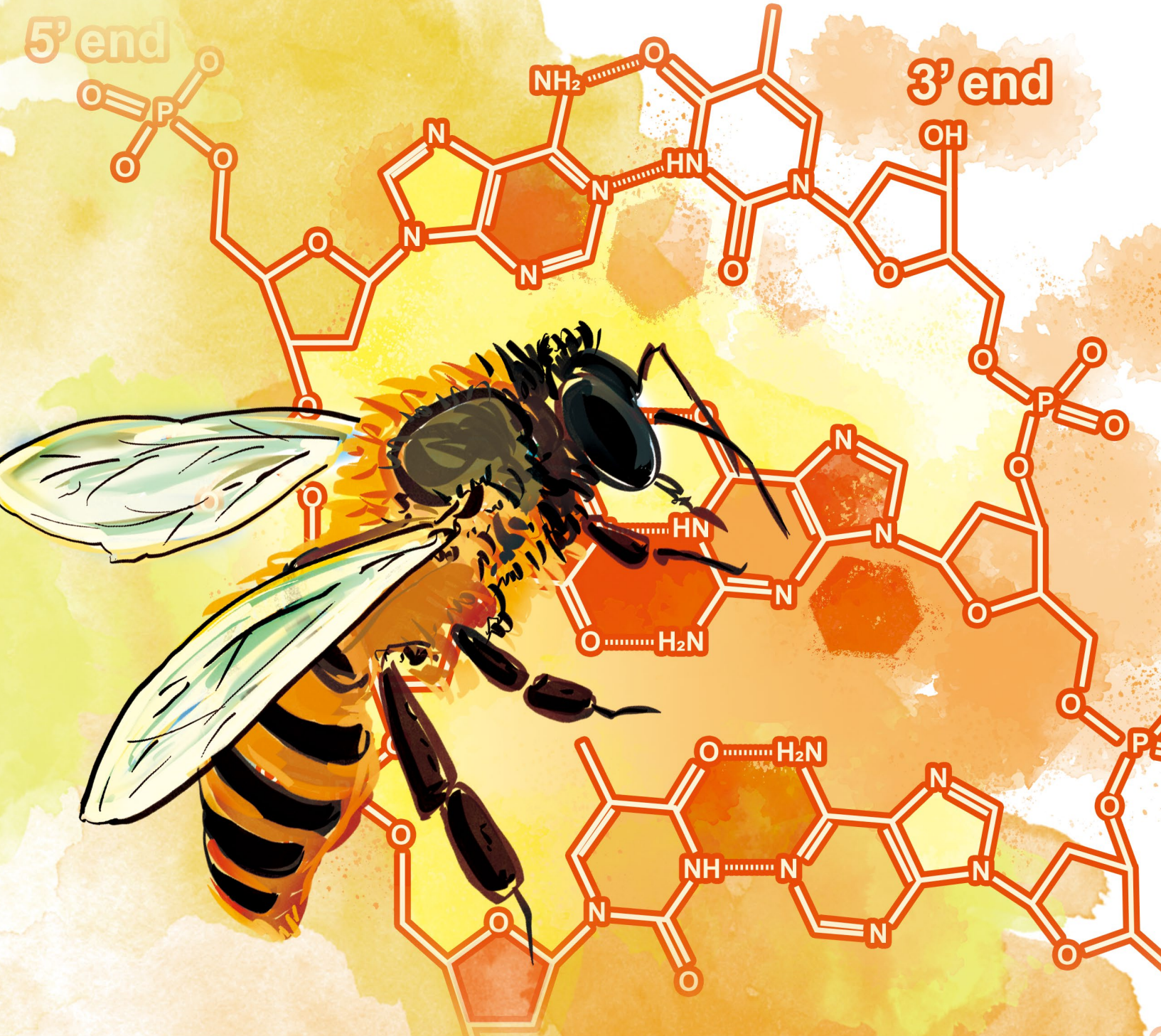
VectorBuilder

Revolutionize Gene Delivery



Product Guide

Vector Cloning | Virus Packaging | Library Construction | mRNA Therapeutics | CRO Services | GMP Manufacturing

About VectorBuilder

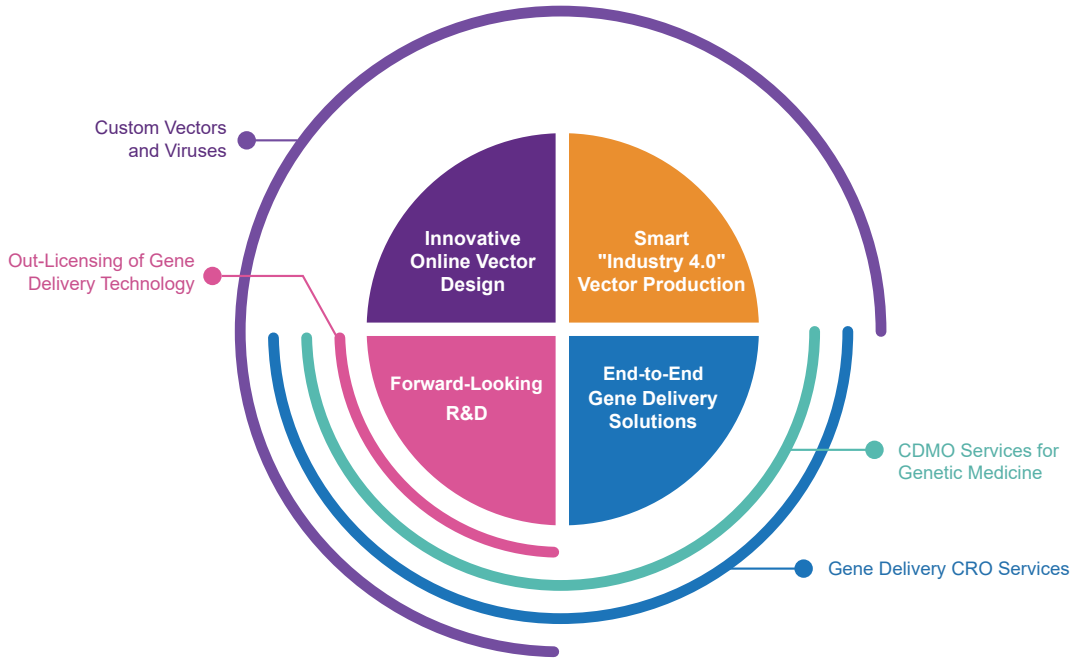
VectorBuilder is a global leader in gene delivery technologies. As a trusted partner in thousands of labs and biotech/pharma companies around the world, VectorBuilder offers a full spectrum of gene delivery solutions covering virtually all research and clinical needs from bench to bedside. Our offerings span several major areas as described below.

- **Custom vectors and viruses:** VectorBuilder is the world's largest provider of custom vectors for both viral and non-viral gene delivery. We currently tailor-make over 80,000 vectors a year for tens of thousands of researchers around the world. Our online platform is a transformative innovation that allows researchers to easily design and order custom vectors online, freeing them from the tedious work of cloning vectors and packaging viruses in the lab.
- **CRO services:** VectorBuilder offers a wide range of CRO services covering diverse gene delivery applications in basic research and drug discovery, including library construction, mRNA synthesis, stable cell line generation, safety and efficacy screening, and more. We have recently launched high value-added R&D services such as AAV capsid evolution, promoter engineering, and experimental codon optimization.
- **CDMO services:** VectorBuilder is a full-service CDMO with extensive experience in cGMP vector manufacturing. Operating several state-of-the-art facilities, we have supported many customers along their entire drug-discovery pipelines, going from research-grade vectors for early discovery, to GMP-like vectors for preclinical testing, to full GMP-grade vectors for clinical trials. Our CDMO services include GMP manufacturing (plasmid DNA, viral vectors, mRNA, etc.), process and analytical development, cell banking, fill/finish, and regulatory support.

We strive to offer innovative and high-quality products and services while maintaining rapid turnaround and exceptional affordability. Our "white-glove" customer care is supported by a PhD-level team with decades of collective experience to devise the best gene delivery solutions for our customers.

So we ask you one question:

Would you join us in the gene delivery revolution?



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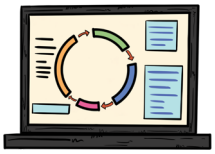

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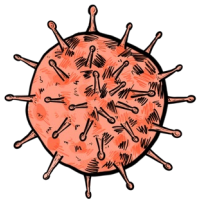

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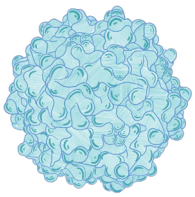

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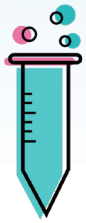

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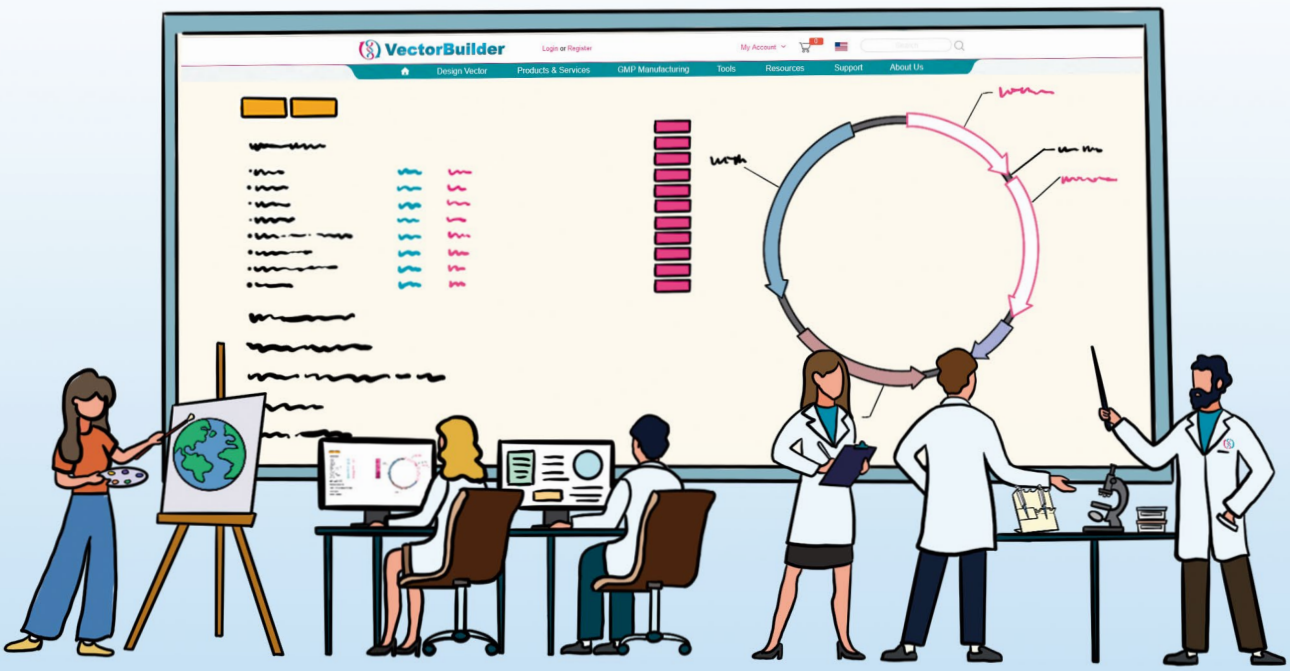
VectorBuilder's Revolutionary Online Platform

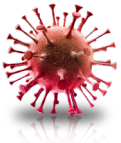


What Can You Do with VectorBuilder?

Design vectors using our intuitive online design platform

Send design requests for complex vector designs or service needs

Order and receive your vectors and viruses in as few as 5 days



Order downstream services (e.g. library construction, BAC recombineering, stable cell line generation, etc.)

