# Genome-TALER™ & Genome-CRISPR™ Mouse ROSA26 Safe Harbor Gene Knock-in Kit

## Catalog# SH-ROS-K100
## Catalog# SH-ROS-K000
## Catalog# SH-ROS-K200
## Catalog# SH-ROS-K002

## User Manual

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# USER MANUAL

## Genome-TALER™ Mouse ROSA26 Safe Harbor Gene Knock-in Kit

## Genome-CRISP™ Mouse ROSA26 Safe Harbor Gene Knock-in Kit

# I. Introduction

### Safe gene targeting

Genome modification by insertion of genes of interest and other genetic elements in unique site(s) of chromosome(s) is of great value for cell engineering. The genetically modified cells are valuable for therapeutic research, gene function study as well as lineage tracking and analysis. All these applications depend on the reliable and predictable function of the transgene without perturbing any endogenous gene and/or other regulation element. Random integration of the transgene, on the contrary, can present a threat of unpredicted insertion or mutagenesis.

The new approach recently developed is to deliver the transgene to a predetermined and safe site in a genome. ROSA26 (also known as ROSA β geo26 locus) in mice genome is first found in chromosome 6 in one particular strain of mice-named ROSA β geo26-expressed β galactosidase from a randomly inserted transgene at high levels uniformly in nearly all tissues examined. This locus expresses one coding transcript and two noncoding transcripts, and only the non-coding transcripts are disrupted by the insertion. While pups homozygous for the insertion are born at slightly lower frequency than heterozygous pups, homozygotes appeared to develop normally and were fertile. So, the "ROSA26" locus has since been used as a transgene insertion site that causes no apparent adverse effects on fitness, and permits stable gene expression.

The GeneCopoeia ROSA26-specific TALEN or CRISPR-Cas9 systems can generate a DNA double-strand break (DSB) in ROSA26 on mouse chromosome 6, stimulating natural DNA repair mechanisms. In the presence of ROSA26 ORF knockin clones, homologous recombination (HR) occurs, resulting in integration of the DNA fragment from the ORF knockin clone into the safe harbor locus.

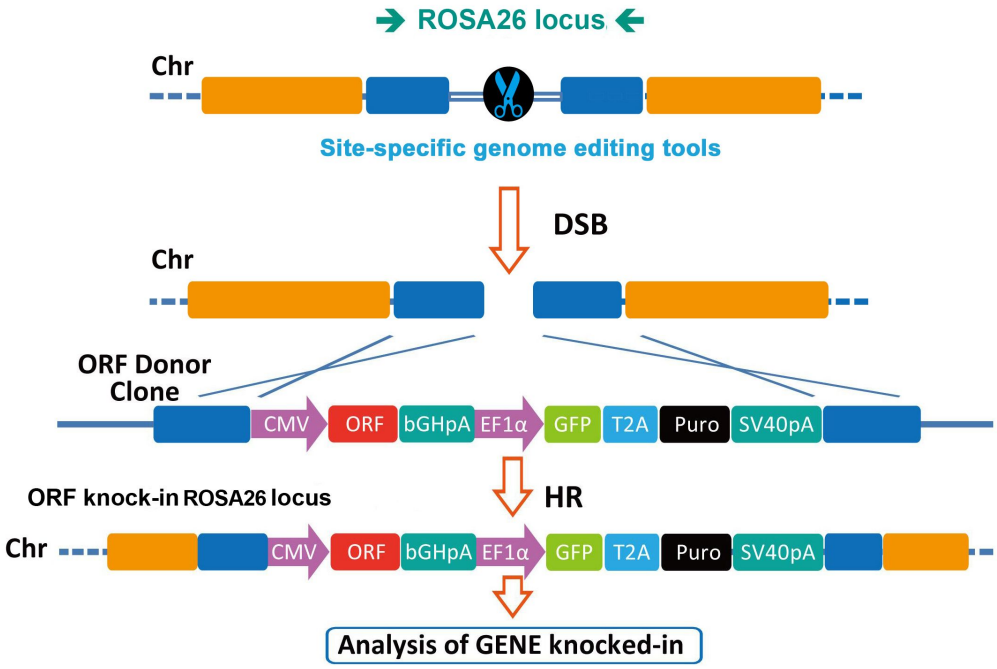



**Figure 1.** Illustration of genome-editing-tool-mediated transgene integration at the mouse safe harbor ROSA26 site.

**Introduction to TALEN**

Transcription activator-like (TAL) effectors can recognize and bind host plant promoter sequences through a central repeat domain consisting of a variable number of ~34 amino acid repeats. The residues at the 12th and 13th positions of each repeat appears to provide a simple one-to-one code for binding to each DNA base of in the target sequence, e.g. NI = A, HD = C, NG = T, and NN = G or A.

TAL effectors have been utilized to create site-specific gene-editing tools by fusing target sequence-specific TAL effectors to nucleases (TALENs), transcription factors (TALE-TFs) and other functional domains. These fusion proteins can recognize and bind chromosome target sequences specifically and execute their gene-editing functions, such as gene knockout, knockin (with donor plasmid), modification, activation, repression and more.

**Introduction to CRISPR-Cas9**

In the CRISPR-Cas9 system, the complex of a CRISPR RNA (crRNA) annealed to a trans-activating crRNA (tracrRNA) is sufficient to guide the Cas9 endonuclease to a specific genomic sequence to generate a double-strand break (DSB) in the target DNA. This system can be simplified by fusing crRNA and tracrRNA sequences to produce a synthetic chimeric single-guided RNA (sgRNA). The selected target sequence consists of a 20-bp DNA sequence complementary to the crRNA or the chimeric sgRNA, followed by the trinucleotide (5'-NGG-3') protospacer adjacent motif (PAM), which is recognized by the Cas9 and essential for cleavage. This RNA-guided DNA recognition mechanism of CRISPR-Cas9 provides a simple but powerful tool for precision genome engineering.

**The GeneCopoeia Genome-TALER ™ mouse ROSA26 safe harbor gene knock-in kit** is designed to specifically transfer your gene of interest, selection marker or other genetic element from a donor plasmid into the ROSA26 safe harbor site on mouse chromosome 6 via TALEN-mediated homologous recombination (HR). HR is a natural DNA repair mechanism that occurs in response to DNA double-strand break (DSB). This DSB is created by a ROSA26-specific TALEN.

**The GeneCopoeia Genome-CRISP ™ mouse ROSA26 safe harbor gene knock-in kit** is designed to specifically transfer your gene of interest, selection marker or other genetic element from a donor plasmid into the ROSA26 safe harbor site on mouse chromosome 6 via CRISPR-Cas9-mediated homologous recombination (HR). HR is a natural DNA repair mechanism that occurs in response to DNA double-strand breaks (DSB). This DSB is created by an ROSA26-specific CRISPR-Cas9 system .

