## Lentiviral shRNA expression Cloning Kit User Manual

for generating shRNA expression lentivectors

<table>
<thead>
<tr>
<th>Cat#</th>
<th>Product Name</th>
<th>Amount</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTSH-H1-GB</td>
<td>pEco-Lenti-H1-shRNA-(GFP-Bsd) cloning kit</td>
<td>1 kit</td>
<td>shRNA expression lentivector with <strong>GFP-Blasticidin</strong> selection marker</td>
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<tr>
<td>LTSH-H1-GP</td>
<td>pEco-Lenti-H1-shRNA-(GFP-Puro) cloning kit</td>
<td>1 kit</td>
<td>shRNA expression lentivector with <strong>GFP-Puromycin</strong> selection marker</td>
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<tr>
<td>LTSH-H1-RB</td>
<td>pEco-Lenti-H1-shRNA-(RFP-Bsd) cloning kit</td>
<td>1 kit</td>
<td>shRNA expression lentivector with <strong>RFP-Blasticidin</strong> selection marker</td>
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<tr>
<td>LTSH-H1-RP</td>
<td>pEco-Lenti-H1-shRNA-(RFP-puro) cloning kit</td>
<td>1 kit</td>
<td>shRNA expression lentivector with <strong>RFP-Puromycin</strong> selection marker</td>
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### Contents of Each Kit

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
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<tr>
<td><strong>One pre-cut, linear vector:</strong> pEco-Lenti-H1 / U6-(<strong>Marker</strong>) linear vector; (dependent upon the each product catalog #, the <strong>Marker</strong> is different).</td>
<td>10ul (10rxn)</td>
</tr>
<tr>
<td>10x shRNA oligo annealing solution</td>
<td>50ul</td>
</tr>
<tr>
<td>5X ligation buffer</td>
<td>25 ul</td>
</tr>
<tr>
<td>T4 DNA ligase enzyme</td>
<td>10ul (10rxn)</td>
</tr>
<tr>
<td><strong>Cloning positive control insert:</strong> annealed shRNA duplex [1x]</td>
<td>10ul (10rxn)</td>
</tr>
<tr>
<td>5'- <strong>AGCTgaaacgatatggtgtcgataacCGAGgtattcgcccatatatgctttc</strong>acttgcattacgccgacttatagGCTCCataagtccgtatagcaaatGAAA**</td>
<td></td>
</tr>
<tr>
<td><strong>Sequencing primer:</strong></td>
<td></td>
</tr>
<tr>
<td>5'- <strong>ggatccaatatgtgcatgctatg (for H1 promoter)</strong></td>
<td>1 tube (10ul x 25ng/ul ) (10 rxn)</td>
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<tr>
<td>Or</td>
<td></td>
</tr>
<tr>
<td>5'- <strong>ggactatatgctgtaccc (for U6 promoter)</strong></td>
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</tbody>
</table>

**Note:** Chemically competent cells are required for the cloning, but not included with this kit. You can use any common competent cells, like DH5α, NovaBlue or others.
Storage:

shRNA Cloning Kit is shipped on dry ice. Each kit contains sufficient amounts for 10 shRNA cloning reactions. Store at -20°C. Products stable for 6 months.

Quick protocol outline (for experienced users):

1. Design two DNA oligonucleotides, hairpin structure encoding shRNA sequence,
2. Anneal the two oligos to generate a duplex;
3. Clone the duplex into provided linear pEco-shRNA vector by T4 ligation reaction;
4. transform into competent cells and grow in LB + ampicillin plate;
5. Pick 1-2 colonies, mini prep the plasmid DNAs, confirm positive clone by sequencing;
6. knockdown analysis after transfection of shRNA plasmids into mammalian cells;
7. Produce shRNA lentivirus and transduced into desired cells for knockdown analysis or generate shRNA stable cells. (Note: to produce the shRNA knockdown lentivirus, you require the virus production cell line (CAT#: TLV-C) and virus packaging plasmid mixture (CAT#: HT-Pack), which are not included in this cloning kit, but available for purchase).