Manage your vectors and orders in your VectorBuilder account

Learn to become a vector expert with free and unlimited access to our rich educational content

A One-Stop Solution for All Your Vector & Virus Needs

Highlights

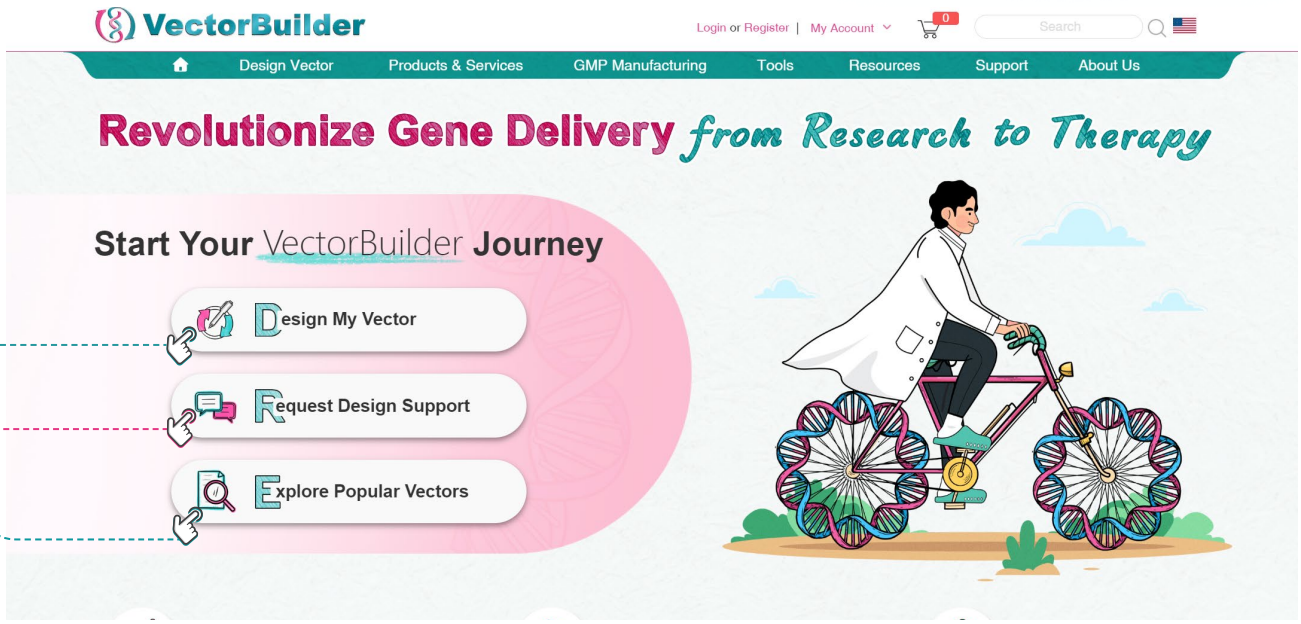
- **Diverse vector systems:** 1000+ vector backbones for various applications in multiple model organisms
- **Comprehensive collections of vector components:** 400,000+ promoters, ORFs, epitope tags, markers, linkers, peptide signals, and whole-genome shRNA and gRNA databases
- **Bioinformatic tools:** codon optimization, sequence alignment, shRNA and CRISPR target design, and many more
- **Streamlined online shopping experience:** fast checkout, easy order tracking, versatile payment options, and dedicated customer service
- **Highly affordable prices and rapid turnaround**
- **Robust production and comprehensive QC for release**

How to Design a Vector on VectorBuilder

To design a vector, follow the simple steps below.

1 Go to the VectorBuilder.com homepage:

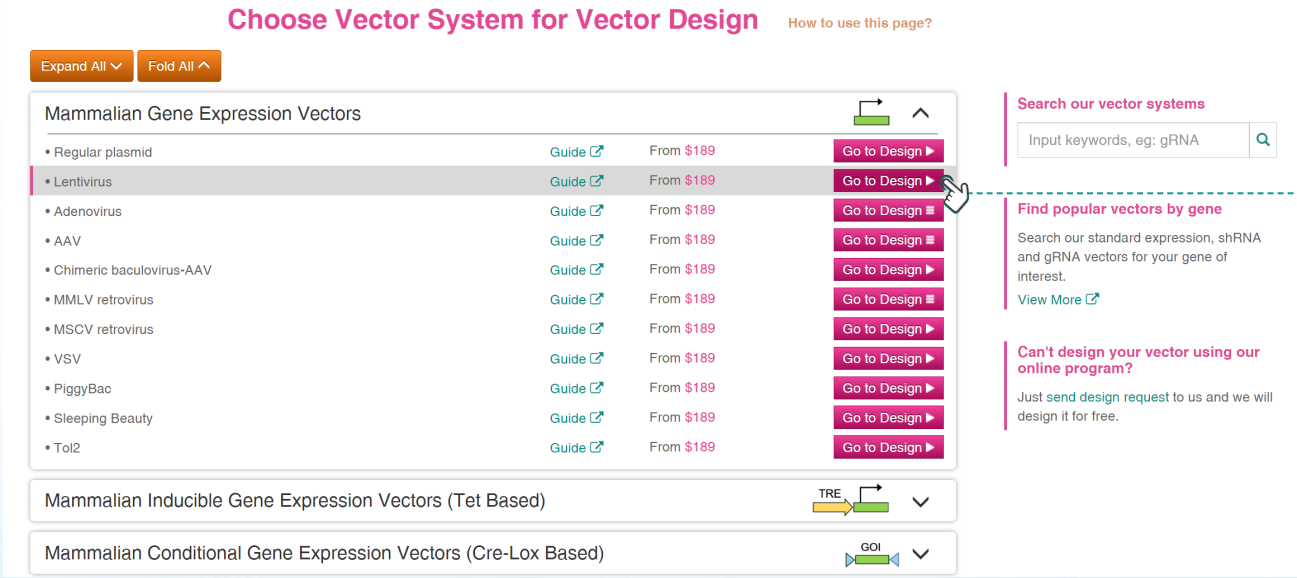
- Click **Design My Vector** to start designing your vector.
- If you can't design your desired vector, click **Request Design Support** to let our scientists create your vector for you.
- Click **Explore Popular Vectors** to search for pre-designed and premade vectors for your genes of interest (GOIs).



2 Next, on the Choose Vector System for Vector Design page:

Choose from 700+ vector systems for a wide range of applications in multiple model organisms.

- Overexpression, shRNA, CRISPR, enhancer/promoter testing, in vitro transcription, recombinant protein expression, homologous recombination, etc.
- Mammalian, zebrafish, Drosophila, worm, plant, yeast, bacteria, etc.



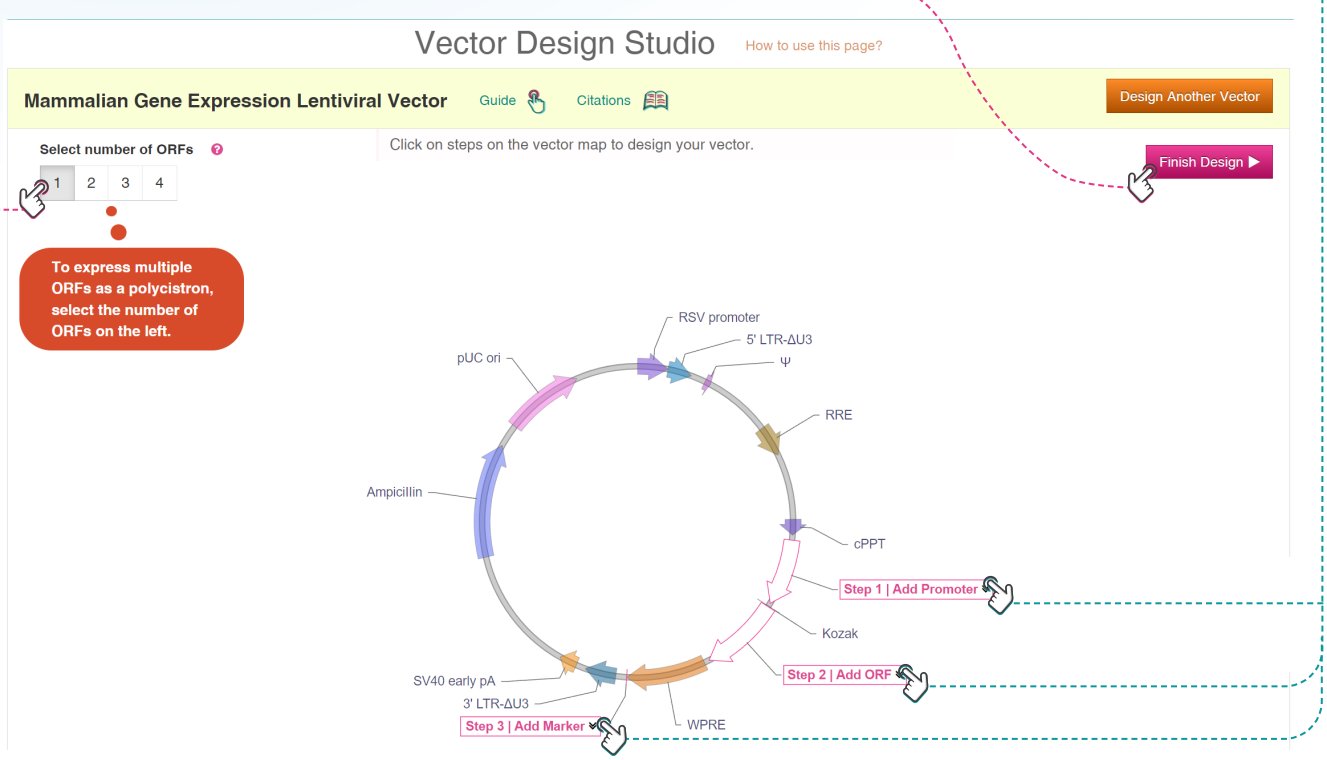
3 Next, on the Vector Design Studio page:

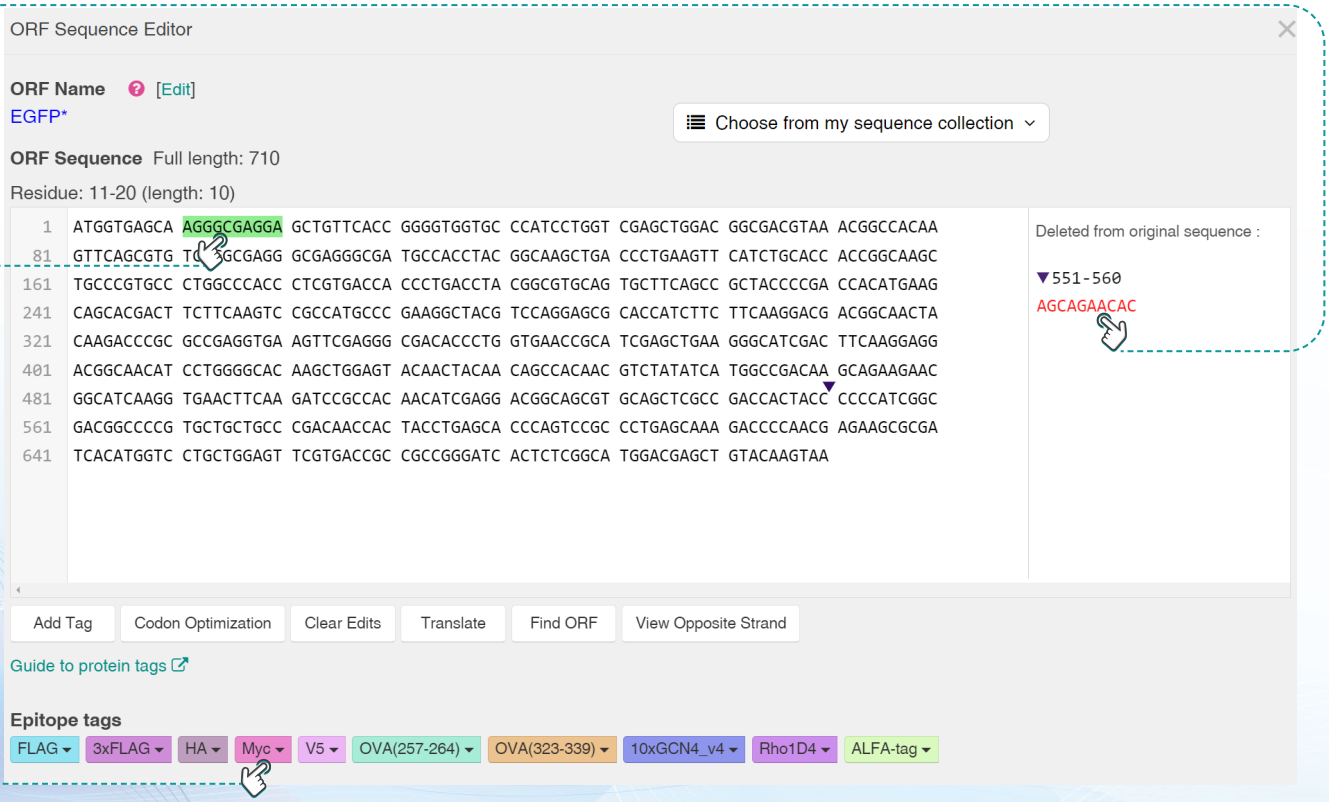
Add your desired vector components, such as promoter, ORF, marker, etc.

You can express up to four ORFs as a single polycistron separated by linkers of your choice, such as 2A or IRES.

You can also edit your ORF to introduce mutations and add epitope tags.

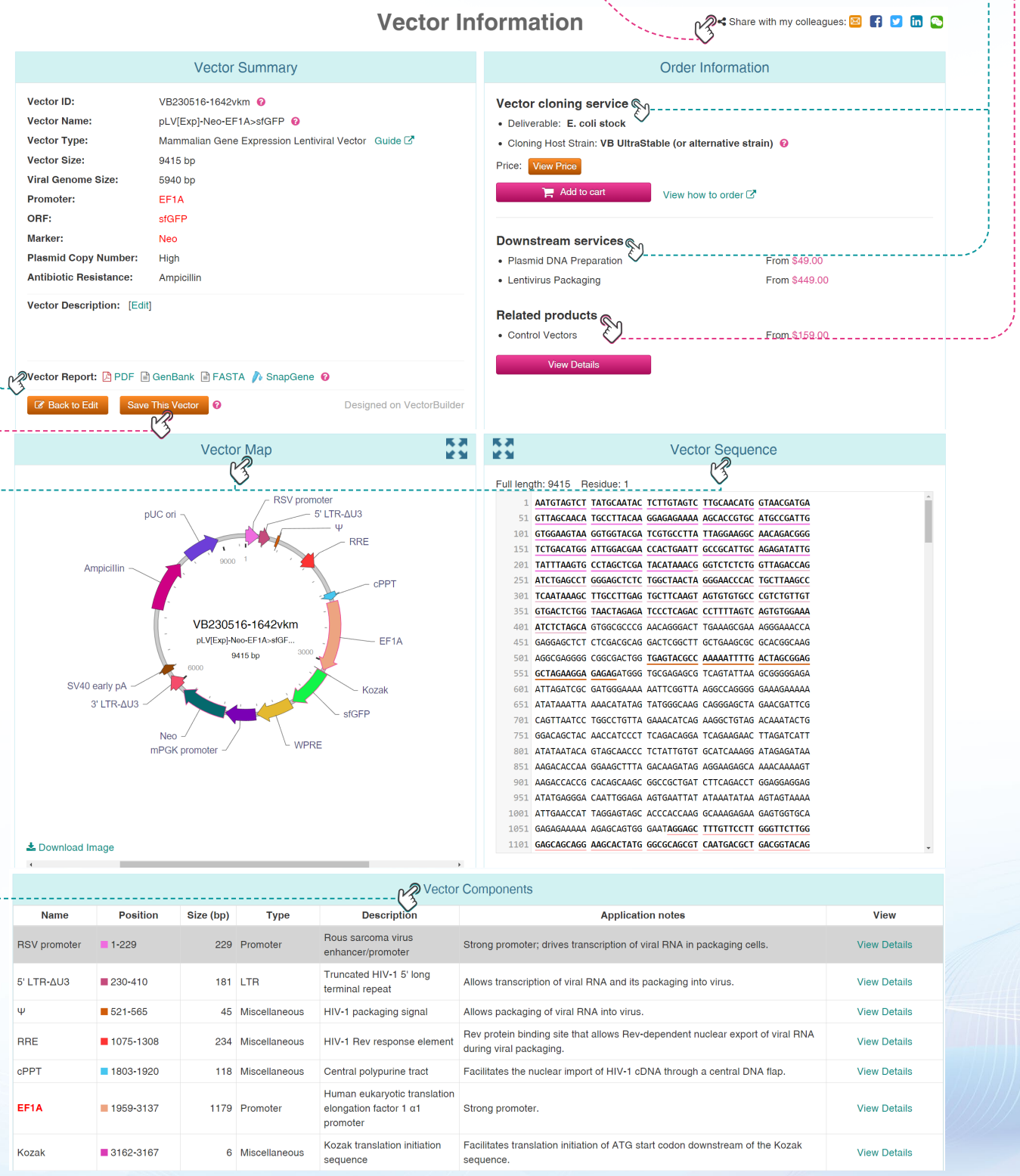
After you have added all the desired vector components, click **Finish Design.**





4 Lastly, you arrive at the Vector Information page where you can:

- View complete vector map and sequence with full annotation.
- Order cloning service for the vector and downstream services, such as plasmid DNA preparation and virus packaging.
- Order related products, such as control vectors.
- Save the vector to your account and share it with colleagues.
- Download a vector report in several file formats.



Vector Components

Name	Position	Size (bp)	Type	Description	Application notes	View
RSV promoter	1-229	229	Promoter	Rous sarcoma virus enhancer/promoter	Strong promoter; drives transcription of viral RNA in packaging cells.	View Details
5' LTR-ΔU3	230-410	181	LTR	Truncated HIV-1 5' long terminal repeat	Allows transcription of viral RNA and its packaging into virus.	View Details
Ψ	521-565	45	Miscellaneous	HIV-1 packaging signal	Allows packaging of viral RNA into virus.	View Details
RRE	1075-1308	234	Miscellaneous	HIV-1 Rev response element	Rev protein binding site that allows Rev-dependent nuclear export of viral RNA during viral packaging.	View Details
cPPT	1803-1920	118	Miscellaneous	Central polypurine tract	Facilitates the nuclear import of HIV-1 cDNA through a central DNA flap.	View Details
EF1A	1959-3137	1179	Promoter	Human eukaryotic translation elongation factor 1 α1 promoter	Strong promoter.	View Details
Kozak	3162-3167	6	Miscellaneous	Kozak translation initiation sequence	Facilitates translation initiation of ATG start codon downstream of the Kozak sequence.	View Details

VectorBuilder

How to Order on VectorBuilder

Design your vector on VectorBuilder.com.

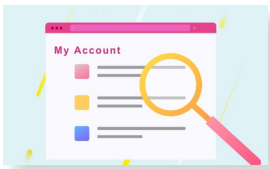
- Design a vector from scratch.
  OR
- Send a design request to our experts.

View your final vector design on the Vector Information page.

- View price and turnaround.
- Add the vector to your shopping cart.
- Add downstream services, such as plasmid DNA preparation and virus packaging.

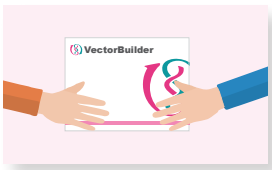
Open the Shopping Cart page and place your order.

- Get an official quote and use it to place your order by PO.
  OR
- Purchase directly with a credit card or use store credit.



Track your order online.

- Monitor the production status and get the estimated completion date for your order.
  OR
- Contact our project managers to get detailed updates on your project.



Receive your vector shipment.

- Your vector is sequence verified.
- Your virus titer is fully validated.

Account Management and Online Tracking

Home > My Account > My Business > Orders

My Saved Designs
- Vectors
- Service Proposals

My Inquiries
- Price Inquiries
- Design Requests

My Business
- Quotes
- Orders
- Invoices
- Order Requests
- Store Credit

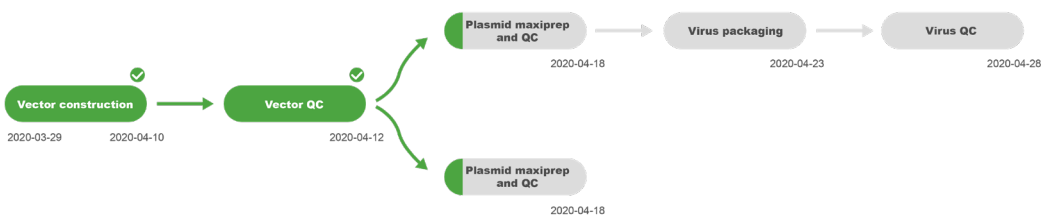
My Information
- Message Center
- Profile
- Address
- Credit Card

Orders

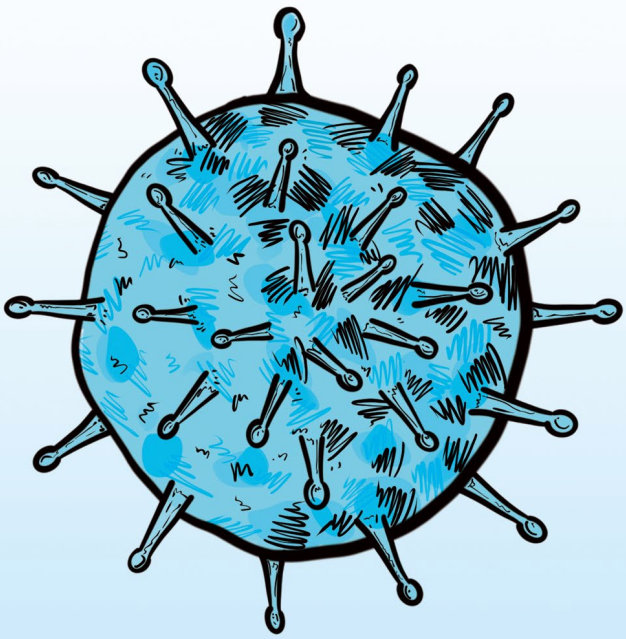
Bulk Actions | See All | Enter ID | Search

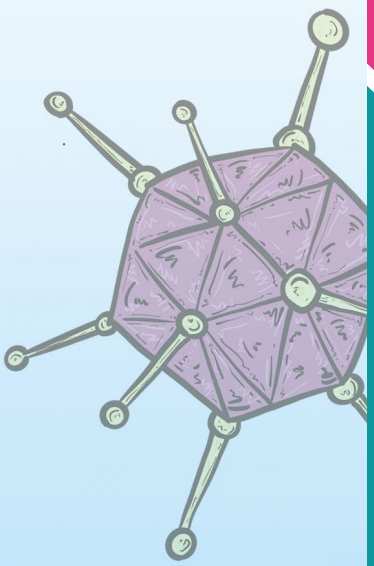
Sales Order #	Project Tracking #	Price (USD)	PO File	Payment	Date Last Updated	Status	Tracker	Monday Tracker
S200329-1012qgy	T200328-1017fcd	$1,737.00			2020-03-29	In Production	Track	
S200223-1002jes	T200218-1014jkp	$1,973.00			2020-03-12	Completed	Track	

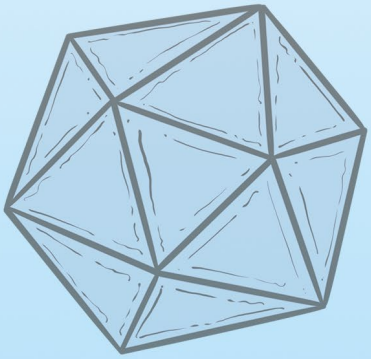
Project Timeline



Research Vectors & Viruses







Vector Cloning

As the world's leading provider of custom DNA vectors, VectorBuilder can clone virtually any vector tailored to your research needs.