**Advantages**

**Safe integration**
Designated ROSA26 mouse genome safe-harbor integration site ensures transcription-competency of the transgenes and presents no known adverse effect on cells.

**Specific targeting**
TALEN-mediated DNA DSBs at the ROSA26 site stimulate homologous recombination dramatically for transgene integration.

**Single copy number**
Known copy number of the transgene ensures predictable expression levels, simplifies phenotype interpretation, and prevents transgene silencing.

**Compatible knock-in ORFs**
Over 20,000 sequence-verified mouse ORFs are compatible for transgene donor DNA design.

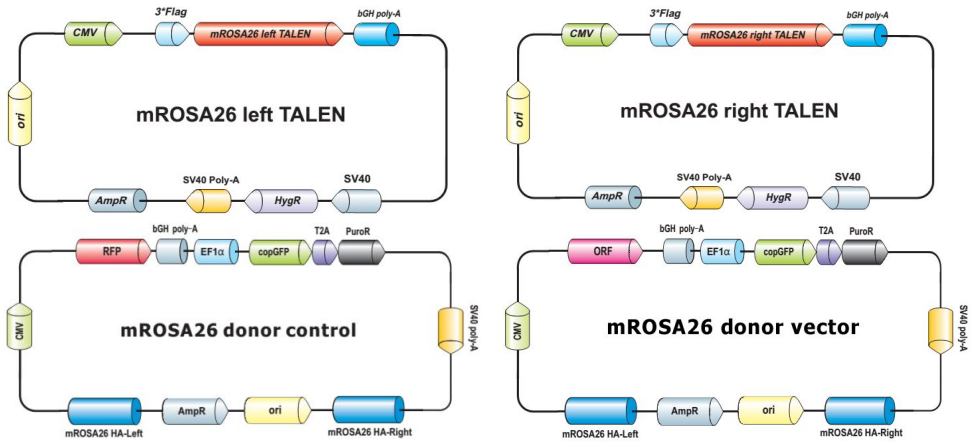
## II. Content and storage

**Genome-TALER™ mouse ROSA26 safe harbor gene knock-in kit (Cat# SH-ROS-K100)**
**Genome-TALER™ mouse ROSA26 safe harbor gene knock-in kit (without donor) (Cat# SH-ROS-K000)**

| Cat. No. | Product name | Qty | Concentration | Shipping and Storage |
|---|---|---|---|---|
| **TN-ROSA26-L** | ROSA26 left TALEN | 10 μg | 500 ng/μl | Shipped at room temperature. Stored at -20°C |
| **TN-ROSA26-R** | ROSA26 right TALEN | 10 μg | 500 ng/μl | Shipped at room temperature. Stored at -20°C |
| **DC-DON-SH02*** | ROSA26 donor vector | 10 μg | 500 ng/μl | Shipped at room temperature. Stored at -20°C |
| **DC-RFP-SH02** | ROSA26 RFP control | 10 μg | 500 ng/μl | Shipped at room temperature. Stored at -20°C |
| **MQPROSHR-5** | 5' HR primer pair | 200 reactions | 10 μM | Shipped at room temperature. Stored at -20°C |
| **MQPROSHR-3** | 3' HR primer pair | 200 reactions | 10 μM | Shipped at room temperature. Stored at -20°C |

* DC-DON-SH02 only comes with SH-ROS-K100 kit. ROSA26 knock-in ORF donor clones can be customized and purchased separately.

**(A)TALEN and donor plasmids**




**(B) Knock-in verification PCR primers**

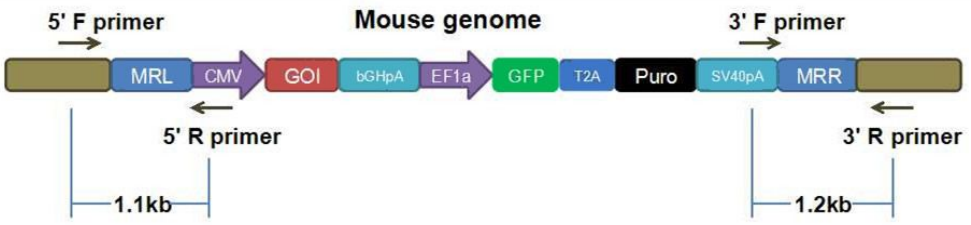


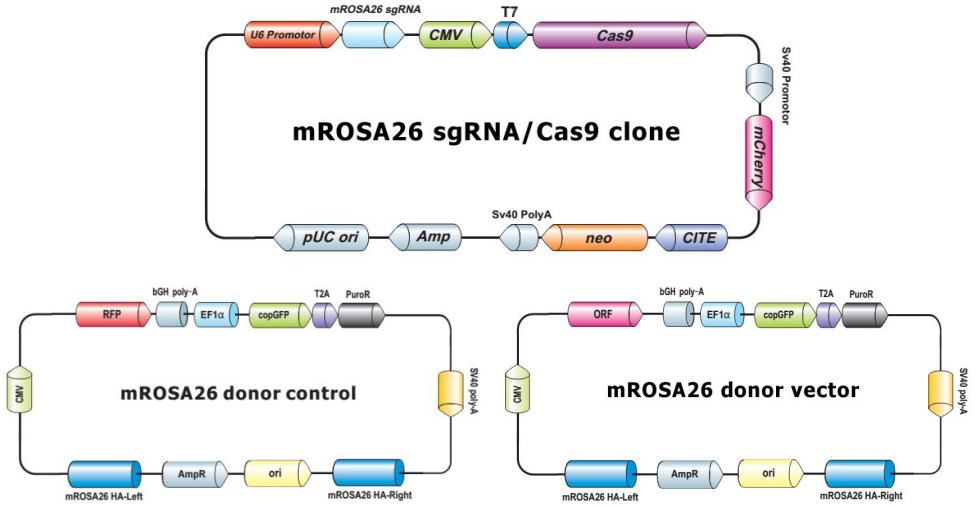

**Figure 2.** Genome-TALER™ mouse ROSA26 safe harbor gene knock-in kit components. **(A)** ROSA26 TALEN and donor plasmids **(B)** Knock-in verification primer pairs.

**Genome-CRISPT™ mouse ROSA26 safe harbor gene knock-in kit (Cat# SH-ROS-K200)**
**Genome-CRISP™ mouse ROSA26 safe harbor gene knock-in kit (without donor) (Cat# SH-ROS-K002)**

| Cat. No. | Product name | Qty | Concentration | Shipping and Storage |
|---|---|---|---|---|
| **MCP-ROSA26-CG01** | All-in-one ROSA26 sgRNA /Cas9 expression clone | 10 μg | 500 ng/μl | Shipped at room temperature. Stored at -20°C |
| **DC-DON-SH02*** | ROSA26 donor vector | 10 μg | 500 ng/μl | Shipped at room temperature. Stored at -20°C |
| **DC-RFP-SH02** | ROSA26 RFP control | 10 μg | 500 ng/μl | Shipped at room temperature. Stored at -20°C |
| **MQPROSHR-5** | 5' HR primer pair | 200 reactions | 10 μM | Shipped at room temperature. Stored at -20°C |
| **MQPROSHR-3** | 3' HR primer pair | 200 reactions | 10 μM | Shipped at room temperature. Stored at -20°C |

* DC-DON-SH02 only comes with SH-ROS-K200 kit. ROSA26 knock-in ORF donor clones can be customized and purchased separately.