Cloning Scheme
**human U6 promoter**

1

GGATCC**AATA** TTTGCA**TATGC** GCTATG**TGT** CTGGGAA**ATC** ACCATAAACG 
CTTAGGTTAT AAACGTACAG CGATACACAA GACCCTTTTAG TGTATTTTGCE 
TRBS TRBS 

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

51

TGA**AATCCCT** ATG**AAGGG** GA**A**CTTTATA AG**T** GGATATA CAGTG**G**AATGAG 
ACTTTAG**GG**A TAG**T**CACTAT CTCTGAATAT TCA**ACTAT**CAT 

Transcription start

101

GA TTTTTG**G**GCCGGCC ACCGGTTAGT AATGATG**C**AC AATCAACCTC 
CTT**CCG** CCGGGCCGG TGGCAAATCA TTACTAGCTG TTATGGGAG 

TRBS: Tetracycline Repressor Binding Site.

---

**human H1 promoter**

1

GGATCC**AATA** TTTGCA**TATGC** GCTATG**TGT** CTGGGAA**ATC** ACCATAAACG 
CTTAGGTTAT AAACGTACAG CGATACACAA GACCCTTTTAG TGTATTTTGCE 
TRBS TRBS 

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

51

TGA**AATCCCT** ATG**AAGGG** GA**A**CTTTATA AG**T** GGATATA CAGTG**G**AATGAG 
ACTTTAG**GG**A TAG**T**CACTAT CTCTGAATAT TCA**ACTAT**CAT 

Transcription start

101

GA TTTTTG**G**GCCGGCC ACCGGTTAGT AATGATG**C**AC AATCAACCTC 
CTT**CCG** CCGGGCCGG TGGCAAATCA TTACTAGCTG TTATGGGAG 

TRBS: Tetracycline Repressor Binding Site.
Vector Schematic maps

**Introduction:**

RNA interference (RNAi) technology is a tool for loss-of-function (knockdown/silencing) studies in mammalian cells without need to make knock-out germline cells. Originally, double-strand short RNAs were found *in vivo*, inhibiting gene expression. The mechanism of action is a series of enzymatic reactions mediated by short RNAs that are complementary in sequence to the silenced targets, leading to mRNA degradation or translational repression. RNAi knockdown can be introduced by synthetic short double-strand RNA (siRNA) or vector expressed stem-hairpin RNA (shRNA) which is further processed by Dicer enzyme to produce double-strand short RNAs. Another category of RNAi found *in vivo* is micro-RNA (miRNA) which has similar knockdown mechanism. Native or artificial miRNA can be processed from pre-micro RNA that are expressed via vectors. Chemically synthesized double stranded RNA (siRNA) is only for transient silencing effect. In contrast, vector expressed RNAi can provide a long term effect by stable selection.

Vector expressed RNAi for gene silencing provides an alternative, convenient method for functional studies in both animal and cell line models. Variety of RNAi vectors are now commercially available.

Lentivectors are HIV-1 (Human Immunodeficiency Virus 1) derived plasmids, used to generate lentiviral particles (lentivirus) that can be transduced into virtually all kinds of mammalian cell
types or organs, including stem cells, primary cells and non-dividing cells both in vivo and in cell culture system. Particles stably integrate into the transduced cell’s genome for long term expression.

**shRNA expression vectors with different markers:**

Amsbio provides cloning kits for making shRNA lentiviral expression vectors with different selection markers (Blasticidin, Puromycin, GFP-blasticidin, GFP-puromycin, RFP-blasticidin, and RFP-puromycin). The shRNA expression is driven by RNA polymerase III promoter, the optional inducible H1 promoter or the constitutive U6 promoter. The promoters are precisely positioned to ensure the production of the precise shRNA transcripts.

**About promoter selection:** U6 and H1 are polymerase III promoters, best suitable for transcription of short RNA molecules. Both are active in majority of mammalian cell types, but one could function better than the other in some cell types. Unless you already know or have validated which promoter is better or stronger in your specific cell types, you can select either promoter for shRNA expression. The H1 promoter is also an optional inducible promoter so the H1 can be used as regular constitutive expression (just like U6 promoter) or optionally used for tetracycline inducible expression when the repressor (tetR) is present in cells. For inducible expression, the shRNA expression is repressed in the presence of TetR and induced by tetracycline presence. The expression of TetR can be achieved by using the Tet-repressor stable cell line (Cat# SC005) or by using pre-made Tet-repressor lentiviral particles, or co-transfection with the TetR expression vectors.