Highlights

- 700+ vector backbones for various applications in multiple model organisms
- Comprehensive inventory of vector backbones and components, including promoters, ORFs, epitope tags, markers, linkers, peptide signals, and whole-genome shRNA and gRNA databases
- Functionally validated vector backbones and components to provide reliable experimental results
- Utilization of versatile cloning technologies for generating vectors with simple or complex designs
- Expertise in delivering highly challenging cloning projects
- Availability of various downstream services, including plasmid DNA preparation and virus packaging
- Robust production and stringent QC for release
- Free vector storage for up to 6 months
- IP of custom vectors owned by customers

Detailed descriptions of our vector cloning services, including ordering information, are available on the VectorBuilder website under ***Products & Services****.*

Price and turnaround

Our custom vector cloning workflow typically consists of three parts: QC of customer-supplied materials (if applicable), sourcing of required vector components (if applicable), and the actual vector cloning step. VectorBuilder offers top-quality cloning services at unbeatable prices and with rapid turnaround times every step of the way.

Vector cloning starts at just **$149**

in as fast as 5 days

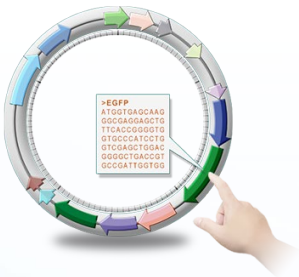


Table 1. Overview of price and turnaround for custom cloning

	Vector cloning*	Vector component sourcing (if applicable)			QC of customer-supplied materials (if applicable)	
Type	Depends on the complexity of vector design	In-stock template	Customer-supplied template	De novo gene synthesis	As vector backbone	As source for vector component
Price (USD)	a. For shRNA, gRNA, and short fragment expression (e.g. enhancer, promoter): starting at $149 b. For protein expression: starting at $189	$0-$50 for most templates	$0	Refer to Table 3	$150	Starting at $150
Turnaround**	1-3 weeks for >80% of the projects	Immediately available	Immediately available after passing QC	Refer to Table 3	3-5 days	
Details	Cloning methods include PCR, ligation-based cloning, Gibson, Gateway, and Golden Gate cloning.	In-stock templates include promoters, ORFs, markers, linkers, and protein tags.	Customers can send vector components and/or plasmids.	About 20% of projects need de novo gene synthesis.	QC includes quantification, re-transformation, plasmid prep, RE digestion, and Sanger sequencing.	

* Vectors built with VectorBuilder's standard backbones and components have a flat price and turnaround based on Table 2 below.

** The cloning turnaround refers to the time from production initiation to completion. It does not include transit time and QC of customer-supplied materials and transit time for shipping of final deliverables to the customer.

Table 2. Price and turnaround for simple vector cloning

Vector type	Price	Turnaround
shRNA vector	$149	5-10 days
CRISPR vector (single gRNA)	$149	
CRISPR vector (dual gRNA)	$329	9-18 days
Expression vector	$189	5-10 days

Table 3. Price and turnaround for de novo gene systhesis

Fragment length	Price*	Turnaround
<1.5 kb	$0.12/bp	5-10 days
1.5-3 kb	$0.14/bp	10-20 days
3-5 kb	$0.17/bp	
5-8 kb	$0.21/bp	

* The de novo gene synthesis fee may be higher when: 1) the fragment contains regions that are difficult to synthesize, such as high GC content, simple repeats, or segmental repeats; 2) fewer than three DNA fragments are synthesized.

		Regular plasmid	Lentivirus	Adeno-virus	AAV	Retrovirus (MMLV and MSCV)	VSV	Piggy-Bac	Sleeping Beauty	Tol2
Mammalian Gene Expression Vectors (from $159)		✓	✓	✓ (human Ad5, Ad5 gutless, chimeric Ad5/F35)	✓ (ssAAV, scAAV, or chimeric baculovirus-AAV)	✓ (WT and SIN MMLV)	✓	✓	✓	✓
Mammalian Inducible Gene Expression Vectors (Tet-Based) (From $189)	All-In-One (Tet-On)	✓ (Tet-On or Tet-On low leak)	✓		✓			✓ (Tet-On or Tet-On low leak)		
	TRE Driven GOI Expression	✓	✓		✓			✓		
	Tet Regulatory Protein Expression	✓	✓		✓			✓		
Mammalian Conditional Gene Expression Vectors (Cre-Lox Based, From $269)		✓ (LoxP-Stop-LoxP or FLEX)	✓	✓	✓			✓ (LoxP-Stop-LoxP or FLEX)		✓
Mammalian CAR Expression Vectors (From $189)		✓	✓			✓		✓	✓	✓
Mammalian Antibody Expression Vectors (Heavy and/or Light Chain Expression, From $299)		✓								
Mammalian Non-Coding RNA Expression Vectors (From $189)		✓	✓	✓	✓ (ssAAV, scAAV)	✓		✓		✓
Mammalian shRNA Knock-down Vectors (From $149)	U6-Based shRNA Expression	✓	✓ (standard or inducible)	✓	✓ (ssAAV, scAAV)			✓		
	miR30-Based shRNA Expression (Single or Multiple shRNA)	✓	✓	✓	✓			✓		
	shRNA Sensor Vectors (for Testing Specificity)		✓							

		Regular plasmid	Lentivirus	Adeno-virus	AAV	Retrovirus (MMLV and MSCV)	VSV	PiggyBac	Sleep-ing Beauty	Tol2
Mammalian CRISPR Gene Editing Vectors (From $149)	gRNA and Cas9 Coexpression	✓ (single or dual gRNA)	✓ (single or dual gRNA)	✓ (single or dual gRNA)	✓ (single SagRNA)			✓ (single or dual gRNA)		
	gRNA Expression	✓ (single or dual gRNA, polycistronic, tRNA-gRNA)	✓ (single or dual gRNA, polycistronic, tRNA-gRNA)	✓ (single or dual gRNA)	✓ (single or dual gRNA)			✓ (single or dual gRNA, polycistronic, tRNA-gRNA)		
	Cas9 Expression	✓	✓	✓	✓			✓		
	Gene Targeting Donor Vectors	✓								
Mammalian CRISPR Gene Regulation Vectors (From $149)	CRISPR-Based Gene Activation		✓	✓						
	CRISPR-Based Gene Inhibition		✓							
Enhancer/ Pro-moter Testing Vectors (From $189)	In Vitro Testing	✓ (enhancer or promoter)								
	In Vivo Testing	✓ (enhancer or promoter)						✓ (enhancer or promoter)		
Zebrafish Gene Expression Vectors (From $189)										✓
Zebrafish CRISPR Vectors (From $149)	gRNA or gRNA and Cas9 Coexpression									✓
	Cas9 Expression									✓

Drosophila Transformation Vectors (From $189)	P element-based vector pUAST	
	PhiC31-based vector pUASTattB	
	P element and phiC31-based vector pUASTB	
Drosophila CRISPR Gene Editing Vectors (From $149)	gRNA Expression	pattB
	Cas9 Expression	P element-based vector pUAST
		PhiC31-based vector pUASTattB
		P element and phiC31-based vector pUASTB
	Gene Targeting Donor Vectors	Regular plasmid (for gene knockout with attP landing pad)
Plant Gene Expression Vectors (From $189)	T-DNA binary vector (for plant transformation)	
	Regular plasmid (for electroporation of plant protoplasts)	
Plant CRISPR Gene Editing Vectors (From $149)	gRNA and Cas9 Coexpression	T-DNA binary vector (for plant transformation)
Worm Gene Expression Vectors (From $189)	Regular plasmid	
	ttTi5606 locus expression vector (for genome integration)	
Recombinant Protein Expression Vectors (From $189)	Bacteria	pET
		pBAD
		Cold-shock induced
	Yeast	Pichia pastoris
		Saccharomyces cerevisiae
	Insect	Baculovirus transfer vector (single promoter)
		Baculovirus transfer vector (dual promoters)
In Vitro Transcription Vectors (From $189)	In vitro transcription vector (for mRNA)	
	In vitro transcription vector (for in situ hybridization)	
	In vitro transcription vector (for small RNA)	

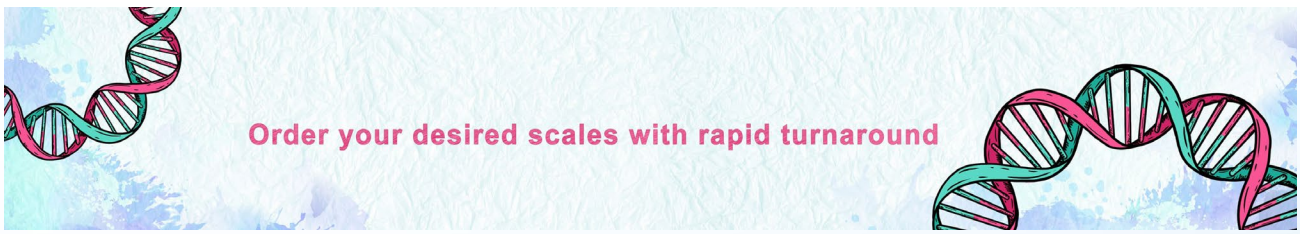
Plasmid DNA Preparation

High quality plasmid DNA is integral to many molecular biology techniques such as cloning, transfection/ transformation, virus packaging, mutagenesis, protein production, Southern blot etc. VectorBuilder's plasmid DNA preparation service allows you to obtain high-quality plasmid DNA on a desired scale in a rapid and cost-effective way. The scales of plasmid DNA we provide range from ug to g, satisfying a vast majority of needs from basic research scientists and industrial customers. In addition to research-grade plasmid, we also offer GMP-like and GMP-grade plasmid manufacturing for clinical applications.

Detailed descriptions of our plasmid DNA preparation services, including ordering information, are available on the VectorBuilder website under ***Products & Services.***

Price and turnaround

Scale	Application	Deliverable (DNA in 1x TE buffer)		Price	Turnaround
		High copy plasmid	Medium/low copy plasmid		
Miniprep	Molecular biology	>200 ng/ul, 50 ul	>100 ng/ul, 50 ul	$29	1-2 days
Midiprep	Molecular biology and cell culture	>1 ug/ul, 100 ul, **endotoxin-free, sterile**	>500 ng/ul, 100 ul, **endotoxin-free, sterile**	$99	3-5 days
Maxiprep		>1 ug/ul, 300 ul, **endotoxin-free, sterile**	>500 ng/ul, 300 ul, **endotoxin-free, sterile**	$149	
Megaprep		>1 ug/ul, 1 ml, **endotoxin-free, sterile**	>500 ng/ul, 1 ml, **endotoxin-free, sterile**	$249	
Gigaprep		>1 ug/ul, 10 ml, **endotoxin-free, sterile**	>500 ng/ul, 10 ml, **endotoxin-free, sterile**	$799	6-8 days
Industrial Grade	Various basic research and preclinical applications	10 mg-1 g	10 mg-1 g	Please inquire	



Animal-Free Plasmid Preparation

VectorBuilder has optimized production processes to eliminate the use of any animal-derived components, providing you with superior quality plasmid DNA suitable for various applications.