**(A) CRISPR-Cas9 and donor plasmids**




**(B) Knock-in verification PCR primers**

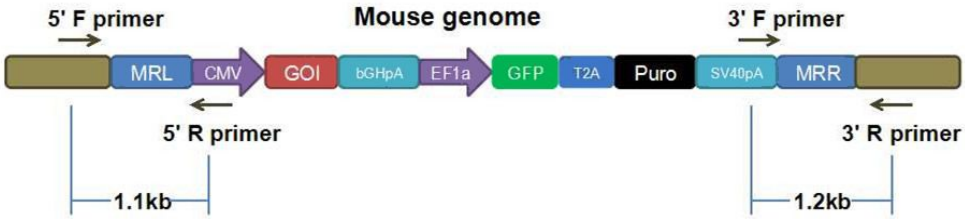



**Figure 3.** Genome-CRISP™ mouse ROSA26 safe harbor gene knock-in kit components. **(A)** ROSA26 CRISPR-Cas9 and donor plasmids **(B)** Knock-in verification primer pairs.

### Additional materials required

1.LB Agar and broth containing 50 µg/ml Ampicillin

2.6-well tissue culture plates and related tissue culture supplies

3.Other specific media and additives specific for cell type of interest

4.Any high-transformation efficiency RecA- and EndA- E.coli competent cells (GCI-5a chemically competent E. Coli, Cat# STK200-10 or -20)

5.Dulbecco's Modified Eagle's Medium (D-MEM) high glucose with sodium pyruvate and glutamine (Invitrogen, Cat. # 11995073)

6.EndoFectin™ Plus Transfection Reagent (Genecopoeia, Cat. # EFP1003-01/02)

7.Qiagen EndoFree Plasmid Maxi Kit (Qiagen, Cat. # 12362)

8.Qiagen DNeasy Blood and Tissue Kit (Qiagen, Cat. # 69504)

9.iProof High-Fidelity DNA Polymerase (BioRad, Cat. # 172-5301)

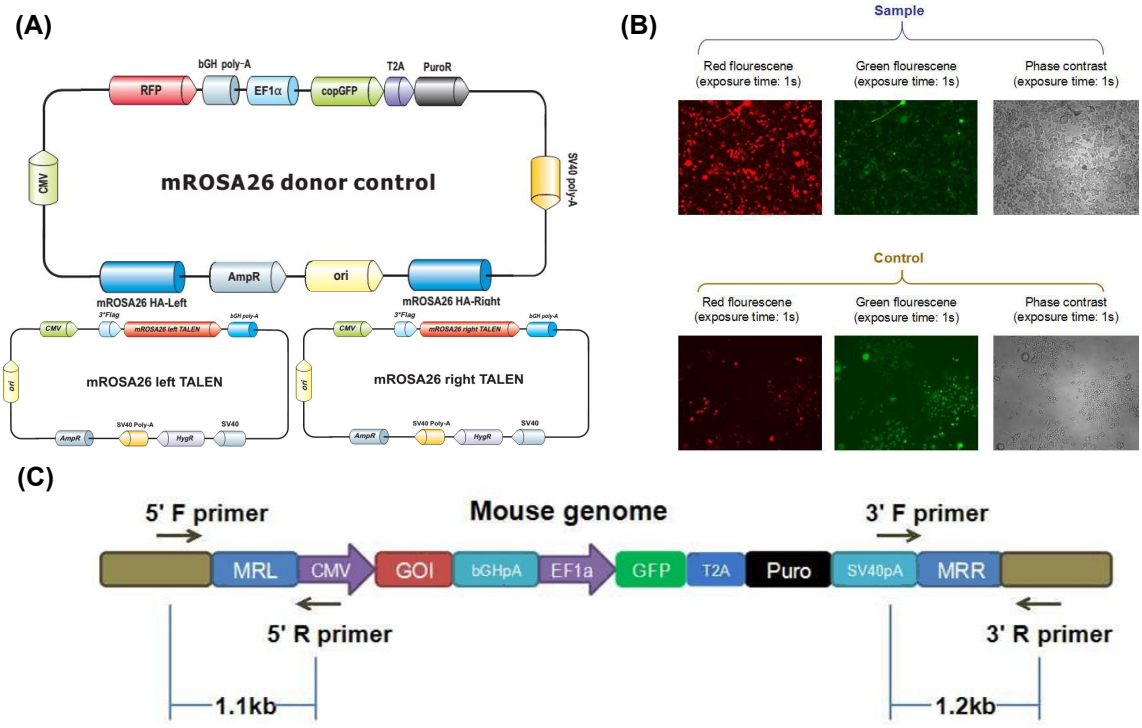
10.Fetal Bovine Serum (Invitrogen, Cat. # 16000036)

11.Penicillin/Streptomycin (Invitrogen, Cat. # 15070063)

12.Trypsin-EDTA (Sigma, Cat. # T3924)

13.**Optional** - For difficult-to-transfect cells, the use of an electroporation system (e.g. Lonza's NucleoFector or Invitrogen's Neon system) is highly recommended

## III. Example



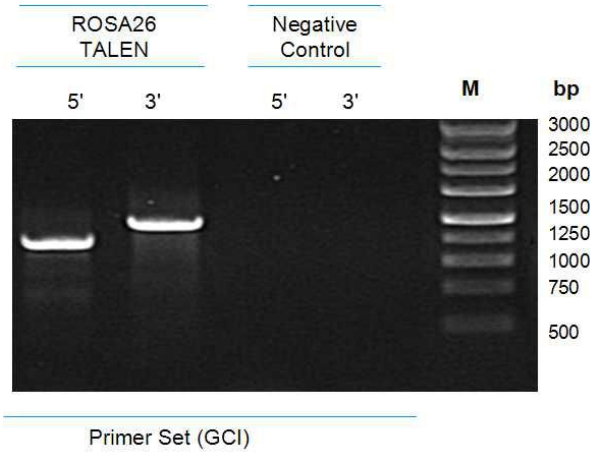




**Figure 4.** Mouse genome safe harbor ROSA26 gene targeting

**(A)** ROSA26 RFP control plasmid DC-RFP-SH02 (800 ng) was co-transfected with ROSA26 TALEN pair (600 ng for each) or control only DC-RFP-SH02 (800 ng) transfected into mouse Neuro2a cells in a 6-well pate.