This lentiviral version of shNA vector allows generation of shRNA lentiviral particles that can be transduced into your desired cell line. The shRNA stable expressing cells can then be selected by antibiotic or sorted via a fluorescent signal when applicable. (Note: to produce the shRNA knockdown lentivirus, you require the virus production cell line (CAT#: TLV-C) and virus packaging plasmid mixture (CAT#: HT-Pack), which are not included in this cloning kit, but available for purchase.

**Each kit contains a pre-cut, ready-to-use linear vector for ligation of shRNA duplex sequence.**

The linear vector was designed for cloning of double-strand DNA encoding a short hairpin RNA. Once transcribed, the shRNA is processed into short RNA in vivo for RNAi analysis. To make shRNA expressing vector, two synthetic oligonucleotides are first annealed to form the DNA duplex which is then cloned into the ready-to-use, linear vector via T4 enzyme ligation.

Each Kit provides enough materials for 10 cloning reactions, for generation of your own lentiviral shRNA expressing clones with the following advanced features.
Key Features:

1. **Linearized vector** is ready for use, no need for the tedious bench work to prepare the vector backbone;
2. **Precise directional cloning** of your DNA duplex encoded shRNA structure;
3. **Rapid, high efficient cloning** with low background (Room temperature for 30-60 min, >90% positive rate);
4. **Internal fluorescent reference**: some vectors encode a fluorescent protein (GFP or RFP), allowing real-time monitoring of the transfection or virus transduction efficiency;
5. **Long-term stable silencing effect**: the vector encodes an antibiotic marker or a dual marker (a fluorescent-antibiotic fusion marker) allowing generation of stable cell lines for long-term knockdown;
6. **Generated lentiviral shRNA particles can be transduced into your cells of interest** (Note: lentivirus can be transfected into cells for gene expression knockdown. It can produce lentivirus to transduce the hard-to-transfect cells for long term knockdown study.)
7. **Optional inducible knockdown**: The H1 version shRNA lentivector can be used for constitutive high expression of shRNA without need for any induction. Optionally, the vector’s human H1 promoter allows the inducible expression of shRNA when the tetracycline repressor protein (TetR) exists in advance.
8. **Insert compatible**: the same annealed shRNA duplex can be readily cloned into all other linear shRNA lentivectors with different promoter or different selection markers.

Protocols:

1. **Design single-stranded DNA oligonucleotide**:

   Design two DNA oligonucleotides, a top strand and a bottom strand according to the following structure. The top strand has AGCG overhang at its 5’-end, followed by the selected target sequence (sense sequence) at 19 ~21 nucleotides, a CGAG loop (or use your own loop), and the reverse-complementary to the target sequence (antisense). The bottom strand has AAAA-overhang at its 5’-end and the rest is complementary to the top strand.

   Overhang Sense (19-21nt) loop Antisense (19-21nt)

   5’ AGCG NNNN…NNNNCGAGNNNN…NNNN
   NNNN…NNNNGCTCNNNN…NNNNAAAA 5’

   Overhang
Loop length has little or no effect on knockdown. Four nucleotides (CGAG) here have been tested good, minimal length for effective RNAi knockdown. You may design your own loop sequence such as a restriction enzyme (RE) recognition sequence. However, most RE sequences are palindrome structures which form a continuous hairpin structure with your RNAi sequence, which may not be processed correctly into RNAi by Dicer in vivo.

Two overhangs ensure the directional cloning of the annealed double stranded oligo into provided linear vector.

The transcription start site is at the first nucleotide of the target sequence (sense) on the top strand. Native H1 RNA initiates at an A, so A is recommended as the first base in sense target sequence.

shRNA target sequence (sense) selection:
There are some general guidelines for selection of effective shRNA sequence. Many online tools can help you select your shRNA sequence. Please see the following links. But the effective RNAi target sequence has to be empirically verified. To avoid the off-target effect, design a scrambled sequence (from selected shRNA sequence) or a universal null sequence as a negative control for knockdown analysis.
1. Promega’s siRNA Target Designer;
2. Clontech’s RNAi Target Sequence Selector;
3. Gene Link shRNA designer;
4. Invitrogen’s BLOCK-iT™ RNAi Designer;
5. katahdin RNAi Central;
6. WI siRNA selection program;