Highlights

- High-quality plasmid DNA free of TSE/BSE, provided with statement
- Prepared using culture media containing plant-based tryptone substitute
- Purified via non-enzymatic processes to circumvent RNase usage

Minicircle DNA Production

VectorBuilder also offers minicircle DNA production services for gene therapy applications to help you achieve long-term and enhanced expression of your target genes while eliminating the risk of potential immunogenic responses. Minicircle DNA vectors are devoid of standard prokaryotic sequences including the antibiotic resistance marker and the origin of replication found in conventional plasmid DNA vectors allowing them to exhibit smaller size and enhanced biosafety compared to plasmid DNA vectors.

Price and turnaround

Scale	Deliverable	Price*	Turnaround
Minicircle maxiprep	DNA (>1 ug/ul, 100 ul, endotoxin-free, sterile)	$599	14-21 days

* Please note that the price shown in the table above applies for minicircle DNA production only and does not include the cost of cloning the parental plasmid from which the minicircle is derived. Please send us a design request if you would like to request parental plasmid cloning or to enquire about other available minicircle DNA scales.

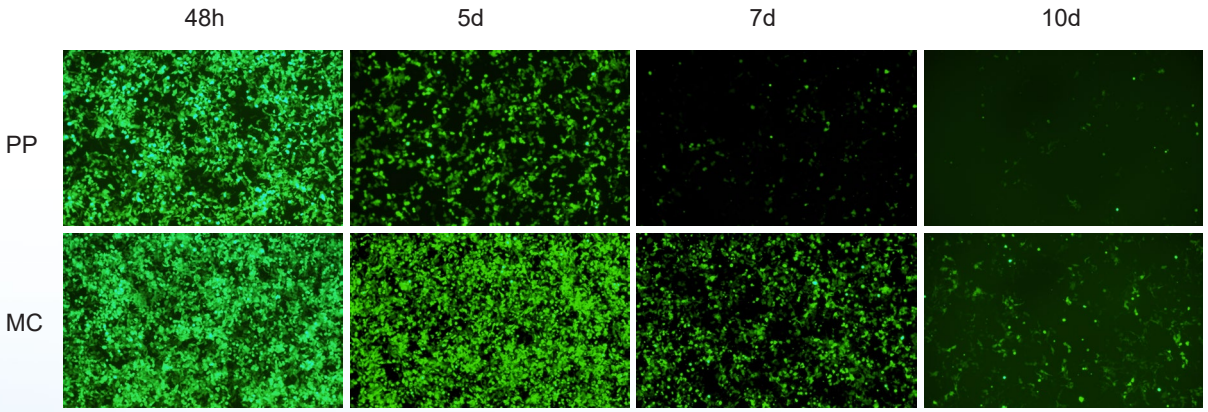


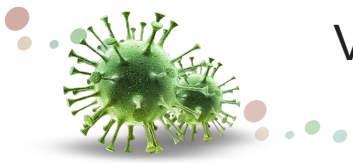
Figure 1. 293T cells transfected with either EGFP expressing parental plasmid DNA (PP) or DNase-treated, EGFP expressing minicircle DNA (MC). Images were taken at 48 hours, 5 days, 7 days, and 10 days post-transfection. Magnification: 100X.

Virus Packaging

VectorBuilder has developed a range of proprietary technologies and reagents that significantly improve virus packaging in titer, purity, viability, and consistency. Our packaging protocols are also optimized for the viral vector systems used in our cloning services. As a result, we have a growing community of highly satisfied customers who repeatedly come back to us for their virus packaging needs.

Viruses produced by VectorBuilder undergo a series of QC assays, including titration by qPCR or immunoassay, sterility testing for bacteria and fungi, mycoplasma detection, transduction test for GOI expression, endotoxin assay (for ultra-purified virus), and SDS-PAGE analysis (for ultra-purified virus). Additional QC assays are available upon request (e.g. ddPCR, full/empty capsid ratio, TCID50).

Detailed descriptions of our virus packaging services, including ordering information, are available on the VectorBuilder website under ***Products & Services****.*



Virus packaging starts at ***$449***
in as fast as 8 days

Lentivirus

Types of lentivirus offered

- VSV-G pseudotyped third-generation lentivirus (this is the default virus type)
- VSV-G pseudotyped second-generation lentivirus
- Lentivirus pseudotyped with other envelope proteins as requested, such as coronavirus spike (S) proteins
- Bald lentivirus lacking viral envelope protein
- Integrase-deficient lentivirus (IDLV)

Note: *We also offer lentivirus pseudotyping services with other envelope proteins.*

Highlights

- Permanent integration of vector DNA
- Very broad tropism targeting dividing and non-dividing cells
- High viral titer
- Customizable internal promoter
- Uniform transduction
- Effective gene delivery both in vitro and in vivo
- Minimal safety concern due to self-inactivating design

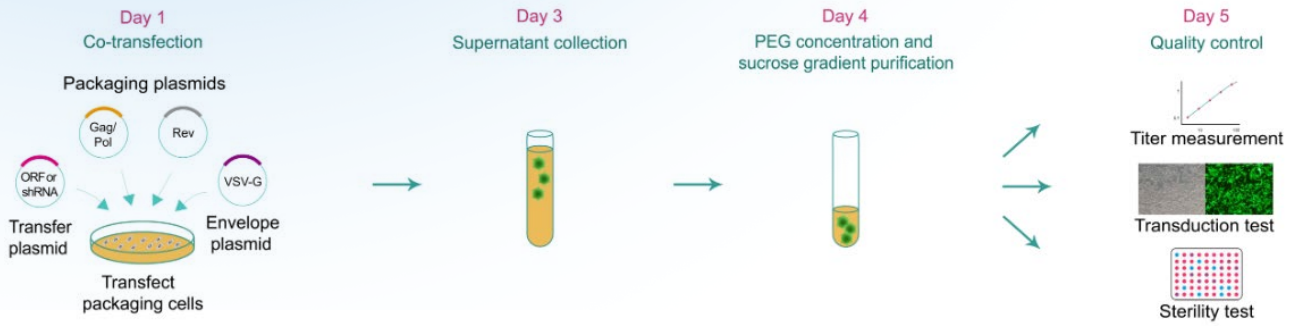


Figure 2. Typical workflow of lentivirus packaging.

Price and turnaround

Scale	Application	Titer	Volume	Price	Turnaround
Pilot	Cell culture	>10^8 TU/ml	250 ul (10x25 ul)	$449	8-16 days
Medium			1 ml (10x100 ul)	$649	
Large		>10^9 TU/ml	1 ml (10x100 ul)	$1,099	
Ultra-purified medium	Cell culture & in vivo	>10^9 TU/ml	500 ul (10x50 ul)	$1,399	
Ultra-purified large			1 ml (10x100 ul)	$1,699	

Note:

The above table applies to VSV-G pseudotyped 2nd- and 3rd-generation lentivirus (integrase-deficient lentivirus (IDLV) included).

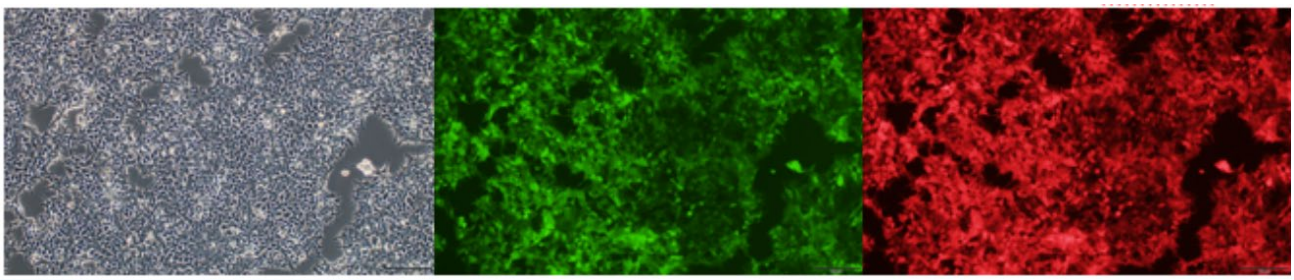


Figure 3. Lentivirus-mediated fluorescent protein expression in 293T cells. Magnification: 100X. Left: bright field. Middle: EGFP. Right: mCherry.

Adeno-Associated Virus (AAV)

Types of AAV offered

- Single-stranded AAV (ssAAV) and self-complementary AAV (scAAV)
- 18 serotypes: 1, 2, 3, 4, 5, 6, 6.2, 7, 8, 9, rh10, DJ, DJ/8, PHP.eB, PHP.S, AAV2-retro, AAV2-QuadYF and AAV2.7m8
- AAV empty capsids or virus-like particles (VLPs)

Highlights

- Non-pathogenic in human
- Low risk of host genome disruption
- Multiple serotypes with broad tropism
- High viral titer
- Effective gene delivery both in vitro and in vivo

	Recommended AAV serotypes
Smooth muscle	AAV1, 2, 3, 5, 6, 7, 8, 9, rh10
CNS	AAV1, 2, 4, 5, 7, 8, 9, rh10, PHP.eB
PNS	AAV-PHP.S
Brain	AAV1, 2, 5, 7, 8, DJ/8
Retina	AAV1, 2, 4, 5, 7, 8, 9, rh10, 2-QuadYF, 2.7m8
Inner ear	AAV1, 2, 6.2, 8, 9, 2.7m8
Spleen	AAV-DJ, DJ/8
Liver	AAV1, 2, 3, 6, 6.2, 7, 8, 9, rh10, DJ, DJ/8
Pancreas	AAV1, 2, 6, 8, 9, rh10
Heart	AAV1, 4, 5, 6, 8, 9, rh10, DJ
Kidney	AAV2, 4, 8, 9, rh10, DJ, DJ/8
Lung	AAV1, 3, 4, 5, 6, 6.2, 9, rh10
Testes	AAV2, 9
Adipose	AAV6, 8, 9
Spinal nerves	AAV2- retro
Endothelial cells	AAV2-QuadYF
Skeletal muscle	AAV1, 9

Research grade AAV packaging

Our research grade AAV packaging services meet the vast majority of AAV-based gene delivery needs in basic research. Both triple transfection and baculovirus-based packaging methods can be selected based on your needs.

Price and turnaround

Scale	Application	Titer	Volume	Price	Turnaround
Triple transfection-based AAV					
Pilot	Cell culture	>2x10^{11} GC/ml	250 ul (10x25 ul)	$449	8-16 days
Medium			1 ml (10x100 ul)	$649	
Large		>2x10^{12} GC/ml	1 ml (10x100 ul)	$1,099	
Ultra-purified pilot	Cell culture & in vivo	>10^{13} GC/ml	100 ul (4x25 ul)	$1,399	12-24 days
Ultra-purified medium			500 ul (10x50 ul)	$1,999	
Ultra-purified large			1 ml (10x100 ul)	$3,099	
Ultra-purified large 5			5 ml (10x500 ul)	From $9,899	23-33 days
Ultra-purified large 10			10 ml (10x1 ml)	From $15,899	40-50 days
Other scales			Please inquire		
Baculovirus-based AAV					
Ultra-purified pilot	Cell culture & in vivo	>5x10^{13} GC/ml	1 ml (10x100 ul)	$5,599	42-56 days
Ultra-purified medium			5 ml (25x200 ul)	$20,199	49-63 days
Ultra-purified large			10 ml (50x200 ul)	$38,199	56-70 days

Research plus grade AAV packaging

Our research plus AAV packaging services are suitable for applications that are sensitive to impurities (e.g. host cell protein, endotoxin, etc.), or applications with special requirements on purification method, titer, or formulation. They are also optimal choices for your preclinical animal experiments.

