



## Lentiviral CRISPR guild RNA Cloning Kit for constructing CRISPR targeting gRNA lentivectors

Cat#	Product Name	Amount	Application
<a href="#">gRNA-H1-GB</a>	pLenti-gRNA-H1-( <b>GFP-Bsd</b> ) cloning kit	1 kit	Make CRISPR targeting gRNA lentivector with <b>GFP-Blasticidin</b> dual selection marker
<a href="#">gRNA-H1-GP</a>	pLenti-gRNA-H1-( <b>GFP-Puro</b> ) cloning kit	1 kit	Make CRISPR targeting gRNA lentivector with <b>GFP-Puromycin</b> dual selection marker
<a href="#">gRNA-H1-RB</a>	pLenti-gRNA-H1-( <b>RFP-Bsd</b> ) cloning kit	1 kit	Make CRISPR targeting gRNA lentivector with <b>RFP-Blasticidin</b> dual selection marker
<a href="#">gRNA-H1-RP</a>	pLenti-gRNA-H1-( <b>RFP-puro</b> ) cloning kit	1 kit	Make CRISPR targeting gRNA lentivector with <b>RFP-Puromycin</b> dual selection marker
<a href="#">gRNA-H1-Puro</a>	pLenti-gRNA-H1-( <b>puro</b> ) cloning kit	1 kit	Make CRISPR targeting gRNA lentivector with <b>Puromycin</b> selection marker
<a href="#">gRNA-H1-Bsd</a>	pLenti-gRNA-H1-( <b>Bsd</b> ) cloning kit	1 kit	Make CRISPR targeting gRNA lentivector with <b>Blasticidin</b> selection marker
<a href="#">gRNA-H1-Neo</a>	pLenti-gRNA-H1-( <b>Neo</b> ) cloning kit	1 kit	Make CRISPR targeting gRNA lentivector with <b>Neomycin</b> selection marker
<a href="#">gRNA-H1-Zeo</a>	pLenti-gRNA-H1-( <b>Zeo</b> ) cloning kit	1 kit	Make CRISPR targeting gRNA lentivector with <b>Zeocin</b> selection marker
<a href="#">gRNA-U6-GB</a>	pLenti-gRNA-U6-( <b>GFP-Bsd</b> ) cloning kit	1 kit	Make CRISPR targeting gRNA lentivector with <b>GFP-Blasticidin</b> dual selection marker
<a href="#">gRNA-U6-GP</a>	pLenti-gRNA-U6-( <b>GFP-Puro</b> ) cloning kit	1 kit	Make CRISPR targeting gRNA lentivector with <b>GFP-Puromycin</b> dual selection marker
<a href="#">gRNA-U6-RB</a>	pLenti-gRNA-U6-( <b>RFP-Bsd</b> ) cloning kit	1 kit	Make CRISPR targeting gRNA lentivector with <b>RFP-Blasticidin</b> dual selection marker





## Notes:

The clones generated from " **Cloning control insert**" will serve as universal negative control gRNA lentivector. The negative control gRNA sequence has minimal homology to human and mouse transcripts by blast.

## Storage:

The gRNA Cloning Kit is shipped on dry ice. Each kit contains all materials , enough for you to carry out **ten cloning reactions**. Upon received, stored at -20°C except, and store the competent cells at -80°C freezer. Products stable for 6 months.

## Protocol outlines:

1. Design target gRNA sequence (20bp in length) for Cas9 cutting sites in your desired genomic locus (select 2 or 3 target sequences for each locus);
2. Order two DNA oligonucleotides with the cloning overhang (top and bottom strand for each target sequence);
3. Anneal the two oligo to generate a duplex (cloning insert);
4. Clone the duplex into the provided linear **gRNA** lentivector by T4 ligation reaction;
5. transform into competent cells and grow in LB/ ampicillin plate;
6. Pick 2 colonies, mini prep the plasmid DNAs, confirm positive clone by sequencing; (**Note:** the generated gRNA plasmid can be used for transfection based CRISPR edition together with a Cas9 expression plasmid if you do not use lentivirus for CRISPR gene edition).