2. Cloning of shRNA expression plasmids:
   • Anneal the designed two single-stranded DNA oligonucleotide:
     Set up the annealing reaction as follows:
     
     | Component                  | Volume  |
     |----------------------------|---------|
     | 100 μM Top strand oligo    | 10 μl   |
     | 100 μM Top strand oligo    | 10 μl   |
     | 10X oligo annealing buffer  | 3 μl    |
     | DNase-free water           | 7 μl    |
     | Total volume               | 30 ul   |

     Incubate reaction mixture at 95°C for 5 minutes (can be done in PCR machine). Leave the mixture on the PCR machine to gradually cool down for 30 minutes. Then put the tube on ice. Make 1:1000 dilution (add 1ul annealed mixture in 99 μl Cold-DNase free water, and then take 2ul, add into 18ul of 1x annealing solution on ice). Final diluted annealed duplex is ready for ligation. Save undiluted duplex at -
20°C for long term storage. **(Note:** always put diluted, annealed duplex on ice to avoid double strand DNA melt.)

- **Ligation reaction:**
  Set up the ligation reaction as follows:
  - pEco-Lenti-H1-shRNA linear vector: 1 ul
  - Annealed duplex (1:1000 dilution): 1 ul
  - 5X T4-ligase buffer: 2 ul
  - DNase free water: 5 ul
  - T4 ligase: 1 ul

  ----------------------------------------Total volume: 10 ul  -----

  Mix reaction well and incubate for 30-60 minutes at room temperature. **(Note:** incubation for longer time generates more colonies.). Place reaction on ice and before progressing with transformation.

  Set up a cloning **positive control reaction** by using 1 ul of annealed control-shRNA duplex (provided, and thawed on ice). The positive clone generated from control shRNA duplex is capable of silencing firefly luciferase gene (see “Example of knockdown” below in the manual).

- **Transformation:**
  1. Transfer 2 ul of the ligation reaction into a vial of DH5a chemical competent **E. Coli** cells, gently mix. **(Note:** competent cells are not included in this kit).
  2. Place cells on ice for 5 minutes, then transfer cells into 42°C water bath, incubate for 30 seconds without shaking. Immediately transfer cells to ice.
  3. Add 250 ul of SOC medium; incubate at 37°C for 1 hour with shaking.
  4. Spread all 250 ul of cultured cells on a pre-warmed LB plate containing 100 ug/ml **ampicillin**, and incubate overnight at 37°C

  **(Note:** in general, you get 30~100 colonies from your reactions and 0 to 5 colonies from the no-insert control reaction.)

3. **Confirm the positive clones:**

- Pick 1-2 colonies, grow in LB/ampicillin medium, miniprep plasmid DNAs, send for sequencing using the provided sequencing primer. **(Note:** Primer provided as ready to use concentration at 25 ng/ul, simply use 1 ul per reaction. Sequencing of stem hairpin structure may need special solution for best result.)
- Purified positive plasmid DNAs are ready for transfection into cells for knockdown analysis, or they can be used to produce lentiviral particles in packaging cell lines, and then the generated lentiviral particles can be used to transduce the cell line of your interest.
4. **Produce shRNA lentiviral particles (optional):**

   **Note:** pEco-Lenti-shRNA vectors are fully compatible with most current lentiviral system on the market. So you can use other vendor’s lentivirus production system for virus production, such as ViraPower / Block-it (Invitrogen), MissionShRNA(Sigma), Lent-X(Clontech), GIPZ Lentiviral ShRNAmir (Open Biosystem), etc. But the following protocol is recommended for the highest virus titers using amsbio lentiviral reagents.

   - **Cells:** grow packaging cells, 293T-LV (cat# TLV-C) in 24-well plate $2.5 \times 10^5$ cell/well), incubated in 5% CO$_2$ overnight.
   - **Transfection:** at the time for transfection, cells should grow to 90% confluency. Add 100ul of serum-free medium (or Opti-Mem, Invitrogen) into 1.5ml tube, then add 600ng of packaging mix (Cat# HT-pack) and 300ng of shRNA lentivector. Use your desired transfection protocols according to the transfection reagent manual. (For example: add 2ul of Lipofectamin 2000, incubate for 30min at room temperature.).
   - Transfer all transfection mixture (~100ul) into a cell well in 24-well plate, incubate in 5% CO$_2$ incubator overnight.
   - The next day, remove the medium and replaced with complete culture medium.
   - Harvest virus supernatants at 48-72 hours after transfection.
   - Centrifuge virus particles at 3000rpm x 15min at 4°C to pellet cell debris. Filter through a sterile 0.45um filter.
   - Store virus at -80°C.