**(B)** 48 hr post-transfection, the cells were split 1:10 into a new 6-well pate and selected against 1.0 μg/ml of puromycin. The images were taken after two weeks of selection. Few colonies left in the wells transfected with only ROSA26 RFP control.

**(C) (D)** PCR primers designed to amplify the HR junction were used to verify the specific and successful integration.

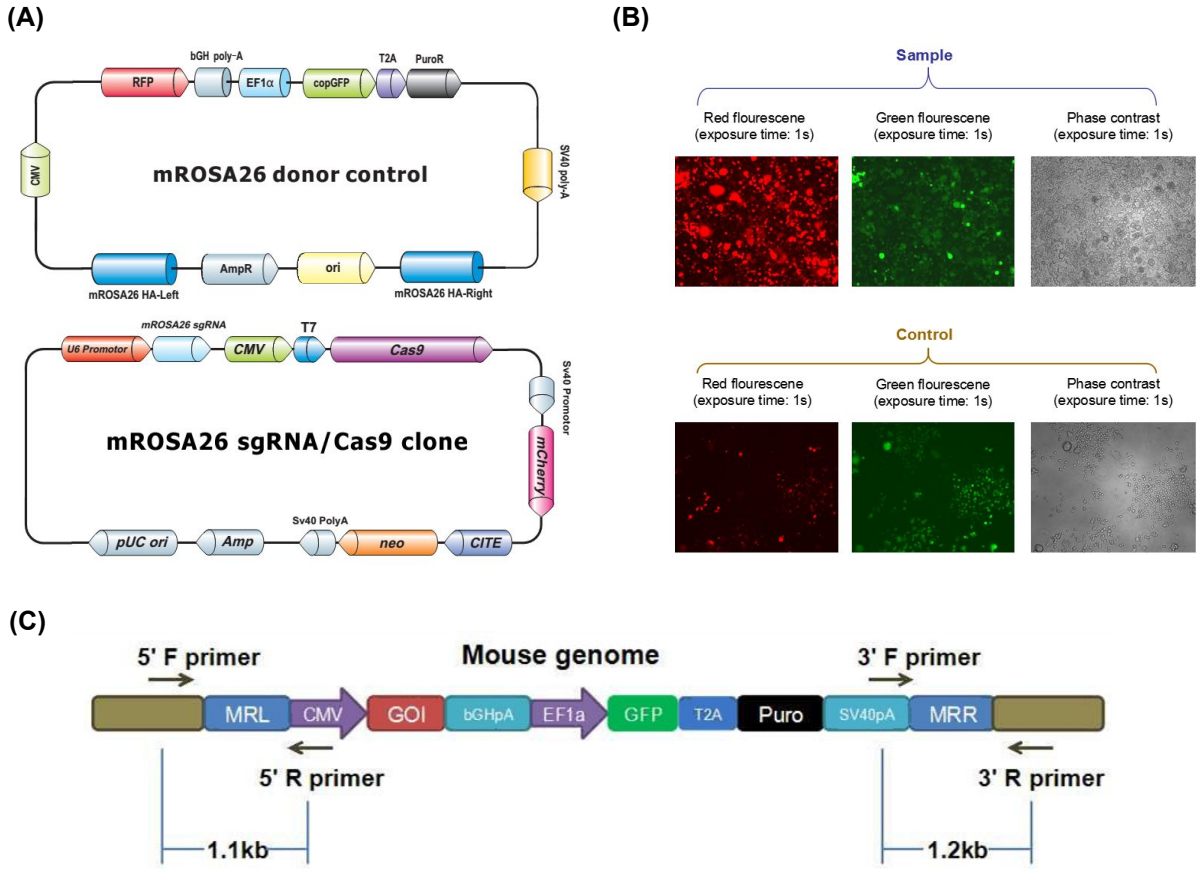


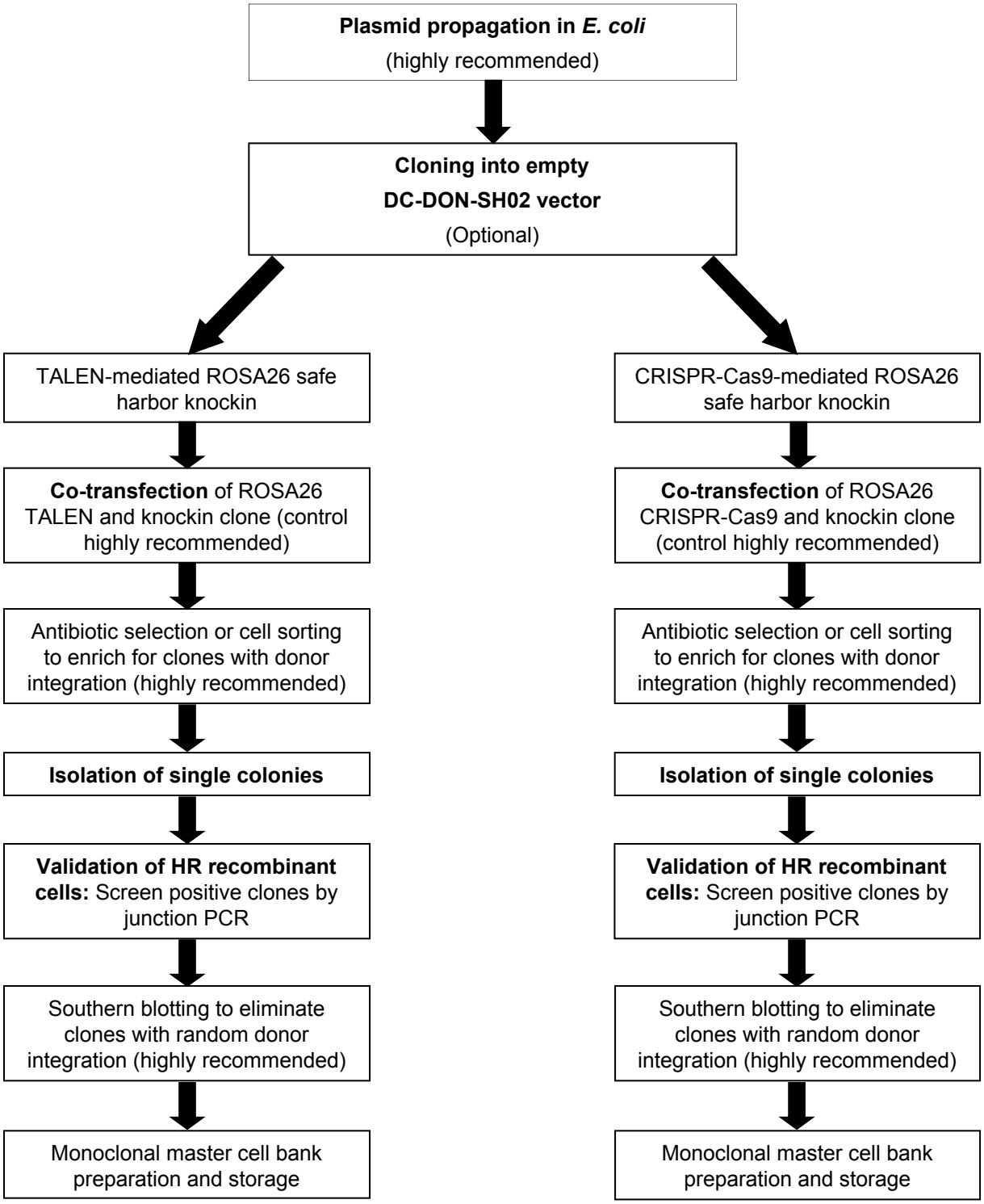

**Figure 5.** Mouse genome safe harbor ROSA26 gene targeting

**(A)** ROSA26 RFP control plasmid DC-RFP-SH02 (800 ng) was co-transfected with ROSA26 all-in-one sgRNA/Cas9 expression clone (600 ng) or control of only control plasmid DC-RFP-SH02 (800 ng) transfected into mouse Neuro2a cells in a 6-well pate.

**(B)** 48 hr post-transfection, the cells were split 1:10 into a new 6-well pate and selected against 1.0 μg/ml of puromycin. The images were taken after two weeks of selection. Few colonies left in the wells transfected with only ROSA26 RFP control.

**(C) (D)** PCR primers designed to amplify the HR junction were used to verify the specific and successful integration.

## IV. Overview of Safe Harbor Integration



## V. Critical Steps

### A. Plasmid propagation

We recommend propagating the plasmids provided in the safe harbor kit before the gene targeting experiment. Plasmids can be transformed using standard conditions suitable in any RecA- and EndA- E.coli competent cell.

For transformation of ROSA26 TALENs, ROSA26 CRISPR-Cas9 and plasmids in the DC-DON-SH02 vector, we suggest plating 50-200 μl of transformed cells on fresh LB-Ampicillin plates (50μg/ml). Incubate the plates at 37°C overnight. Inoculate colonies from the transformation and grow them at 37°C overnight in ~200ml of LB media containing 50μg/ml of Ampicillin. Use an endotoxin-free plasmid DNA maxiprep kit to extract plasmid DNA after the overnight growth.

To confirm integrity of the amplified plasmids, we recommend restriction digestion analysis or direct sequencing.

### B. Cloning into empty DC-DON-SH02 vector

**1.** Ligation

1) Digest and gel-purify the vector plasmid. Dilute it to 10ng/μl.

2) Set up 10μl ligation reaction for each control and test sample:

| Volume | Item |
|---|---|
| 1.0 μl | Digested DC-DON-SH02 empty vector |
| 7.0 μl | DNA insert (~30-50 ng) or water control |
| 1.0 μl | 10X T4 DNA ligase buffer |
| 1.0 μl | T4 DNA Ligase (40 U/μl) |
| **10.0 μl** | **Total Reaction Volume** |

3) Incubate reactions at 25℃ for 1-2 hours (sticky-end ligation) or O/N at 16℃ (for blunt-end ligation)

**2.** Transformation

Transform competent cells (transformation efficiency at least 1x109 colonies/μg pUC19) with the whole ligation reaction (10μl) following the provided protocol of the competent cells. Plate the transformed competent cells on LB-Ampicillin/Carbencillin agar plates.

**3.** Screening correct clones

1) Depending on the ratio of colony numbers for the cDNA sample vs. the negative control sample, randomly mark 5 or more well-isolated colonies.