--The following protocol requires additional reagents (which are not included in this kit) to complete:

7. Produce the targeting gRNA lentivectors using the gRNA lentivectors generated above. [you need 293T cell (CAT#: [TLV-C](#)), Packaging vector mixture (CAT#: [HT-Pack](#))]
8. **For knock-Out:** apply [premade Cas9 expression lentivectors](#) (can be purchased separately), and gRNA targeting lentivirus together into your desired cell culture or tissue, and select/sort the transduced positive cells



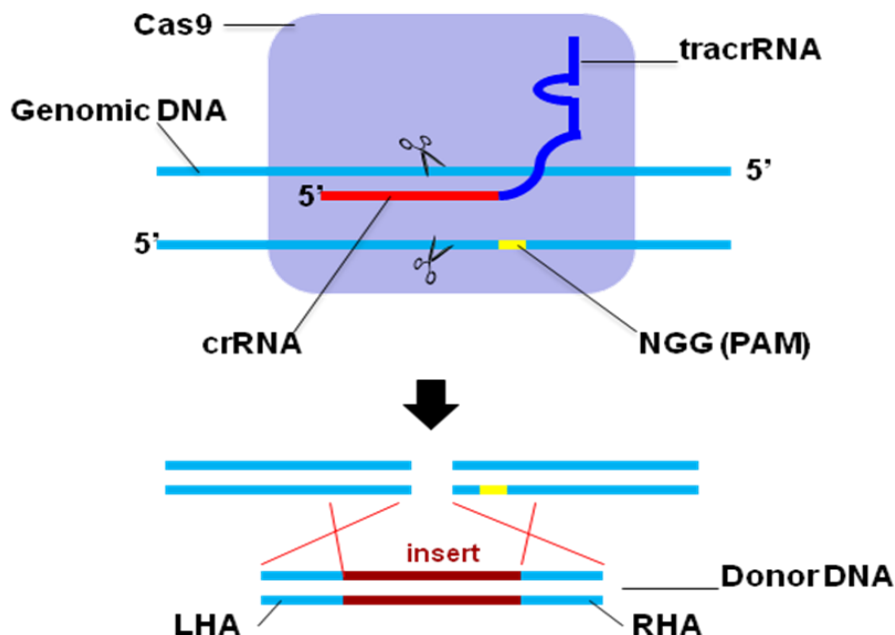
by antibiotic or fluorescent signal. The selected cells are ready for downstream gene knockout analyses (mRNA or protein detection or genomic sequencing analysis).

9. **For knock-In or sequence repair or changes:** you need deliver double stranded Donor DNA or single strand repair Oligo in addition to the Cas9 expression lentivirus and gRNA targeting lentivirus.

## Introduction:

Targeted and precise genomic gene editing technologies are the tools for genomic correction, modification and gene therapy. The TALEN, ZFN and CRISPR/Cas are the three main genome editing technologies. The CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats) technology was originally discovered as part of a prokaryotic adaptive immune system to protect against invading viruses and bacteriophages. The recent discovered CRISPR technology has many advantages: (1) higher targeting accuracy; (2) much more target sequence selection; (3) much less complexity; and (4) much less off-target cell toxicity, than the previous genome editing technologies TALEN (transcription activator-like effector nuclease) and ZEN (Zinc-finger nuclease).

## Mechanism of CRISPR/Cas9 genomic editing:





A target sequence-specific guide RNA molecule (gRNA) directs a Cas endonuclease to the genomic DNA target sequence. Then, the Cas enzyme creates a double-strand break (or single cut depends on Cas enzyme types) at the target sequence that can be repaired either by Non-Homologous End-Joining (NHEJ), which can result in insertion or deletions (InDels), or by Homology Directed Repair (HDR) when a repair Donor DNA template is present. InDels can disrupt expression of the target gene (So called, Knock-Out). While repaired by HDR, the genome then was modified with a foreign gene (So called, Knock-In), or corrected of the target gene (targeted gene therapy). Cas9 is the most frequently used cas endonuclease in CRISPR. See the illustration scheme below for the CRISPR's mechanism.

## **CRISPR/Cas9 technology requires three components:**

1. **Target specific guild RNA (gRNA):** it comprises two segments: a targeting sequence (crRNA) containing the target complementary RNA, and an auxiliary trans-activating non-coding RNA sequence (tracrRNA or scaffold). The crRNA and tracrRNA are combined into a single guide RNA (gRNA) which directs the Cas9 nuclease to the target sequence.

