

Cloning – Multiple Gateway Reaction

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Version: 1.0 - [Print Version \(.PDF\)](#)

ATTENTION: This is not something what is done with low quality material or just to try. One reaction as described here is 20 Euro and should only be spend if you are convinced it will work!

If possible use Gateway LR-Reaction II plus because the enzyme is more stable and available in smaller amounts. See for different protocols on this page.

1. Make sure you have **three different (!) ENTR and one DEST clones** for multiple Gateway
2. **Measure the DNA concentration** of all constructs
3. **Calculate the amount** in ng needed of each ENTR clone
Please choose one option:
OPTION A: For the Master mix you need 200fmol in 20 μ l of which we use later 1 μ l containing 10 fmol of each ENTR:
ng needed = (length of the plasmid in bp) x 0.132

OPTION B: You can vary the protocol if you clones are in a very low concentration. Without Master mix you need 10fmol of each ENTR:
ng needed = (length of the plasmid in bp) x 0.0066
4. Calculate the amount in μ l needed of each plasmid
 μ l needed = ng needed / (concentration in ng/ μ l)
5. ONLY OPTION A: Prepare the ENTR-Premix
Pipett the calculated amount of the three ENTR clones
add water to a total volume of **20 μ l**
6. Obtain a tested DEST-vector (10 fmol needed)
ng needed = (length of the plasmid in bp) x 0.0066
7. Prepare in a new Eppi the multiple Gateway reaction
OPTION A:
1 μ l ENTR-Premix
10 fmol DEST-vector
add water to a total volume of **6 μ l**

OPTION B:
10 fmol of each of the 3 ENTR-clones
10 fmol DEST-vector
add water to a total volume of **6 μ l**

From now on everything is identical again.

8. Remove the LR-Clonase **Plus** Reaction Buffer from -80°C
9. Pipett **2 µl** of this buffer solution to the multiple Gateway reaction
10. Remove the LR-Clonase **Plus** Enzyme mix from -80°C and vortex 2 x 2 sec
This is expensive stuff don't leave it to rot in the ice-bucket!
11. Add **2 µl** of the Enzyme mix to the multiple Gateway reaction and mix well
12. Store the enzyme mix and buffer **immediately at -80°C !!!**
13. Incubate at room temperature for 16 hours or **over night**
14. Add **1 µl of Proteinase K** solution and incubate for 10 min at 37°C
15. **Transform DH5α bacteria**
For electro competent cells use 2 µl, for chemical competent the complete mix.
16. Plate bacteria with proper antibiotic selection

Useful Formula:

Desired amount in **ng** =
= amount in **fmol** x length of plasmid in **bp** (660 fg / 1 fmol) x (1 ng / 1000000 fg)

Which is equal to:

Desired amount in **ng** = amount in **fmol** x length of plasmid in **bp** x **0.00066** x (ng / fmol)

Materials needed:

Gateway[®] Enzyme: LR-Clonase[™] plus Kit (# 12538-013) by [Invitrogen](#)

Commented Protocol:

1. Make sure you have three different (!) ENTR and one DEST clones for multiple Gateway

You need one ENTR[™] clone with attL4 and attR1, one with the "classical" combination attL1 and attL2 and one with attR2 and attL3. The DEST[™] vector MUST have attR4 and attR3 sites, or it will not work. Most Errors are made at that step when people by accident use two ENTR[™] clones with identical att-sites and lack one pair due to that.

2. Measure the DNA concentration of all constructs

The amount of ENTR is very important for this 4-plasmid-combination-reaction. Measure the amount of each plasmid again to avoid variations between different measurements. If you want to be really sure, than use 1 µg of each plasmid, linearize them by restriction digest and compare the amount on gel (all bands should be of same idensity).

3. Calculate the amount in ng needed of each ENTR clone

Please choose one option:

OPTION A: For the Master mix you need 200fmol in 20 μ l of which we use later 1 μ l containing 10 fmol of each ENTR:

$$\text{ng needed} = (\text{length of the plasmid in bp}) \times 0.132$$

OPTION B: You can vary the protocol if you clones are in a very low concentration. Without Master mix you need 10fmol of each ENTR:

$$\text{ng needed} = (\text{length of the plasmid in bp}) \times 0.0066$$

Here you can go two ways. Either you make first a MasterMix of the ENTR clones or you dilute the ENTR clones separately to the right concentration. I prefer the MasterMix, because it's a little more handy, but I guess its personal choice.

4. Calculate the amount in μ l needed of each plasmid

$$\mu\text{l needed} = \text{ng needed} / (\text{concentration in ng}/\mu\text{l})$$

This should be easy.

5. ONLY OPTION A: Prepare the ENTR-Premix

Pipett the calculated amount of the three ENTR clones
add water to a total volume of **20 μ l**

This step not required if you don't use a MasterMix

6. Obtain a tested DEST-vector (10 fmol needed)

$$\text{ng needed} = (\text{length of the plasmid in bp}) \times 0.0066$$

The DEST-vector should be tested for low background colonies (due to a mutated ccdB-gene) when transferred in DH5alpha-bacteria.

7. Prepare in a new Eppi the multiple Gateway reaction

OPTION A:

1 μ l ENTR-Premix
10 fmol DEST-vector
add water to a total volume of **6 μ l**

OPTION B:

10 fmol of each of the 3 ENTR-clones
10 fmol DEST-vector
add water to a total volume of **6 μ l**

From now on everything is identical again.

You can also make this reaction in a total volume of 5 μ l, but I prefer 10 μ l because I am afraid that 5 μ l dry out during the incubation over night.

8. Remove the LR-Clonase Plus Reaction Buffer from -80°C

9. Pipett 2 µl of this buffer solution to the multiple Gateway reaction

10. Remove the LR-Clonase Plus Enzyme mix from -80°C and vortex 2 x 2 sec

This is expensive stuff don't leave it to rot in the ice-bucket!

11. Add 2 µl of the Enzyme mix to the multiple Gateway reaction and mix well

It is most efficiently mixed by pipetting up and down, do not vortex.

12. Store the enzyme mix and buffer immediately at -80°C !!!

This is expensive stuff don't leave it to rot in the ice-bucket!

13. Incubate at room temperature for 16 hours or over night

I would not shorten this incubation, it is already not giving so many clones.

14. Add 1 µl of Proteinase K solution and incubate for 10 min at 37°C

This step will enhance the reaction ca. 2fold.

15. Transform DH5α bacteria

For electro competent cells use 2 µl, for chemical competent the complete mix.

Electroporation requires low concentrations of salts, that's why we can not use too much.

16. Plate bacteria with proper antibiotic selection

The pDEST R4-R3 is ampicillin resistant, all our Binary-vectors are spectinomycin resistant. If you are not sure, check first.

Known Issues:

- The reaction is not very efficient. You can obtain 20 - 200 colonies of which 70 - 80 % are correct.
- The obtained plasmids are big. To check for correct clones digest with Sty I and in parallel with Eco RI and Hind III. Compare the pattern of bands with the predicted band size to find the correct clones.

References and Comments:

I developed this protocol myself, because the supplied instructions were not clear enough and complex. I did it as described before many times and never had any problems (also the students). If it didn't work most of the cases two ENTR™ clones with identical Att-sites were used.

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<http://www.untergasser.de/lab/protocols/lr_multiple_gateway_reaction_v1_0.htm>.

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