5. **Transduction of shRNA lentivirus and selection of the stable clones:**

   - **Cells:** plate the desired hosting cells at 10%-20% confluency, culture at 37°C overnight;  
     **[Note:** for inducible shRNA expression, a Tet-repressor stable cell line has to be used as hosting cells here to repress the expression in advance and expression is induced later on by adding tetracycline. Amsbio provides a Tet-repressor expression cell line with Blasticidin selection (Cat# SC005).]

   - On 2$^{nd}$ day, thaw lentiviral stock, change medium with complete medium containing 6 ug/ml polybrene; and add appropriate amounts of lentiviral particles into culture to get a range of MOI from 1 to 10 as desired, incubate at 37°C overnight;
   - At 24 hours after transduction, remove the medium containing virus and replace with complete medium, 37°C overnight;
   - At 72 hours after transduction, remove the medium and replace it with complete medium containing the appropriate amount of antibiotics to select for stably transduced cells. (Note: the amount of antibiotic added is dependent on the cell type. A kill cure has to be
tested to use the right amount of antibiotics. In general, use 0.5 - 10 µg/ml of blasticidin and 10-100 µg/ml of puromycin).

- Change medium containing Puromycin every 3-4 days;
- At the time when the mock transduced well has no live cells, trypsinize the antibiotic-resistant colonies and make a series of dilution, seed into each well in 24-well plate and continue to grow cells,
- Inspect the cells under fluorescent microscope, select the wells that show GFP signal from all cells, grow cells in large flask;
- Collect cells, and freeze down cells in cryogenic vial, saved as stable shRNA expression cell lines.

**Validation of shRNA knockdown:**

In general, most RNAi designs can obtain greater than 50% successfully rate with greater than 75% knockdown levels. However, there is no “holy-grail” for an ultimate RNAi design. Effective RNAi sequence has to be empirically validated. To validate effective shRNAs, different approaches are used to measure the mRNA levels or its protein products, such as using Q-PCR or western blot. Alternatively, a reporter assay can be applied to screen shRNAs.

One main concern for RNAi knockdown is the so called “Off target effect”. We designed a negative shRNA sequence as the universal negative control. It was designed against entire human and mouse transcripts with the minimal sequence homology to any human or mouse ORFs sequences to minimize the non-specific knockdown. These **Negative-control shRNA lentiviral particles** are provided as catalog product. You can also design and clone your own negative control shRNA using this kit.

For you reference, please review the following expression knockdown results using shRNA vector:

- **Examples of knockdown using pEco-H1-shRNA-(GFP-Bsd) vectors:**
  - **Example A**: Luc-shRNA: (measure the luciferase activity by luciferase assay kit)
    - **Luc-shRNA top strand**:
      ```
      5' AGCGatgaacagtatggctgaatacCGAGgtattcagcccatatcgtttca
      ```

![Knockdown of co-transfected luciferase by Luc-shRNA](image.png)
Knockdown of co-transfected luciferase expression in 293-HEK cells by pEco-H1-luc-shRNA-(GFP-Bsd) plasmid.

Luc-shRNA duplex was cloned into pEco-H1-shRNA-(GFP-Bsd) vector, then co-transfected pcDNA3.1-luciferase (firefly) plasmid (100ng) with Luc-sh-RNA plasmid (700ng) into 293HEK cells in 24-well plate. Cells were harvested at 3 days after transfection. Luciferase activity was measured from cell lysate (10ul/ea) using luciferase reporter assay kit on LMax microplate luminometer. Null-shRNA plasmid serves as the Neg-Ctr plasmid here.

Example B: P53-shRNA: (Measure the mRNA level by real-time qPCR)

**P53-shRNA top strand:**

```
5' - AGCGcactacaactatgtgtaaCGAGttacacatgtagttgtagtgg
```

Knockdown of endogenous human P53 in A549 cells by pEco-H1-P53-shRNA-(GFP-Bsd) plasmid. P53-shRNA duplex was cloned into pEco-H1-shRNA-(GFP-Bsd) vector, and transfected into A549 cells, grown in medium containing 10ug/ml Blasticidin. Cells were harvested at 3 days after transfection. P53 levels were detected from extracted total RNAs by real-time Q-PCR assay. Data were normalized to internal level of GAPDH. Null-shRNA plasmid serves as Neg-Ctr.