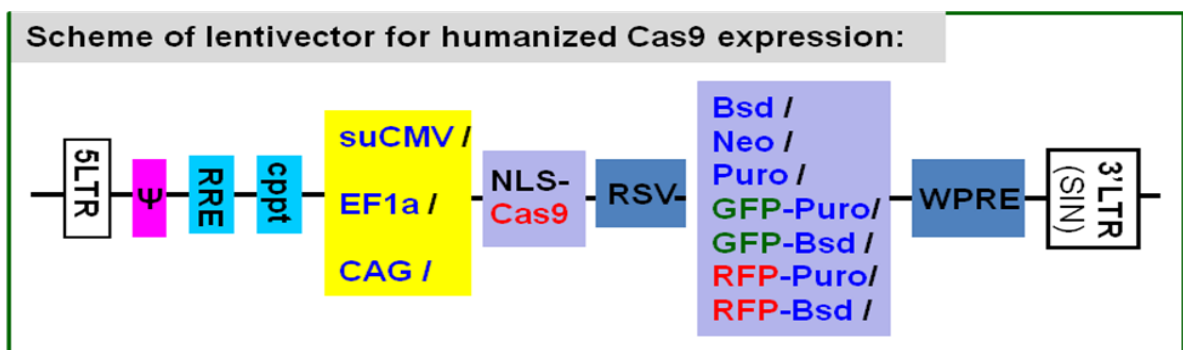
Gentarget developed **a set of gRNA lentivectors** (with different selection markers) for deliver the target specific gRNAs. You first design / select the target sequences, the crRNA region, and then synthesize the oligo and cloned into Gentarget's gRNA lentivector that contains the tracrRNA (the scaffold). The generated gRNA lentivectors can be used for transfection (Lipid) based CRISPR editing, or further produce gRNA lentivirus for virus based CRISPR editing. The gRNA is driven by either human U6 promoter, or by modified H1 promoter (an optional inducible promoter). A antibiotic marker or antibiotic-fluorescent fusion dual marker is expressed under the Rsv promoter. see the cloning scheme below.





- (1) the Cas9 can be pre-made as standalone products (like GenTarget's [Cas9 expression lentivirus](#) and [Cas9 Adenovirus](#)) which makes the delivery of Cas9 enzyme more efficient and more reliable;
- (2) One standalone Cas9 enzyme can be used together with multiple gRNAs for editing multiple targets without over-delivering Cas9 enzyme.
- (3) it is much easier to construct and deliver the much smaller gRNA vector without the large Cas9 segment in the vector;
- (4) the standalone gRNAs give you the flexibility to pair with different types of Cas enzymes (like the cas9 mutants with single cut/nicking in one strand of genome for better off-target effects) for optimized efficacy;
- (5) the standalone Cas9 expression can make your cell line or animal as "CRISPR ready" which can be used for multiplex gene editing and more flexible for any combination of "Editing on Demand".

GenTarget provides standalone Cas9 expression lentivirus with different antibiotic markers which provide great flexibility to combine a gRNA lentivirus with a different marker for double selection when desired. The humanized wild-type Cas9 enzyme is expressed under different promoters with two optimized nuclear localization signal leaders, demonstrating the highest CRISPR efficiency. See the Cas9 expression lentivirus core structure scheme below.



**3. The Donor DNA template ("knock In"):** For genomic modification application, a double strand or single stranded repair DNA is required after the Cas9 creates the double stranded breaks at desired genomic loci. (**Note:** when this Donor DNA is not present, the CRISPR only creates the knockOut via random non-homologous end joining of the cleavage ends).



The donor DNA provides the desired sequence insertion that flanked by the gene loci's homology sequences: left homologous arm (LHA) and right homologous arm (RHA), for the genomic editing via HDR mechanism. This Donor DNA can be single-strand or double stranded DNA which can be synthesize DNA or constructed in a vector and delivered by lipid based transfection.

### gRNA lentivector cloning kits:

For CRISPR genomic editing, Gentarget provides the standalone premade cas9 expression lentivirus, and the gRNA lentivector cloning kits with which you can construct your desired target specific gRNA lentivectors (sequentially produce the gRNA lentivirus). You then apply both Cas9 lentivirus and gRNA lentivirus to achieve the target knockOut or modification /knockIn (when a donor DNA is also applied).