2) Prepare a PCR Master Mix with PCR primers flanking the insert:

| 1 rxn | 10 rxn | Composition |
|---|---|---|
| 0.1 µl | 1 µl | 5' PCR primer (10 µM) |
| 0.1 µl | 1 µl | 3' PCR primer (10 µM) |
| 0.2 µl | 2 µl | 50X dNTP mix (10 mM of each) |
| 2.5 µl | 25 µl | 10X PCR Reaction Buffer |
| 21.9 µl | 219 µl | Nuclease-free water |
| 0.2 µl | 2 µl | Taq DNA polymerase (approx. 5 U/µl) |
| **25 µl** | **250 µl** | **Total volume** |

3) Mix the master mix very well and aliquot 24 µl into each well of 96-well PCR plate or individual tubes.

4) Pick the each marked colony from step 1) using sterilized tips and mix it to each well (or tube).

5) Proceed with PCR using the following program:

| | |
|---|---|
| 94°C, 4 min | 1 cycle |
| 94°C, 0.5 min, then 68°C, 1 min/1 kb* | 25 cycles |
| 68°C, 3 min | 1 cycle |

* Depending on the size of final PCR product, use a shorter or longer time.

6) Take 5 µl of the PCR reaction and run it on a 1.2% agarose/EtBr gel in 1X TAE buffer to identify clones with correct insert.

**4.** Inoculate a positive colony containing insert in an appropriate amount of LB-Ampicillin / Carbenicillin broth. Incubate at 37°C overnight. Extract and purify the construct using an endotoxin-free plasmid purification kit. Sequence verification of the insert is optional.

**C. Co-transfection of ROSA26 genome editing tools and donor plasmid**

**1.** Plate ~100,000 to 300,000 cells/well in a 6-well plate following the recommended conditions for cell type(s) being transfected. Include wells for the following: On the day before transfection, trypsinize and count the cells. The number of cells plated in each well should be determined so that they are 70-80% confluent at the time of transfection.

a) ROSA26 TALENs (or MCP-ROSA26-CG01) + positive control DC-RFP-SH02
b) Positive control DC-RFP-SH02 only
c) ROSA26 TALENs (or MCP-ROSA26-CG01) + donor in vector DC-DON-SH02
d) Donor in vector DC-DON-SH02 only

**2.** The next day, prepare transfection complexes of genome editing tool plasmids and donor plasmids using suitable transfection reagents according to the manufacturer's instructions. Leave the transfection complexes on the cells to react for >6 hours.

Example: For Neuro2A cells using EndoFectin™ Plus Transfection Reagent, transfect 0.5μg of each TN-ROSA26-L and TN-ROSA26-R vectors (1μg total) and 1μg of donor vector.

Tech Notes:

1) Since transfection efficiencies vary across different cell lines, we recommend optimizing the input of genome editing tool plasmids to donor vectors for best results. We recommend starting with a 1:1 ratio (e.g. 1μg of donor HR plasmid, 0.5μg of each TALE Nuclease plasmid, or 1μg of MCP-ROSA26-CG01 plasmid).

2) For optimal results, we recommend complexing DNA with transfection reagent in serum- and antibiotic-free media and cells growing in complete media (e.g. DMEM/F12+10% FBS w/o antibiotics).