**Conclusion:** RNAi gene silence can be effectively carried out via pEco-H1-shRNA-(GFP-Bsd) vectors.
Trouble shooting:

<table>
<thead>
<tr>
<th>Problems</th>
<th>Solution</th>
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<tbody>
<tr>
<td>Few or no colonies</td>
<td>1. Make fresh annealed duplex, and dilute for ligation reaction;</td>
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<tr>
<td></td>
<td>2. Extend ligation time, or leave it at 4°C overnight;</td>
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<tr>
<td></td>
<td>3. Use more duplex: add 5ul diluted duplex in ligation reaction;</td>
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<tr>
<td></td>
<td>4. Use different competent cells;</td>
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</table>

Lentiviral shRNA cloning service:
Amsbio provides cost effective shRNA cloning services. Simply tell us the target you want to knockdown, we will design the shRNA for your target (or you provide your own sequences), and we clone shRNA sequences into our shRNA expression vectors with the selected promoter and marker. The sequence verified shRNA plasmids and the pre-made lentiviral shRNA particles will be delivered to you. Our service has the fast turnaround time and lowest costs. Please contact us for quote or email us.

References:

Related products: Pre-made lentivirus Products:

<table>
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<tr>
<th>Product Category</th>
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<tbody>
<tr>
<td>Fluorescent protein</td>
<td>Premade Lentivirus for GFP/ CFP/ YFP/ RFP</td>
</tr>
<tr>
<td>Human and mouse ORFs</td>
<td>Premade lentivirus expressing <strong>hundreds of human and mouse ORFs</strong> with RFP-Blasticidin fusion dual markers.</td>
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<tr>
<td>Luciferase expression</td>
<td>Premade lentivirus for all kinds of luciferase protein expression: <strong>firefly and Renilla</strong> with different antibiotic selection markers.</td>
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<tr>
<td>CRE recombinase</td>
<td>Premade lentivirus for expressing <strong>nuclear permeant CRE</strong> recombinase with different fluorescent and antibiotic markers.</td>
</tr>
<tr>
<td>Category</td>
<td>Description</td>
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<tr>
<td>LoxP ColorSwitch</td>
<td>Premade lentivirus expressing &quot;LoxP-GFP-Stop-LoxP-RFP&quot; cassette, used to monitor the CRE recombination event in vivo.</td>
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<tr>
<td>TetR inducible expression repressor</td>
<td>Premade lentivirus expressing TetR (tetracycline regulator) protein, the repressor protein for the inducible expression system.</td>
</tr>
<tr>
<td>iPS factors</td>
<td>Premade lentivirus for human and mouse iPS (Myc, NANOG, OCT4, SOX2, FLF4) factors with different fluorescent and antibiotic markers</td>
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<tr>
<td>T-antigen Expression</td>
<td>Express different large and small T antigens with different selection markers</td>
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<tr>
<td>Cell Organelle imaging</td>
<td>Premade lentivirus for cell organelle imaging. The fluorescent marker GFP/RFP/CFP are used for sub-cellular localization in different cell organelles for living cell imaging.</td>
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<tr>
<td>LacZ expression</td>
<td>Express different full length β- galactosidase (lacZ) with different selection markers</td>
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<tr>
<td>Fluorescent-ORF fusion</td>
<td>Pre-made lentivirus expression a &quot;GFP/RFP/CFP-ORF&quot; fusion target.</td>
</tr>
<tr>
<td>Pre-made shRNA lentivirus</td>
<td>Premade shRNA lentivirus for knockdown a specific genes (P53, LacZ, Luciferase and more).</td>
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<tr>
<td>microRNA and anti-microRNA lentivirus</td>
<td>Premade lentivirus expression human or mouse precursor miRNA and anti-miRNA lentivector and virus for human and mouse miRNA.</td>
</tr>
<tr>
<td>Negative control lentiviruses</td>
<td>Premade negative control lentivirus with different markers: serve as negative control for lentivirus treatment, for validation of the specificity of any lentivirus target expression effects.</td>
</tr>
<tr>
<td>Other Enzyme expression</td>
<td>Ready-to-use lentivirus, expressing a specific enzymes with different selection markers.</td>
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