You can select the pLenti-gRNA lentivectors with a human **U6** or **H1** promoter to drive the gRNA, and a desired anionic / Fluorescent selection marker. see the sequence segment below:

```

                                human H1 promoter
1      GGATCCAATA TTTGCATGTC GCTATGTGTT CTGGGAAATC ACCATAAACG
      CCTAGGTTAT AAACGTACAG CGATACACAA GACCCTTTAG TGGTATTTGC
                                TRBS                                TRBS
      ~~~~~~
51     TGAAATCCCT ATCAGTGATA GAGACTTATA AGTTCCTAT CAGTGATAGA
      ACTTTAGGGA TAGTCACTAT CTCTGAATAT TCAAGGGATA GTCACTATCT

      Transcription start
      ~~
101    GA          GTTT TAGAGCTAGA AATAGCAAGT TAAATAAAGG CTAGTCCGTT
      CTTCGC          ATCTCGATCT TTATCGTTCA ATTTTATTCC GATCAGGCAA

      ATCAACTGA AAAAGTGGCA CCGAGTCGGTGC
      TAGTTGA ACT TTTTCACCGT GGCTCAGCCACG

TRBS: Tetracycline Repressor Binding Site.

```





**human U6 promoter**

```

1  GGATCCAAGG TCGGGCAGGA AGAGGGCCTA TTTCCCATGA TTCCTTCATA
   CCTAGGTTCC AGCCCGTCCT TCTCCCGGAT AAAGGGTACT AAGGAAGTAT

   TTTGCATATA CGATACAAGG CTGTTAGAGA GATAATTAGA ATTAATTTGA
   AAACGTATAT GCTATGTTCC GACAATCTCT CTATTAATCT TAATTAAACT

101 CTGTAAACAC AAAGATATTA GTACAAAATA CGTGACGTAG AAAGTAATAA
    GACATTTGTG TTTCTATAAT CATGTTTTAT GCACTGCATC TTTCATTATT

    TTTCTTGGGT AGTTTGCAGT TTTAAAATTA TGTTTTAAAA TGGACTATCA
    AAAGAACCCA TCAAACGTCA AAATTTTAAT ACAAATTTT ACCTGATAGT

201 TATGCTTACC GTAACCTGAA AGTATTTTCTGA TTTCTTGGCT TTATATATCT
    ATACGAATGG CATTGAACCT TCATAAAGCT AAAGAACCGA AATATATAGA
  
```

Transcription start

```

      ↓
TGTGAAAGG ACGAAA GTTTTAGAGCTAGA AATAGCAAGT TAAAATAAGG
ACACCTTCC TGCTTTTCGC ATCTCGATCT TTATCGTTCA ATTTTATTC

CTAGTCCGTT ATCAACTTGA AAAAGTGGCA CCGAGTCGGTGC
GATCAGGCAA TAGTTGAACT TTTTCACCGT GGCTCAGCCAG
  
```

gRNA Scaffold

**Note:** The lentivector’s backbone sequences can be [downloaded](#) from our website. The full lentivector sequence will be provided upon request after the purchasing. To make the final clone’s map, simply paste gRNA target sequence (not include the 4 bp overhangs at both ends) at position between 106 and 107 for H1 promoter vector, or between 270 and 271 for U6 promoter vector.

### Key features of gRNA lentivector cloning kit:

1. **Pre-linearized lentivector**--no need for tedious works at preparation of lentivector backbone,
2. **Precisely directional cloning** of your DNA duplex encoded gRNA structure,
3. **Rapid, highly efficient cloning** with very low background. Clones has >95% positive rate.
4. **Internal fluorescent reference (for some gRNA lentivectors):** the vector encodes a fluorescent protein (**GFP** or **RFP**), allowing real-time monitoring of transfection or virus transduction efficiency.
5. **Desired selection:** the lentivector encodes an antibiotic marker or a **dual marker** (a fluorescent-antibiotic fusion marker), allowing to select the positive transduced cells via a desired



antibiotic marker, like, Neomycin, Puromycin, Blasticidin, Zeocin, or sort via GFP / RFP fluorescent signal.

6. **Optional inducible knockdown (only for H1 promoter):** The gRNA lentivectors driven by the optional inducible H1 promoter can be used for constitutive high expression without the need for induction. Optionally, this modified H1 promoter allows the inducible expression of gRNA when the tetracycline repressor protein (TetR) is present in advance (see [inducible expression link](#) for its mechanism).

