

NEBuilder HiFi DNA Assembly Reaction

Introduction

NEB (NEBuilder HiFi DNA Assembly Reaction Protocol, 2020) recommends a total of 0.03–0.2 pmols of DNA fragments when 1 or 2 fragments are being assembled into a vector, and 0.2–0.5 pmols of DNA fragments when 4–6 fragments are being assembled. Efficiency of assembly decreases as the number or length of fragments increases. To calculate the number of pmols of each fragment for optimal assembly, based on fragment length and weight, we recommend the following formula, or using the tool, NEBicalculator.

$\text{pmols} = (\text{weight in ng}) \times 1,000 / (\text{base pairs} \times 650 \text{ daltons})$

50 ng of 5000 bp dsDNA is about 0.015 pmols

50 ng of 500 bp dsDNA is about 0.15 pmols

The mass of each fragment can be measured using the NanoDrop instrument, absorbance at 260 nm or estimated from agarose gel electrophoresis followed by ethidium bromide staining.

Materials

- NEBuilder HiFi DNA Assembly Master Mix
- Deionized H₂O
- Vector
- Insert(s)

Procedure

1. Set up the following reaction on ice:

	Recommended Amount of Fragments Used for Assembly		
	2–3 Fragment Assembly*	4–6 Fragment Assembly**	Positive Control†
Recommended DNA Molar Ratio	vector:insert = 1:2	vector:insert = 1:1	
Total Amount of Fragments	0.03–0.2 pmols* X μ l	0.2–0.5 pmols** X μ l	10 μ l
NEBuilder HiFi DNA Assembly Master Mix	10 μ l	10 μ l	10 μ l
Deionized H ₂ O	10-X μ l	10-X μ l	0
Total Volume	20 μ l ^{††}	20 μ l ^{††}	20 μ l

- * Optimized cloning efficiency is 50–100 ng of vector with 2-fold excess of inserts. Use 5-fold molar excess of insert if size is less than 200 bp. Total volume of unpurified PCR fragments in the assembly reaction should not exceed 20%.
- ** To achieve optimal assembly efficiency, design \geq 20 bp overlap regions between each fragment with equimolarity (suggested: 0.05 pmol each).
- † Control reagents are provided for 5 experiments.
- †† If greater numbers of fragments are assembled, increase the volume of the reaction, and use additional NEBuilder HiFi DNA Assembly Master Mix.

- Incubate samples in a thermocycler at 50°C for 15 minutes (when 2 or 3 fragments are being assembled) or 60 minutes (when 4–6 fragments are being assembled). Following incubation, store samples on ice or at –20°C for subsequent transformation.

Note: Extended incubation up to 60 minutes may help to improve assembly efficiency in some cases (for further details see FAQ section).

- Transform NEB 5-alpha or 10-beta Competent *E. coli* cells (provided in the cloning kit, bundle or purchased separately from NEB) with 2 μ l of the assembled product, following the transformation protocol.

References

New England Biolabs 2020. *Nebuilder Hifi DNA Assembly Reaction Protocol*. [online] Available at: <<https://international.neb.com/protocols/2014/11/26/nebuilder-hifi-dna-assembly-reaction-protocol>> [Accessed 5 December 2020].