day prior transduction, however cells can also be prepared few hours before the transduction. The suitable cell density will depend on the growth rate and the condition of the cells. Best results are achieved if cells are at least 60-80 % confluent at the time of Magnetofection (refer to Table 1). Cells should be plated in the same manner as required for standard viral gene delivery. For example, the confluency must be low for retroviral vectors, which require cell division for infection.

Culture vessel	Number of adherent cells	Final Transduction Volume*
96-well	$0.05 - 0.15 \times 10^5$	150 μ L
24-well	$0.5 - 1 \times 10^5$	500 μ L
6-well	$2 - 5 \times 10^5$	2 mL

*Transduction volume corresponds to the volume of culture medium covering the cells plus the volume of the ViroMag RL/viral particles mixture.

Table 1: Recommended adherent cell number to seed per well 24h before transduction experiment

2. Viral particles/ViroMag RL complexes preparation

- a. *ViroMag RL*: Vortex the reagent and place the appropriate amounts (refer to Table 2) in an empty microtube.

Culture Vessel	ViroMag RL Quantity (μ L)	Suggested ViroMag RL Quantity (μ L)	Volume of ViroMag RL / virus solution	Final Transduction Volume*
96 well	0.2 - 3	1.5	50 μ L	150 μ L
24 well	1 - 12	6	100 μ L	500 μ L
6 well	5 - 60	30	200 μ L	2 mL

*Transduction volume corresponds to the volume of culture medium covering the cells plus the volume of the ViroMag/virus mixture

Table2: Recommended amounts of ViroMag RL, volume of vector preparation and final transduction volume

- b. *Viral particles solution*: Add your virus suspension to the tube containing ViroMag RL and mix immediately by pipetting up & down.
NOTE: Prefer virus solutions made in serum-free medium or salt-containing buffers.
- c. Incubate at room temperature for 15 to 20 minutes.

3. Transduction

- a. Add the ViroMag RL / Virus complexes onto cells drop by drop and gently rock the plate to ensure a uniform distribution.
- b. Place the cell culture plate on the magnetic plate during 30 minutes.

- c. Remove the magnetic plate.
- d. Cultivate the cells at 37°C in a CO₂ incubator under standard conditions until evaluation of transgene expression.

NOTE: In case of cells very sensitive to transduction or infection, the medium can be changed after 3-4 hours or 24 hours incubation with fresh medium.

Protocol | Lentiviral transduction enhancement in suspension cells

1. Cells preparation

Suspension cells should be prepared in the adequate vessel just before the infection (see Table 3).

Culture vessel	Number of suspension cells	Final Transduction Volume*
96-well	0.5 – 1 x 10 ⁵	150 µL
24-well	2 – 5 x 10 ⁵	500 µL
6-well	1 – 2 x 10 ⁶	2 mL

*Transduction volume corresponds to the volume of culture medium covering the cells plus the volume of the ViroMag RL/viral particles mixture.

Table 3: Recommended suspension cell number to seed per well prior transduction experiment

2. Viral particles/ViroMag RL complexes preparation

- a. *ViroMag RL*: Vortex the reagent and place the appropriate amounts (refer to Table 2) in an empty microtube.
- b. *Viral particles solution*: Add your virus suspension to the tube containing ViroMag RL and mix immediately by pipetting up & down.

NOTE: Prefer virus solutions made in serum-free medium or salt-containing buffers.

- c. Incubate at room temperature for 15 to 20 minutes.

3. Transduction

- a. While the ViroMag RL / virus mixtures incubate, prepare the cells to be transduced (as suggested in Table 3). For example, dilute the cells to 5×10^5 - 1×10^6 / mL in medium (with or without serum- or supplement; depending on cell type and sensitivity of cells towards serum-free conditions) and perform one of the following three options to sediment the cells at the bottom of the culture dish in order to promote the contact with the magnetic nanoparticles.
 - Seed the cells on polylysine-coated plates and use the protocol for adherent cells, **OR**
 - Briefly, centrifuge the cells (2 minutes) to pellet them and use the protocol for adherent cells, **OR**
 - Mix cell suspension with 20-30 μ L of CombiMag reagent (Magnetofection) per 1 ml of cell suspension and incubate for 10 - 15 minutes. Then, distribute the cells to your tissue culture dish placed upon the magnetic plate and incubate for 15 more minutes
- b. Add the resulting mixture of ViroMag RL/ virus to the cells while keeping the cell culture plate on the magnetic plate.
- c. Continue to incubate for 15 minutes.
- d. Remove culture plate from magnetic plate.
- e. Continue to cultivate cells as desired until evaluation of the transduction experiment.

NOTE: refer to the following papers for a detailed protocol for transduction and synchronous infection of suspension cell (T lymphocyte):

- Sacha JB *et al. Nat Protoc.* 2010 Feb;5(2):239-46. doi: 10.1038/nprot.2009.227
- Barsov EV. *Methods Mol Biol.* 2009;511:143-58. doi: 10.1007/978-1-59745-447-6_6.

Optimization Protocol

In order to get the best out of ViroMag RL several parameters can be optimized:

- ViroMag RL dose & Ratio to viral particles
 - cell density and incubation times
- 1) Start by optimizing the ViroMag RL dose with a fixed MOI. This will vary the concentration of ViroMag RL and the ratio ViroMag RL / Virus. To this end, vary the amount of ViroMag RL in the range suggested in the Table 2. For instance, from 0.2 to 3 μ L of ViroMag RL in a 96-well plate.
 - 2) Next, use a fixed volume of reagent and vary the MOI.
 - 3) Finally, you can optimize the cell number (density), kinetics of readout and also the incubation time for the magnetofection procedure.

Additional products for Viral Transduction Enhancement

- **ViroMag** for enhancing viral transduction efficiency (suitable for all viruses)
- **AdenoMag** specific for Adenoviral and AAV transduction

Additional products for Virus Capture and Concentration

- **Mag4C-LV** for Lentiviruses
- **Mag4C-AD** for Adenoviruses

Purchaser Notification

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