## Cloning procedure:

### 1. Design gRNA sequences:

The gRNA sequence is 20 bp sequence complementary to the target. The effective target sequence region is 20bp target sequence upstream of a trinucleotide sequence (5'-NGG-3') called the protospacer adjacent motif (**PAM**). The wild-type Cas9 nuclease digests both strands of the genomic DNA at 3 to 4 nucleotides at 5' of the PAM sequence.

The target sequence (20bp) can be in either the sense or anti-sense orientation with respect to the target gene. It is a good idea to create several target sequences for your gene of interest and to select sequences with minimal homology to other genes. There are many online CRISPR gRNA designing tool (see below links), for designing the target sequence: 5' “(20 bp target sequence) + PAM (NGG)”

<https://chopchop.rc.fas.harvard.edu/>

<http://zifit.partners.org/ZiFiT/Introduction.aspx>

<http://crispr.mit.edu/>

<http://www.e-crisp.org/E-CRISP/designcrispr.html>

- the selected sequences are in front of the NGG in genomic sequence, but NGG should not be included in the synthesized gRNA oligo.
- you can design multiple gRNA targeting sequence to lead Cas9 make specific cut in double-strand genomic DNA where the PAM is located. Thus, the break DNA ends will be repaired either by non-homologous end joining that create deletion, early stop



(resulted in a target gene knockOut) or by homology-directed recombination with introduced donor DNAs (resulted in knockIn or correction).

## 2. Anneal gRNA duplex:

synthesize the top and bottom gRNA oligos with cloning overhung,

Top strand: 5'- **AGCG**-nnnnnnnnnnnnnnnnnnnnnnnn

Bottom strand: 5'- **AAAC**-nnnnnnnnnnnnnnnnnnnnnnnn

anneal the two oligo to generate a duplex, the cloning insert.

Set up the annealing reaction as follows:

100 $\mu$ M Top strand oligo:	10 $\mu$ l
100 $\mu$ M Bottom strand oligo:	10 $\mu$ l
10X oligo annealing buffer:	3 $\mu$ l
DNase-free water:	7 $\mu$ l
-----	
Total volume:	30 $\mu$ l

Incubate the 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 tube on ice. Make 1: 1000 dilution ( first add 1 $\mu$ l annealed mixture in 99  $\mu$ l Cold-1x annealing solution, and then take 2  $\mu$ l, added into 18 $\mu$ l 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 / water to avoid double strand DNA melt.)

## 3. Ligase the gRNA duplex into linearized lentivector:

Set up the ligation reaction as follows:

pLenti-gRNA- linear vector (provided):	1 $\mu$ l
Annealed duplex (1: 1000 diluted):	1 $\mu$ l
5 X T4-ligase buffer:	2 $\mu$ l
DNase free water:	5 $\mu$ l
T4 ligase:	1 $\mu$ l
-----	
Total volume:	10 $\mu$ l

Mix reaction well and incubate for 30-60 minutes at room temperature (22°C to 25°C). Place reaction on ice and ready for transformation.



Set up a **positive cloning control reaction** by using **1 µl** of annealed Control-gRNA duplex (provided). Set no-insert negative control reaction using pure water.

#### 4. Transformation:

1. Transfer all 10ul of the ligation reaction into a vial of DH5a chemically competent *E. Coli* cells, mix gently.
2. Place cells on ice for 5 minutes, and then transfer cells into 42 °C water bath, incubate for 40 seconds without shaking. Immediately transfer cells to ice.
3. Add 250 µl of SOC medium; incubate at 37 °C for 1 hour with shaking.
4. Spread all 250~300 µl of transformation onto a pre-warmed LB plate containing 100 µg/ml **ampicillin** and incubate overnight at 37 °C

**Note:** In general, 5-100 colonies will be produced from your reaction and 0 to 5 colonies from the no-insert control reaction, depends on your competent cell's efficiency.

#### 5. Confirm positive clones by direct sequencing:

- Pick 1-2 colonies, grow in LB/ampicillin medium, isolate plasmid DNAs by miniprep column, and sequence analysis using the sequencing primer provided. **Note:** The provided primer is at a ready-to-use concentration of [10 µM]; simply use 1µl per reaction.
- Purified lentivector plasmid DNAs are ready for transfection into cells, or for use in producing gRNA lentivirus in packaging cell lines. The generated gRNA lentivirus can be used to transduce cell lines for CRISPR assay (Need used with [Cas9 expression lentivirus](#) which can be purchased as off-shelf products).