3) For hard-to-transfect cells (e.g. primary, stem, hematopoietic), it may be advisable to utilize a non-passive transfection method. Please follow recommended guidelines provided by the manufacturer for the specific cell type(s) being transfected.

**3.** 24 hours post-transfection, remove transfection media and split the cells 1:10 and 1:20 in complete growth media w/antibiotics. Plate cells into 6-well plates and save a set of plate(s) for characterization of samples by junction-PCR assay (see below). Allow cells to recover for 24 hours.

4. Begin puromycin selection 48 hours post-transfection. For Neuro2A cells, the recommended concentration of puromycin is 1 μg/ml.

Tech Note:

Establishing a kill-curve on untransfected cells can determine the effective working puromycin concentration for a target cell line. The concentration of puromycin (typical working range of 0.5μg-5μg/ml) that kills >90% of cells after 48hours of selection is the correct dose for the cells being selected.

**D. Clonal isolation of cell lines**

Serial dilution is widely used to isolate single clones with desired modifications, followed by an expansion period to establish a new clonal cell line. Like most clonal isolation methods, there is no guarantee that the colonies arose from single cells. A second round is advised to increase the likelihood of clonal isolation. Also, it is worth noting that cell types can vary substantially in their responses to single-cell isolation, therefore literature specific to the cell type of interest should be consulted.

**1.** Fill each well of a sterile 96-well plate with 100μl of medium except for well A1, which should remain empty.

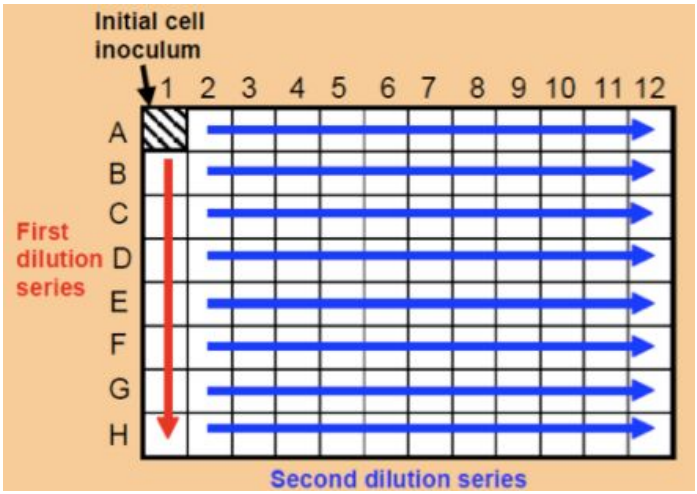



**Figure 6.** Illustration of serial dilution.

**2.** Add 200μl cell suspension to well A1. Mix 100μl from A1 with the medium in well B1. Avoid bubbles. Continue this 1:2 dilution through column 1. Add 100μl of medium back to column 1 so that wells A1 through H1 contain 200μl.

**3.** Mix cells and transfer 100μl of cells from column 1 into column 2. Mix by gently pipetting. Avoid bubbles. Repeat these 1:2 dilutions through the entire plate. Bring the final volume to 200μl by adding 100μl of medium to all but the last column of wells.

**4.** Incubate plates undisturbed at 37℃.

**5.** Cells will be observable via microscopy over 3 days and be ready to score in 5-8 days, depending on the growth rate of cells. Mark each well on the cover of the plate indicating which well contains a single colony. These colonies can later be subcultured from the well into larger vessels.

Tech Note:

1) Adding 4000 cells in well A1 (2×104 cells/ml) is a good starting concentration. Increase the concentration for more difficult to grow cell lines.

2) If the reporter gene is fluorescent, determine which of these colonies express it. If the reporter gene is not observable you will have to wait until later in the culture process.

3) Label each well with a single colony using a unique identification number and record this number on the plate and in your notebook.

**E. Validation of HR recombinant cells**

**1.** Assay for genome editing tools cutting and HR of donor vectors on samples as follows:

1) ROSA26 TALENs (or MCP-ROSA26-CG01) + positive control DC-RFP-SH02:
Select cells in Puromycin for 7-10 days. The resulting colonies should be RFP & GFP positive.

2) Positive control DC-RFP-SH02 only:
Select cells in Puromycin for 7-10 days, after which very few colonies (if any) should be seen compared with Sample a. The presence of PuroR, RFP/GFP+ colonies indicates random integration events.

3) ROSA26 TALENs (or MCP-ROSA26-CG01) + donor in vector DC-DON-SH02
Select cells in Puromycin for 7-10 days, after which colonies should be GFP positive. Expression of the insert may be detected by qPCR or Western blot.

4) Donor in vector DC-DON-SH02 only
Select cells in Puromycin for 7-10 days, after which very few colonies (if any) should be seen compared with Sample c. The presence of PuroR, GFP+ colonies indicates random integration events.

**2.** To confirm donor vector integration specifically at the ROSA26 target locus, junction-PCR can be performed using PCR primer pairs that flank the 5' ROSA26 homology arm (5' ROSA26-HA-L) and 3' ROSA26 homology arm (3'ROSA26-HA-R).

**3.** Protocol for Junction-PCR

1) Primer sequences

| Primer description | Primer name | Primer sequence |
|---|---|---|
| 5' ROSA26 Positive Control Donor - Forward Primer | MQPROSHR-5F | See datasheet |
| 5' ROSA26 Positive Control Donor - Reverse Primer | MQPROSHR-5R | See datasheet |
| 3' ROSA26 Positive Control Donor - Forward Primer | MQPROSHR-3F | See datasheet |
| 3' ROSA26 Positive Control Donor - Reverse Primer | MQPROSHR-3R | See datasheet |

The primers are provided as mixes (F/R primers) at 10μM. Validation of either the 5' or 3' homology arms for donor integration is usually sufficient; however, both arms can be done for additional confirmation.