Price and turnaround

Scale	Application	Total yield (GC)	Price	Turnaround
Research-plus 1	Various in vitro and in vivo experiments	1x10^{13}	From $4,699	12-24 days
Research-plus 5		5x10^{13}	From $14,899	30-40 days
Research-plus 10		1x10^{14}	From $23,899	40-50 days
Other scales		Please inquire		

Note:

1. GC = Genome copies.

2. The above listed price and turnaround are based on purification by CsCl density gradient centrifugation. When other purification methods (e.g. iodixanol density gradient, affinity chromatography, ion-exchange chromatography, etc.) are required, please send us a design request to get the quote.

Comparison of different AAV grades

The table below is an overview comparison of different grades of AAV we offer for research use.

	Nonpurified research grade	Ultra-purified research grade	Research plus grade
Available purification method	-	CsCl density gradient	CsCl density gradient (default), iodixanol density gradient, affinity chromatography, ion-exchange chromatography
Titer	>10^{12} GC/ml	>10^{13} GC/ml	1x10^{13} - 5x10^{13} GC/ml
Achievable purity (assessed by SDS-PAGE)	-	>80%	>90%
Achievable endotoxin level	<30 EU/ml	<10 EU/ml	<2 EU/ml
Typical full capsid ratio	-	>70%	>80%

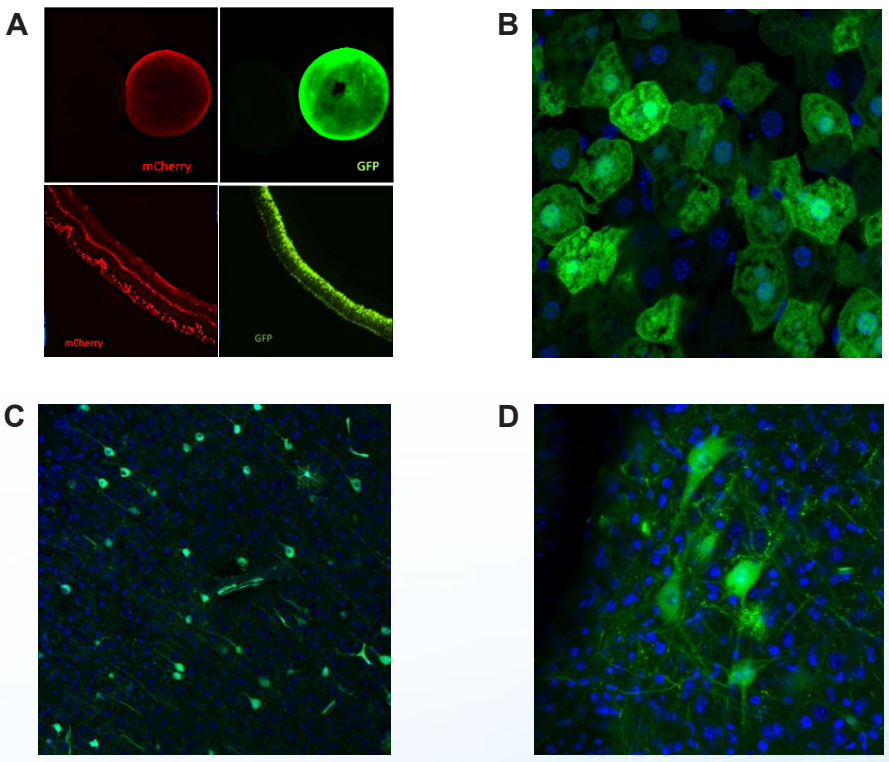


Figure 4. (A) AAV8-mediated mCherry and EGFP expression in mouse retina. (Hoang et al., unpublished data) (B) AAV9-mediated EGFP expression in mouse hepatocytes. Magnification: 480X. Green: EGFP. Blue: DAPI. (C) AAV9-mediated EGFP expression in mouse cortical neurons. Magnification: 120X. Green: EGFP. Blue: DAPI. (D) AAV9-mediated EGFP expression in mouse motor neurons. Magnification: 240X. Green: EGFP. Blue: DAPI.

Adenovirus

Types of adenovirus offered

- Human Ad5 adenovirus
- Chimeric Ad5/F35 adenovirus
- Gutless adenovirus

Price and turnaround

Scale	Application	Titer	Volume	Price	Turnaround
Human Ad5 adenovirus					
Pilot	Cell culture	>10^{10} IFU/ml	250 ul (10x25 ul)	$649	27-39 days
Medium			1 ml (10x100 ul)	$1,099	
Large		>10^{11} IFU/ml	1 ml (10x100 ul)	$1,699	
Ultra-purified medium	Cell culture & in vivo	>10^{12} VP/ml	500 ul (10x50 ul)	$2,099	29-43 days
Ultra-purified large			1 ml (10x100 ul)	$2,499	
Chimeric Ad5/F35 adenovirus					
Pilot	Cell culture	>10^{10} IFU/ml	250 ul (10x25 ul)	$1,099	35-49 days
Medium			1 ml (10x100 ul)	$1,699	
Large		>10^{11} IFU/ml	1 ml (10x100 ul)	$2,599	
Ultra-purified medium	Cell culture & in vivo	>10^{12} VP/ml	500 ul (10x50 ul)	$3,199	37-53 days
Ultra-purified large			1 ml (10x100 ul)	$3,799	
Gutless adenovirus					
Ultra-purified large	Cell culture & in vivo	>10^{11} VP/ml	10x100 ul	$4,999	44-62 days

MMLV Retrovirus

Types of MMLV retrovirus offered

VSV-G pseudotyped wild-type and self-inactivating MMLV retrovirus. SIN-MMLV allows for Promoter customization.

Price and turnaround

Scale	Application	Titer	Volume	Price	Turnaround
Pilot	Cell culture	>10^{7} TU/ml	250 ul (10x25 ul)	$449	8-16 days
Medium			1 ml (10x100 ul)	$649	
Large		>10^{8} TU/ml	1 ml (10x100 ul)	$1,099	
Ultra-purified large	Cell culture & in vivo	>10^{8} TU/ml	1 ml (10x100 ul)	$1,699	

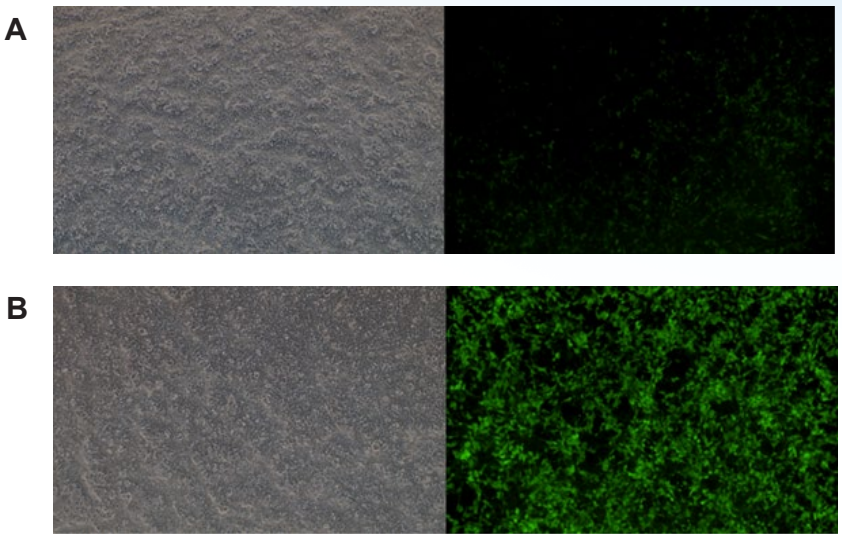


Figure 5. Comparison of two MMLV systems. (A) Wild-type MMLV vector pMMLV[Exp]-EGFP:T2A:Puro and (B) Self-inactivating MMLV vector pMMLV-SIN[Exp]-CMV>EGFP:T2A:Puro were packaged and transfected with an equal MOI. Magnification: 100X. Left: bright field. Right: EGFP.

MSCV Retrovirus

Types of MSCV retrovirus offered

VSV-G pseudotyped MSCV retrovirus

Price and turnaround

Scale	Application	Titer	Volume	Price	Turnaround
Pilot	Cell culture	>10^7 TU/ml	250 ul (10x25 ul)	$449	8-16 days
Medium			1 ml (10x100 ul)	$649	
Large		>10^8 TU/ml	1 ml (10x100 ul)	$1,099	
Ultra-purified large	Cell culture & in vivo	>10^8 TU/ml	1 ml (10x100 ul)	$1,699	

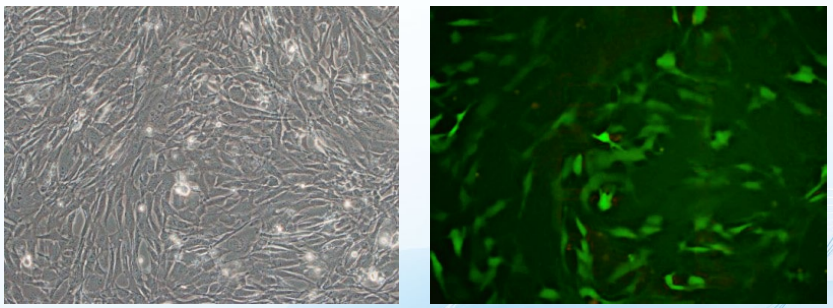


Figure 6. MSCV-mediated EGFP expression in mouse mesenchymal stem cells. Magnification: 100X. Left: bright field. Right: EGFP.

Baculovirus

Types of baculovirus offered

Baculovirus strain AcMNPV (Autographa californica multicapsid nucleopolyhedrovirus)

Price and turnaround

Scale	Application	Titer	Volume	Price	Turnaround
Medium	Cell culture	>10^6 PFU/ml	1 ml (10x100 ul)	$649	15-22 days
Large		>10^7 PFU/ml		$1,099	22-29 days

Herpes Simplex Virus (HSV)

Types of HSV services offered

- HSV vector cloning in BAC or BACYAC backbone
- HSV-1 virus packaging
- HSV-1 amplicon vector cloning

Price and turnaround

Scale	Application	Titer	Volume	Price	Turnaround
Ultra-purified pilot	Cell culture & in vivo	>10^7 PFU/ml	1 ml (10x100 ul)	$2,099	28-35 days
Ultra-purified medium		>10^8 PFU/ml		$3,099	

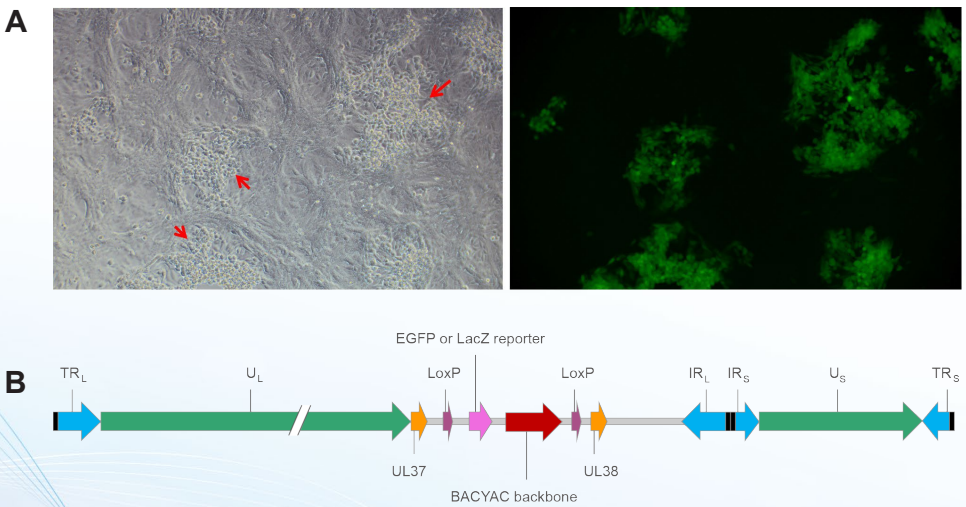


Figure 7. (A) Vero cells were transfected with our BACYAC vector carrying the full genome sequence of wildtype HSV-1 (KOS strain) along with an EGFP reporter. Images were taken at 72 hours post-transfection. Signs of cytopathic effect (CPE), namely clumps of dying cells with round morphology and increased light refraction (indicated by red arrows), can be seen demonstrating the presence of live virus. Magnification: 100x. Left: bright field. Right: EGFP. (B) Map of HSV BACYAC backbone.