#### 6. Production of gRNA lentivirus:

**Note:** GenTarget's pLenti-gRNA vectors are fully compatible with most commercially available lentiviral systems including ViraPower / Block-it (ThermoFisher), MissionShRNA (Sigma), Lent-X (Clontech), etc. The following protocol is recommended for the highest virus titer using GenTarget's lentiviral reagents.

- **Cells:** seed 293T packaging cells (cat# [TLV-C](#)) in plate or flask according virus production scale; incubate overnight in 5% CO<sub>2</sub>.



- ✿ **Transfection:** at the time for transfection, cells should grow to 90% confluence. Use your favorite transfection protocol according to the transfection reagent manual to co-transfection of gRNA lentivector and **packaging plasmid mixture (CAT#: [HT-pack](#))**.
  - ✿ The next day, remove the medium and replace it with complete culture medium.
  - ✿ Harvest viral supernatants at 48-72 hours after transfection.
  - ✿ Centrifuge virus particles at 3000 rpm x 15 minutes at 4 °C to pellet cellular debris. Filter through a sterile 0.45 µm filter.
  - ✿ Store virus at -80 °C.
7. **Apply both gRNA lentivirus and Cas9 lentivirus to the desired cell culture for CRISPR gene editing applications.**

### [Trouble shooting:](#)

Problems	Solution
Few or no colonies	<ol style="list-style-type: none"><li>1. Make freshly annealed duplex and dilution for ligation reaction,</li><li>2. Use high efficient competent cells if available.</li></ol>

### [Lentiviral gRNA cloning service:](#)

GenTarget offers a cost-effective [gRNA cloning services](#). Simply tell us the target you want to editing or provide us with your own gRNA sequences, and we will design the gRNA for your target and clone the gRNA sequence into our gRNA lentivectors with the promoter and marker of your choice, and produce the gRNA lentivirus. We will deliver both sequence-verified gRNA plasmids and the pre-made gRNA lentivirus. For the cas9 part, you simply order them from our catalog products. Our service has the fastest turnaround time and lowest costs available. Please [contact us](#) for quote.



**Attachment:** GenTarget's pre-made lentivirus product categories.

<b>Product Category</b>	<b>Product Description (please click into each category's page)</b>
<a href="#">Pathway Reporter</a>	Repoter Lentivirus for all kinds of pathway screening assays
<a href="#">Cell Immortalization</a>	Lentivirus for cell immortalization: Large T-antigen, hTERT, EBNA1/EBNA2, HpV16-E6/E7, Adenovial E1A, Kras_G12V, HOXA9, et al.
<a href="#">ImmunoOncology Research</a>	Lentivirus products for immuno therapy research: CAR and TCR; Assay Cell Lines for T-cell targeted killing assay and other cell-based assays; over-expression lentivirus products for the immune response targets; Cell surface antigens (CDs); immune checkpoint / Receptors; CRISPR gene Repair and knock-IN lentivirus; CRISPR knockout lentivirus;
<a href="#">CAR-T, TCR Lentivirus</a>	<b>CARs</b> Lentivirus: Anti-CD19 /CD20 /CD22 /BCMA /hHER2 /HLA-A2 /TGFβ; <b>TCRs</b> : MART-1/ NY-ESO1/ CD1d-α-GalCer/ TRαV3-F2A-TRβV5-6;
<a href="#">CRISPR Gene Editing</a>	Preamde lentivirus express humanzied wild-type <b>Cas9</b> endonuclease, the <b>dCas9</b> , gRNAs, <b>CRISPR</b> gene editing research
<a href="#">Epigenomic: CRISPRi and CRISPRa</a>	" <b>dCas9-Protein</b> " fusion Lentivirus for epigenomic modification, resulted in CRISPR interference (CRISPRi) or activation (CRISPRa).
<a href="#">Cell-Specific Reporter</a>	a set of reporter lentiviruses to express a luminescence or fluorescent reporter (firefly Luciferase, Renilla luciferase, RFP or GFP fluorescent marker) under a tissue specific promoter
<a href="#">Infectious Antigens</a>	Lentivirus that express all kinds of infectious antigens with C-term 6His-tag.
<a href="#">Virus Like Particles (VLP)</a>	Lentiviral Like Particles, pseudo-typed with a different envelope proteins.
<a href="#">Non-integrating LV</a>	Integration Defective Lentivirus, express different targets for transient expression without the unwanted insertional mutagenesis.
<a href="#">shRNA Knockdown</a>	Knockdown verifeid and customized shRNA lentivirus for target knockdown,