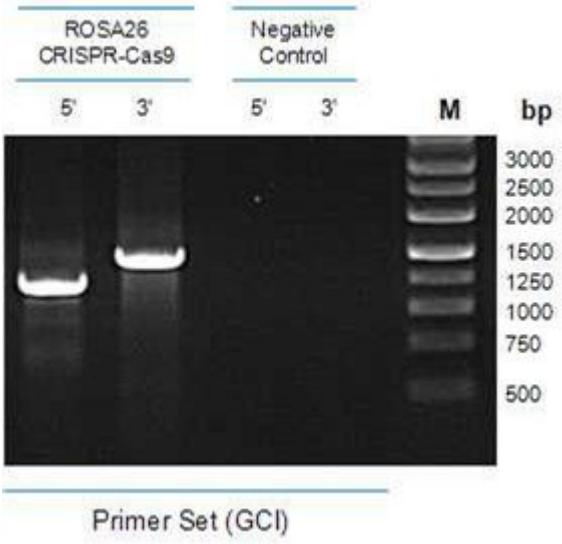
2) Protocol details for junction-PCR assay:

a) Isolate genomic DNA from positive control cells or test sample cells using a suitable genomic DNA miniprep kit. Please follow the protocol recommended by the manufacturer.

b) Perform junction-PCR (PCR reaction below)

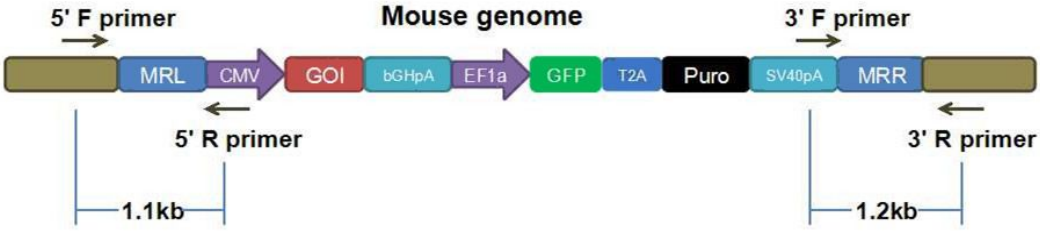
| Reagent | TALEN cut+ positive control donor | Positive control donor only |
|---|---|---|
| Genomic DNA(60~100ng/μl) | 1 μ l | 1 μ l |
| 10 μ M 5' (or 3') ROSA26 PCR Primer Mix | 1 μ l | 1 μ l |
| 5×UltraPFTM Buffer (Mg2+ free) | 5 μ l | 5 μ l |
| 10 mM dNTPs | 0.5 μ l | 0.5 μ l |
| 20mM MgSO4 | 2.5 μ l | 2.5 μ l |
| UltraPF(5U/ μ l) | 0.25 μ l | 0.25 μ l |
| PCR-grade distilled water | 14.75 μ l | 14.75 μ l |
| **Total** | **25 μ l** | **25 μ l** |

98°C, 5min
98°C, 20sec
55°C, 30sec } 35 cycles
72°C, 1min
72°C, 7min
Hold at 4~16°C




Run the PCR reaction on a 1% Agarose/EtBr gel in 1X TAE buffer to confirm the Junction-PCR result.

Sample results for 5' and 3' Junction-PCR Assay shown below:



Tech Note:

1)If the 3’junction PCR band is weaker than 5’ junction PCR band, it is likely that the amplification efficiency for the 3’junction region is lower due to the nature of the chromosomal structure, modification and sequence around that region.

2)One positive in junction PCR is sufficient to confirm the integration.

3)Though rare, it is possible that random integration can coexist with ROSA26-specific integration. Southern blotting can be used to detect coexisting random integration. The method is described in:
http://www.bloodjournal.org/content/117/21/5561

## VI. References

1. Zou, J. et al. 2009. Gene targeting of a disease-related gene in human induced pluripotent stem and embryonic stem cells. Cell Stem Cell. 2009 Jul 2;5(1):97-110

2. Sadelain, M. et al. 2011. Safe harbours for the integration of new DNA in the human genome. Nat Rev Cancer. 2011 Dec 1;12(1):51-8.

3. van Rensburg, R. et al. 2013. Chromatin structure of two genomic sites for targeted transgene integration in induced pluripotent stem cells and hepatopoietic stem cells. Gene Therapy. 2013 20(2):201-14.

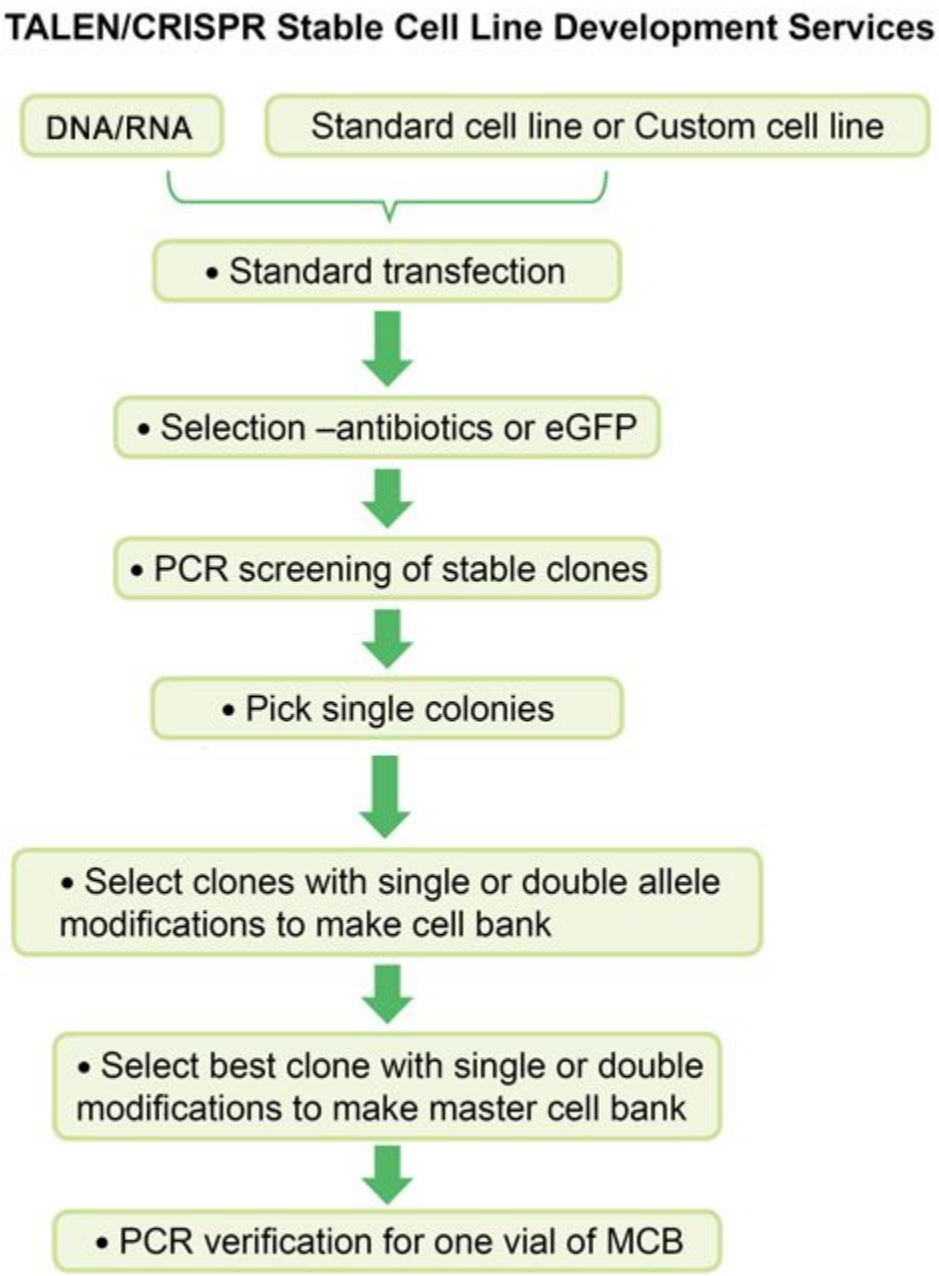
4. Papapetrou, EP. et al. 2011. Genomic safe harbors permit high ß-globin transgene expression in thalassemia induced pluripotent stem cells. Nat. Biotechnol. 2011 29(1):73-8.

