

# High Efficiency Transformation Protocol using NEB 10-beta Competent E. coli (C3019H) Version 3

New England Biolabs

## Abstract

This is the correct protocol if you are using the C3019H cells. If you are using the C3019I cells, please refer to [this protocol](#).

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## Guidelines

### Transformation Protocol Variables

**Thawing:** Cells are best thawed on ice and DNA added as soon as the last bit of ice in the tube disappears. Cells can also be thawed by hand, but warming above 0°C will decrease the transformation efficiency.

**Incubation of DNA with Cells on Ice:** For maximum transformation efficiency, cells and DNA should be incubated together on ice for 30 minutes. Expect a 2-fold loss in transformation efficiency for every 10 minutes this step is shortened.

**Heat Shock:** Both the temperature and the timing of the heat shock step are important and specific to the transformation volume and vessel. Using the transformation tube provided, 30 seconds at 42°C is optimal.

**Outgrowth:** Outgrowth at 37°C for 1 hour is best for cell recovery and for expression of antibiotic resistance. Expect a 2-fold loss in transformation efficiency for every 15 minutes this step is shortened. SOC gives 2-fold higher transformation efficiency than LB medium; and incubation with shaking or rotating the tube gives 2-fold higher transformation efficiency than incubation without shaking.

**Plating:** Selection plates can be used warm or cold, wet or dry without significantly affecting the transformation efficiency. However, warm, dry plates are easier to spread and allow for the most rapid colony formation.

### DNA Contaminants to Avoid

Contaminant	Removal Method
Detergents	Ethanol precipitate
Phenol	Extract with chloroform and ethanol precipitate

Ethanol or Isopropanol	Dry pellet before resuspending
PEG*	Column purify or phenol/chloroform extract and ethanol precipitate
DNA binding proteins (e.g. Ligase)	Column purify or phenol/chloroform extract and ethanol precipitate

\* Ideally, DNA for transformation should be purified and resuspended in water or TE. However, up to 10 µl of DNA directly from a ligation mix can be used with only a two-fold loss of transformation efficiency. Where it is necessary to maximize the number of transformants (e.g. a library), a purification step, either a spin column or phenol/chloroform extraction and ethanol precipitation should be added.

## Materials

 NEB 10-beta Competent E.coli (High Efficiency) - 20x0.05 ml [C3019H](#) by [New England Biolabs](#)

## Protocol

### Step 1.

Thaw a tube of NEB 10-beta Competent *E. coli* cells on ice for 10 minutes.



#### REAGENTS

 NEB 10-beta Competent E.coli (High Efficiency) - 20x0.05 ml [C3019H](#) by [New England Biolabs](#)



#### DURATION

00:10:00



#### NOTES

**New England Biolabs** 17 Sep 2014

Cells are best thawed on ice and DNA added as soon as the last bit of ice in the tube disappears. Cells can also be thawed by hand, but warming above 0°C will decrease the transformation efficiency.

### Step 2.

Add 1-5 µl containing 1 pg-100 ng of plasmid DNA to the cell mixture.

### Step 3.

Carefully flick the tube 4-5 times to mix cells and DNA. **Do not vortex.**

### Step 4.

Place the mixture on ice for 30 minutes. Do not mix.



#### DURATION

00:30:00



#### NOTES

**New England Biolabs** 02 Oct 2014

For maximum transformation efficiency, cells and DNA should be incubated together on ice for 30 minutes. Expect a 2-fold loss in transformation efficiency for every 10 minutes this step is shortened.

### Step 5.

Heat shock at exactly 42°C for exactly 30 seconds. Do not mix.

#### DURATION

00:00:30

#### NOTES

**New England Biolabs** 02 Oct 2014

Both the temperature and the timing of the heat shock step are important and specific to the transformation volume and vessel. Using the transformation tube provided, 30 seconds at 42°C is optimal.

### Step 6.

Place on ice for 5 minutes. Do not mix.

#### DURATION

00:05:00

### Step 7.

Pipette 950 µl of room temperature NEB 10-beta/Stable Outgrowth Medium into the mixture.

#### AMOUNT

950 µl Additional info:

### Step 8.

Place at 37°C for 60 minutes., shaking vigorously (250 rpm) or rotating.

#### DURATION

01:00:00

#### NOTES

**New England Biolabs** 02 Oct 2014

Outgrowth at 37°C for 1 hour is best for cell recovery and for expression of antibiotic resistance. Expect a 2-fold loss in transformation efficiency for every 15 minutes this step is shortened. SOC gives 2-fold higher transformation efficiency than LB medium; and incubation with shaking or rotating the tube gives 2-fold higher transformation efficiency than incubation without shaking.

### Step 9.

Warm selection plates to 37°C.

#### NOTES

**New England Biolabs** 02 Oct 2014

Selection plates can be used warm or cold, wet or dry without significantly affecting the transformation efficiency. However, warm, dry plates are easier to spread and allow for the most rapid colony formation.

### Step 10.

Mix the cells thoroughly by flicking the tube and inverting.

#### REAGENTS

 SOC Outgrowth Medium - 100 ml [B9020S](#) by [New England Biolabs](#)

### Step 11.

Perform several 10-fold serial dilutions in NEB 10-beta/Stable Outgrowth Medium.

#### NOTES

## New England Biolabs 26 Jun 2017

Please note that NEB no longer recommends SOC for use in this protocol. NEB 10-beta/Stable Outgrowth Medium is now provided with NEB 10-beta Competent E.coli and will be available also as a stand-alone product in the fall of 2017.

### Step 12.

Spread 50-100 µl of each dilution onto a selection plate

### Step 13.

Incubate overnight at 37°C

 **DURATION**

15:00:00

 **NOTES**

**New England Biolabs** 25 Jan 2015

Alternatively, incubate at 30°C for 24-36 hours or 25°C for 48 hours.