Vesicular Stomatitis Virus (VSV)

Types of VSV offered

- VSV pseudotyped with VSV-G protein
- VSV pseudotyped with coronavirus S protein and its variants
- VSV pseudotyped with any other envelope proteins as requested
- Bald VSV lacking viral envelope protein (can be used as negative control

Price and turnaround

Scale	Application	Titer	Volume	Price	Turnaround
VSV pseudotyped with VSV-G					
Medium	Cell culture	>10^7 PFU/ml	1 ml (10x100 ul)	$1,099	21-35 days
Large		>10^8 PFU/ml		$1,399	
Ultra-purified medium	Cell culture & in vivo	>10^8 PFU/ml	500 ul (5x100 ul)	$1,699	
Ultra-purified large			1 ml (10x100 ul)	$2,699	
VSV pseudotyped with SARS-CoV-2 S protein and its variants (Luc or EGFP as transgene)					
Medium	Cell culture	>10^7 PFU/ml	1 ml (10x100 ul)	$2,199	21-35 days
Large		>10^8 PFU/ml		$2,799	
Ultra-purified medium	Cell culture & in vivo	>10^8 PFU/ml	500 ul (5x100 ul)	$3,399	
Ultra-purified large			1 ml (10x100 ul)	$5,399	
VSV pseudotyped with SARS-CoV-2 S protein and its variants (other transgenes)					
Medium	Cell culture	>10^7 PFU/ml	1 ml (10x100 ul)	$2,199	21-35 days
Large		>10^8 PFU/ml		$2,799	
Ultra-purified medium	Cell culture & in vivo	>10^8 PFU/ml	500 ul (5x100 ul)	$3,399	
Ultra-purified large			1 ml (10x100 ul)	$5,399	

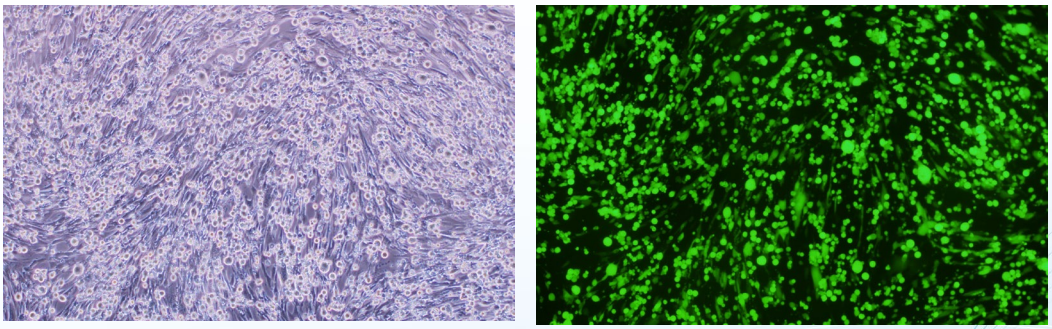


Figure 8. BHK-21 cells transduced with VSV pseudotyped with VSV-G protein. Magnification: 100X. Left: bright field. Right: EGFP.

Vaccinia Virus (VACV)

Types of VACV offered

- VACV vector cloning in VAC-BAC backbone for both attenuated Western Reserve (WR) and Modified Vaccinia virus Ankara (MVA) strains
- VACV virus packaging

Price and turnaround

Scale	Application	Titer	Volume	Price	Turnaround
Medium	Cell culture	>10^8 PFU/ml	1 ml (10x100 ul)	$1,699	21-28 days
Ultra-purified medium	Cell culture & in vivo	>10^8 PFU/ml	1 ml (10x100 ul)	$2,699	21-35 days

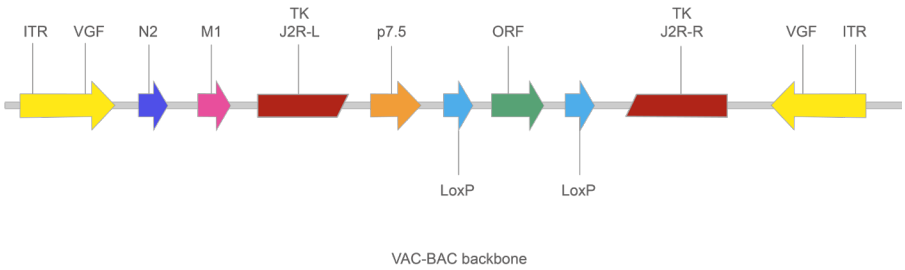


Figure 9. Map of recombinant VAC-BAC vector with ORF insert

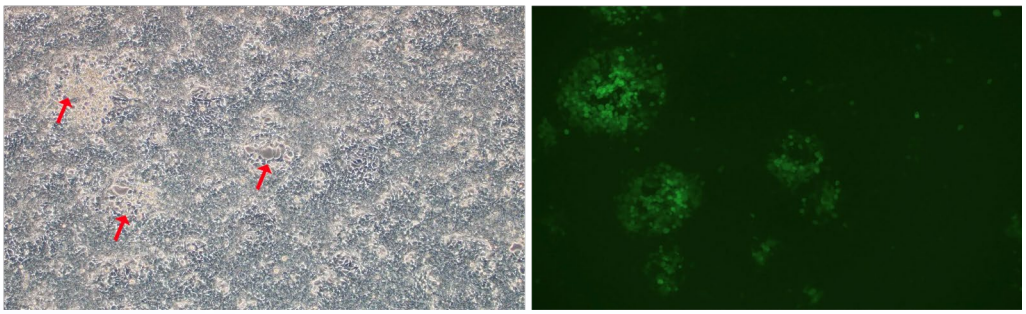
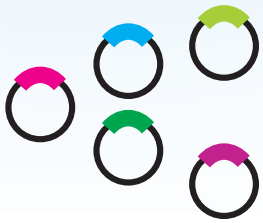


Figure 10. 293T cells were transduced with VACV particles expressing EGFP (MOI: 2×10^{-3}). Images were taken at 96 hours post-transduction. Magnification: 200x. Arrows indicate signs of cytopathic effect (CPE). Left: bright field. Right: EGFP.

CRO Services

Library Construction



Pooled Library Construction starts at *$2,300*

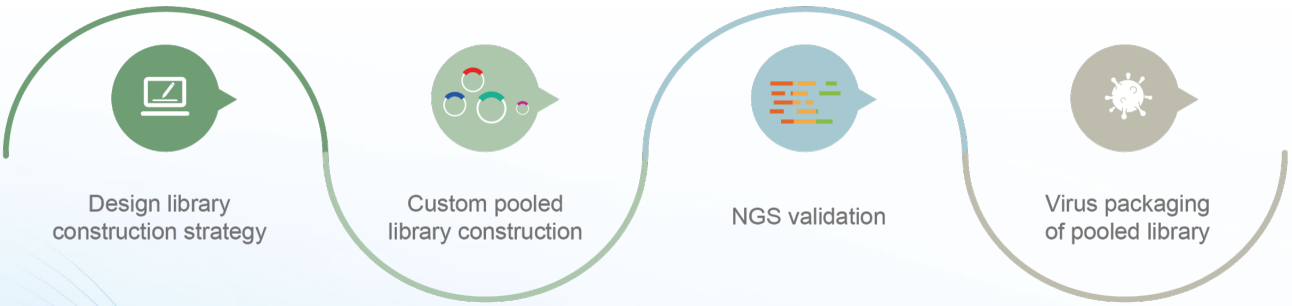
VectorBuilder can help you build custom pooled libraries to perform large-scale functional screens. We have extensive experience in constructing high-quality pooled libraries utilizing our optimized vectors and proprietary technologies. We can deliver your library as E. coli stock, DNA, or recombinant virus, depending on your needs. Our custom libraries are fully validated by next-generation sequencing (NGS) so you know exactly what you get.

Detailed descriptions of our pooled library construction services, including ordering information, are available on the VectorBuilder website under ***Products & Services***.

Libraries Offered

- CRISPR libraries (e.g. CRISPR KO, CRISPRa/i, CROP-seq, Perturb-seq, etc.)
- shRNA libraries
- Barcode libraries
- Enhancer/promoter screening libraries
- Peptide expression libraries
- DNA shuffling libraries
- Two-hybrid libraries
- Capsid screening libraries
- And many more

Workflow for Pooled Library Construction



Price and turnaround

Service	Brief description	Price	Turnaround
Custom library construction strategy design		Free	1-4 days
Custom pooled library construction	Includes high-efficiency cloning of variable regions into desired vector backbone, and preliminary validation of the plasmid pool by Sanger sequencing.	From $1,500	3-5 weeks
Amplification of premade plasmid library pool	The plasmid pool is transformed into E. coli cells at an average of >100x representation, and E. coli glycerol stocks are prepared for long-term storage.	From $300	3-5 days
Library DNA preparation	>1 ug/ul, 150 ul, 1 x TE buffer, endotoxin-free, sterile	$149	4-6 days
Virus packaging of pooled library	Please see “Virus Packaging” on page 18.		
NGS validation of pre-made plasmid library pool	We can validate the quality of your premade plasmid library pool by NGS before and/or after amplification. This includes NGS library preparation from plasmid pool, Illumina sequencing, and data analysis.	From $300	3-4 weeks
NGS deconvolution of post-screening sample	Includes NGS library preparation from genomic DNA of screened cells, Illumina sequencing, and data analysis.	From $200 per sample	5-7 weeks
Other custom library construction	Please inquire.		

User Testimonials

“Before using VectorBuilder, producing lentiviral overexpression vectors for our in vitro models was a recurring and time-consuming enterprise. We faced frequent challenges in every experimental step, which made it difficult to plan the actual experiments. Setting up the process with VectorBuilder was very efficient, thanks to their great expertise and support. Once we started using VectorBuilder's services, we noticed a substantial increase in productivity as well as a more uniform and predictable transduction pattern of our target cells.

We went on to use VectorBuilder for a large-scale CRISPR screen with a custom library spanning over 1,600 genes. With the provided virus, we were able to easily maintain cell representation and we derived a number of interesting hit genes, which we are excited to follow up on. A big thank you to the entire VectorBuilder Team!”

Dominic Schmid

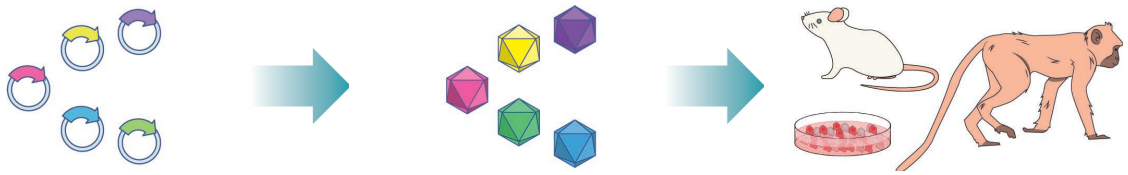
University of Basel

AAV Capsid Evolution

Recombinant adeno-associated virus (AAV) is a highly popular gene delivery vector for a wide range of gene therapy and vaccine applications, thanks to its broad tropism, prolonged transgene expression, non-pathogenicity, and low immunogenicity.