<b>Product Category</b>	<b>Product Description (please click into each category's page)</b>
<a href="#">microRNA lentivirus</a>	Premade lentivirus expression human or mouse <b>precursor miRNA</b> . And <b>anti-miRNA</b> lentivector and virus for human and mouse miRNA.
<a href="#">Anti-miNA lentivirus</a>	Pre-made lentivirus expression a specific anti-miRNA cassette.
<a href="#">Human and mouse ORFs</a>	Premade lentivirus expressin a <b>human, mouse or rat</b> gene with RFP-Blastididin fusion dual markers.
<a href="#">Luciferase expression</a>	Premade lentivirus for all kinds of luciferase protein expression: <b>firefly and Renilla, Red-Luc and more</b> , with different antibiotic selection markers.
<a href="#">Fluorescent Markers</a>	Lentivirus express all commonly used fluorescent proteins: GFP, RFP, CFP, BFP YFP, niRFP, unstable GFP and others.
<a href="#">Luminescent Imaging</a>	Lentivirus express Nano-Latern as Bio-probes for in vivo imaging of sub-cellular structural organization and dynamic processes in living cells and organisms
<a href="#">Sub-cellular Imaging</a>	Lentivirus contain a well-defined organelle targeting signal fused to a fluorescent protein, great tools for live-cell imaging and for dynamic investigation of sub-cellular signal pathways.
<a href="#">Cytoskeleton Imaging</a>	A fluorescent marker (GFP, RFP or CFP) fusion with a cellular structure protein, provides a convenient tool for visualization of cytoskeletal structure
<a href="#">Unstable GFP</a>	Lentivirus express the the destabilized GFP (uGFP) which provides fast turnover responses in signal pathway assay and in knockdown / knockout detection
<a href="#">near-infrared RFP</a>	The near-infrared Red fluorescent (niRFP) expression Lentiviurs provides the whole-body images with better contrast and brighter images
<a href="#">Fluorescent-ORF fusion</a>	Pre-made lentivirus expression a " <b>GFP/RFP/CFP-ORF</b> " fusion target.
<a href="#">CRE recombinase</a>	Premade lentivirus for expressing <b>nuclear permeant CRE</b> recombinase with different flurescent and antibiotic markers.
<a href="#">CRE, Flp ColorSwitch</a>	Lentivirus expressing "LoxP-GFP-Stop-LoxP-RFP" or "FRT-GFP-Stop-FRT-RFP" cassette, used to monitor the CRE or Flp recombination event in vivo.





<b>Product Category</b>	<b>Product Description (please click into each category's page)</b>
<a href="#">SEAP Reporter</a>	lentivirus expressing SEAP under different promoters (TetCMV, EF1a, CAG, Ubc, mPGK, Actin-beta or a signal pathway responsive promoter),
<a href="#">TetR Repressor</a>	Premade lentivirus expressing TetR (tetracycline regulator) protein, the repressor protein for the inducible expression system.
<a href="#">rtTA Expression</a>	rtTA binds to the tetracycline operator element (TetO) in the presence of doxycycline (Dox). Used for Tet-On /OFF inducible system.
<a href="#">iPS factors</a>	Premade lentivirus for human and mouse iPS ( <b>Myc, NANOG, OCT4, SOX2, FGF4</b> ) factors with different fluorescent and antibiotic markers
<a href="#">LacZ expression</a>	Express different full length <b><math>\beta</math>-galactosidase (lacZ)</b> with different selection markers
<a href="#">Negative control lentiviruses</a>	Premade <b>negative control lentivirus with different markers</b> : serves as the negative control of lentivirus treatment, for validation of the specificity of any lentivirus target expression effects.
<a href="#">Other Enzyme expression</a>	Ready-to-use lentivirus, expressing a specific enzymes with different selection markers.
<a href="#">Ultra titer lentivirus</a>	Ultra-titer lentivirus used for the hard-to-transduced cells and for in vivo manipulation of sperm cells, or stem cells.