5. Lombardo, A. et al. 2011. Site-specific integration and tailoring of cassette design for sustainable gene transfer. Nat. Methods. 2011 8(10):861-9.

## VII. Related Services

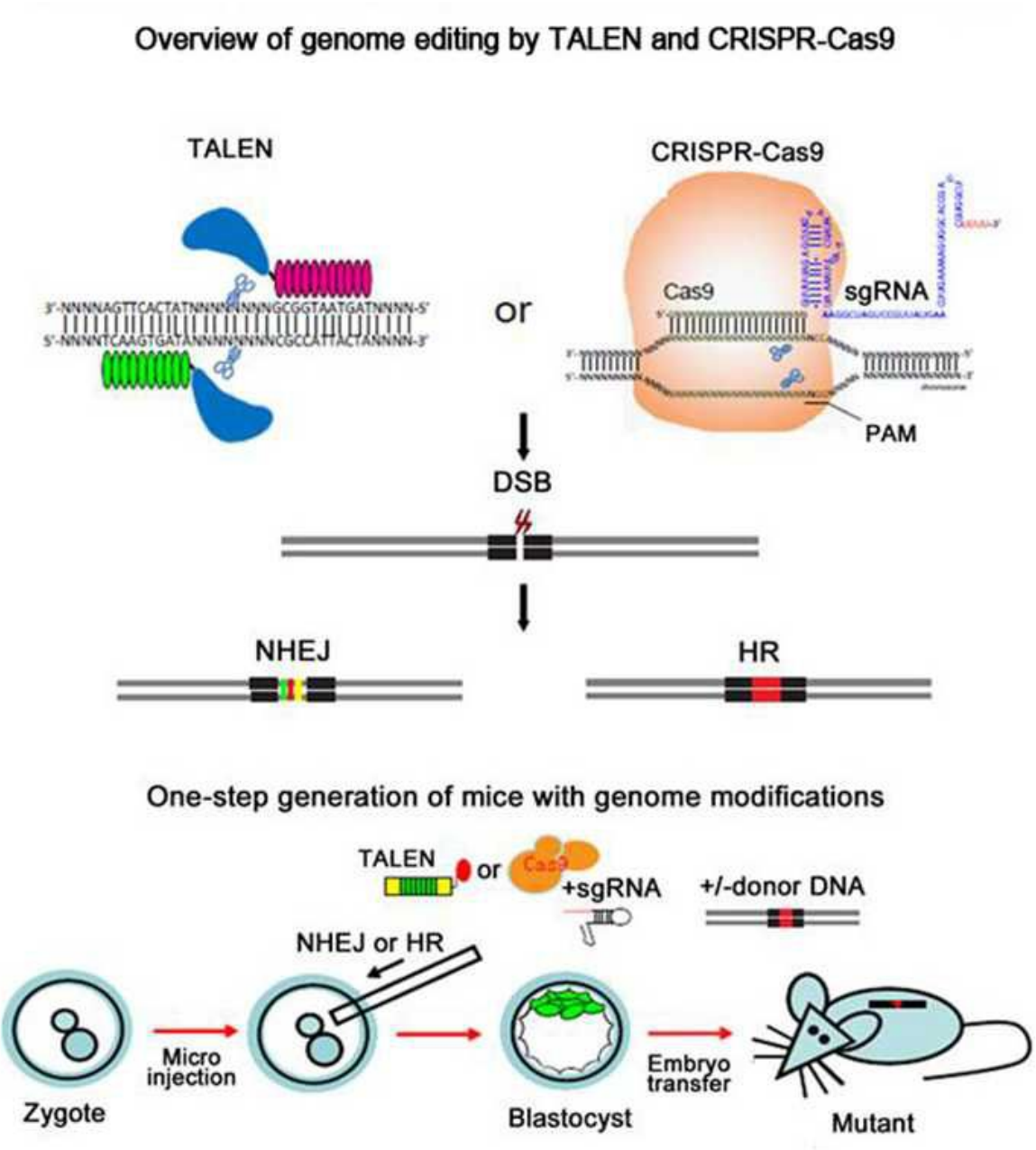
**Stable cell line services**

GeneCopoeia offers monoclonal stable cell line service with customized TALEN- or CRISPR-Cas9-mediated genome modifications. Cell banking service is also available.



**Transgenic mouse services**

GeneCopoeia offers transgenic mice with customized TALEN- or CRISPR-Cas9-mediated genome modifications.



## VIII. Limited Use License and Warranty

**Limited Use License**

Following terms and conditions apply to use of the Genome-TALER™ mouse ROSA26 Safe Harbor Gene Knock-in Kit & Genome-CRISP™ mouse ROSA26 Safe Harbor Gene Knock-in Kit (the Product). If the terms and conditions are not acceptable, the Product in its entirety must be returned to GeneCopoeia within 5 calendar days. A limited End-User license is granted to the purchaser of the Product. The Product shall be used by the purchaser for internal research purposes only. The Product is expressly not designed, intended, or warranted for use in humans or for therapeutic or diagnostic use. The Product must not be resold, repackaged or modified for resale, or used to manufacture commercial products or deliver information obtained in service without prior written consent from GeneCopoeia. This Product should be used in accordance with the NIH guidelines developed for recombinant DNA and genetic research. Use of any part of the Product constitutes acceptance of the above terms.

**Limited Warranty**

GeneCopoeia warrants that the Product meets the specifications described in the accompanying Product Datasheet. If it is proven to the satisfaction of GeneCopoeia that the Product fails to meet these specifications, GeneCopoeia will replace the Product. In the event a replacement cannot be provided, GeneCopoeia will provide the purchaser with a refund. This limited warranty shall not extend to anyone other than the original purchaser of the Product. Notice of nonconforming products must be made to GeneCopoeia within 30 days of receipt of the Product. GeneCopoeia's liability is expressly limited to replacement of Product or a refund limited to the actual purchase price. GeneCopoeia's liability does not extend to any damages arising from use or improper use of the Product, or losses associated with the use of additional materials or reagents. This limited warranty is the sole and exclusive warranty. GeneCopoeia does not provide any other warranties of any kind, expressed or implied, including the merchantability or fitness of the Product for a particular purpose.

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