However, several problems with existing AAV serotypes limit their therapeutic potential. First, while available serotypes offer a variety of tropisms to choose from, many clinical applications require tissue-specificities that fall outside of their coverage. Second, even if a tissue of therapeutic interest is covered by the tropism of one or more serotypes, the efficiency of gene delivery may be too low and there may also be undesirable tropism for off-target tissues. Third, pre-existing neutralizing antibodies against many AAV serotypes can block their efficient delivery initially or with repeated drug administration. Lastly, some serotypes are inherently difficult to manufacture at high titer, purity and stability. To overcome these limitations, AAV capsid engineering has been a critical area of research that has significantly accelerated the development of novel AAV variants with improved features.

Directed evolution is a widely used high-throughput approach to engineer enhanced biomolecules. It mimics the process of natural selection through repeated genetic diversification and selection. Directed evolution of AAV capsid is performed by mutating the wildtype AAV capsid gene to generate highly diverse AAV capsid libraries, which are then screened to identify novel capsid variants with improved properties. Since directed evolution does not require prior knowledge of the structure-function relationship of proteins, it is often preferred over rational design for AAV capsid engineering.



Capsid library construction via various strategies

High-titer packaging of viral capsid library

Capsid screening and characterization in vitro and in vivo

Figure 11. Our capabilities for developing novel AAVs by directed evolution of AAV capsids.

Highlights

- Full-service platform to fulfill all your needs along the workflow of generating highly diverse AAV capsid libraries
- High-complexity capsid library construction via any mutagenesis or combinatorial approach, including error-prone PCR, random peptide display, DNA family shuffling, and in silico design
- High-titer packaging of viral capsid library by either one-step or two-step approach
- In vivo screening in multiple species, including mice, rats, and NHPs
- Full technical support covering every aspect of your AAV capsid project from library design and construction to in vivo screening and NGS analysis

Detailed descriptions of our AAV capsid evolution services are available on the VectorBuilder website under ***Products & Services****.*

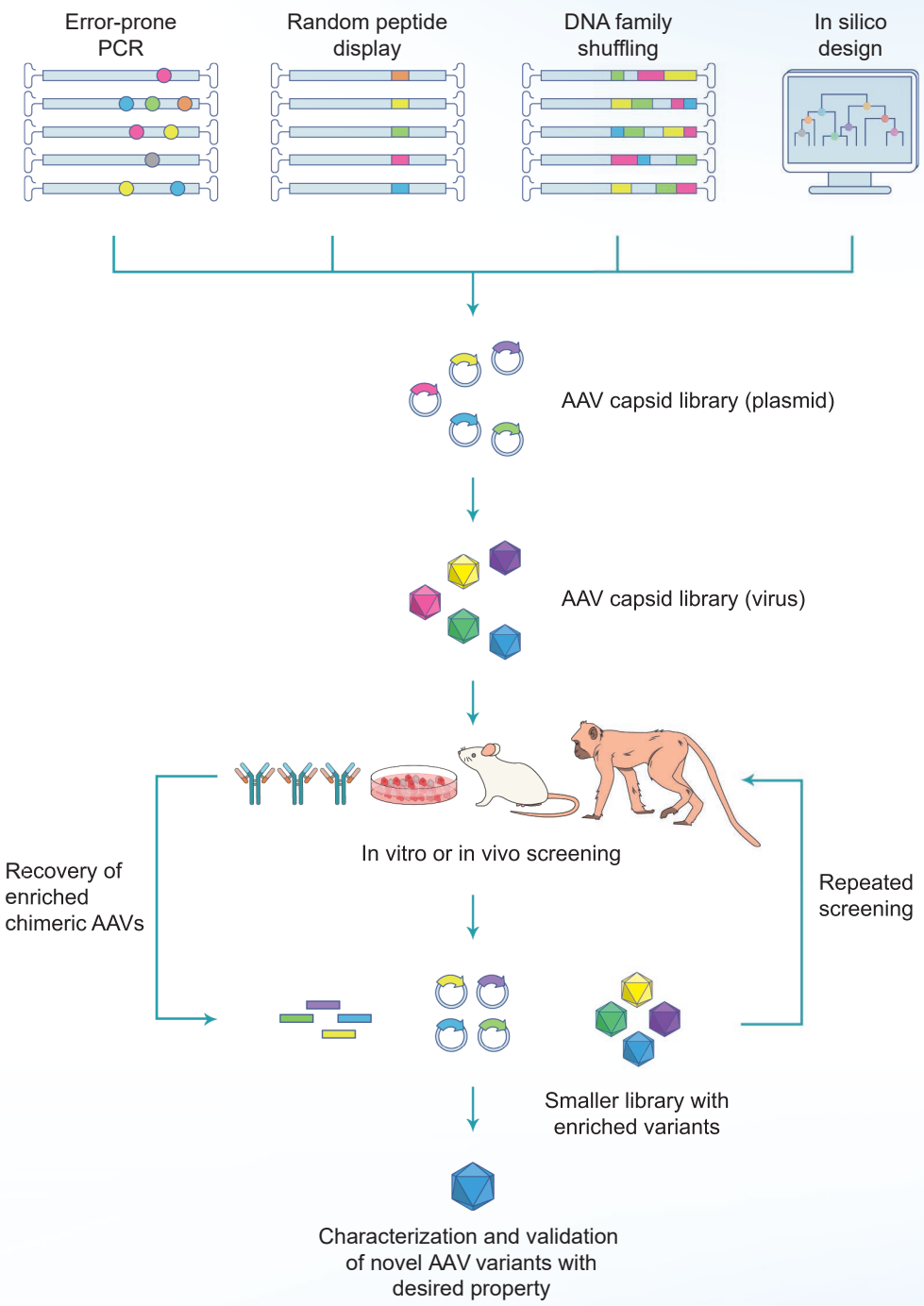


Figure 12. Typical workflow for screening novel AAV capsids by directed evolution. The first and most critical step in the entire workflow of AAV capsid evolution is the generation of a highly diverse AAV capsid library in which each plasmid carries a chimeric AAV genome consisting of a rep gene and a capsid gene variant. The capsid gene variants can be efficiently generated using various approaches, such as error-prone PCR, random peptide display, DNA family shuffling, or in silico design. The capsid library is then packaged into viral particles, and each viral particle harbors a corresponding capsid variant in its genome. The viral library is then subsequently subjected to a screening process. Viral genomes past screening are recovered from target cells and made into a smaller library for the second round screening. Multiple rounds of screening are usually performed to enrich high-confidence hits. The resulting hits are then validated and characterized to identify novel AAV capsid variants with enhanced properties.

AAV Biodistribution Profiling

Assessing the distribution and persistence of AAV vectors in various body tissues and organs at the developmental and preclinical stages is critical to ensure the success of AAV-based gene therapy. AAV biodistribution studies have been highly instrumental in identifying off-target effects, thereby playing a significant role in the safety assessment of AAV vectors.

VectorBuilder offers the most comprehensive AAV biodistribution studies in the industry to help you obtain high-resolution data in the most appropriate species, including NHPs.

Detailed descriptions of our AAV biodistribution profiling services are available on the VectorBuilder website under ***Products & Services.***

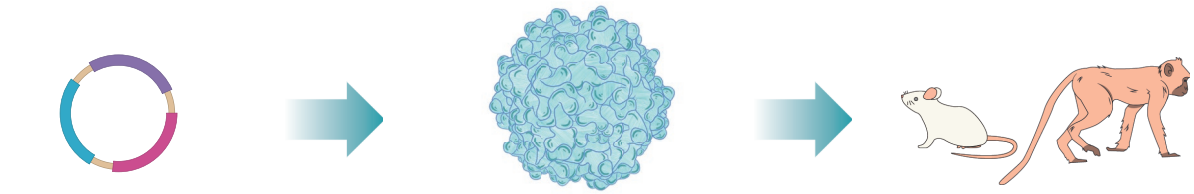


Figure 13. Our capabilities for performing biodistribution profiling studies of AAV vectors.

Highlights

- Full-service platform to fulfill all your needs along the workflow of biodistribution assessment for your AAV vectors
- Services available for multiple species, including mice, rats, and NHPs
- Multiple analytical assays, including fluorescence imaging, flow cytometry analysis, luciferase assay, qPCR, and RT-qPCR
- Multiplexing analysis using barcode and NGS for assessing the biodistribution of different vectors within the same animal
- Multiple routes of AAV administration by highly trained experts, including tail vein injection, facial vein injection (for neonatal mice and rats), intracerebroventricular injection, intrathecal injection, subretinal injection, intravitreal injection, intratympanic injection, and intramuscular injection
- Full technical support that covers every aspect of your AAV biodistribution project

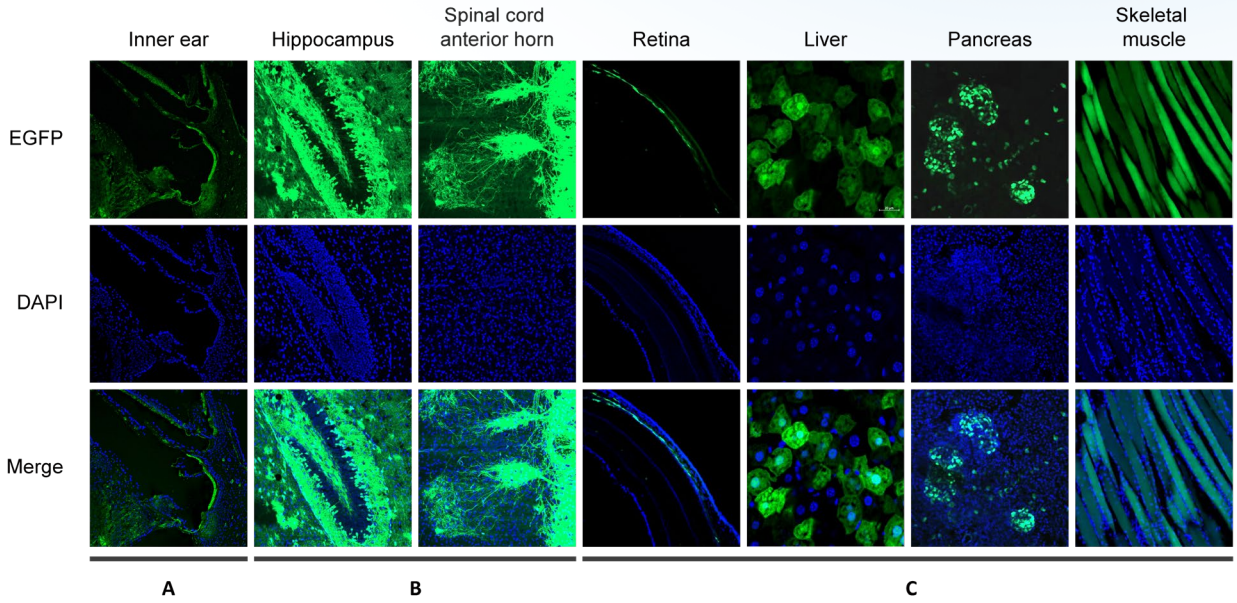


Figure 14. AAV9 biodistribution profiling. AAV9 carrying CAG promoter driving EGFP was administered to mice by various routes. EGFP and DAPI fluorescence were analyzed in the following organs: (A) inner ear, images were taken 13 days after vector delivery by intratympanic injection to the left ear; (B) hippocampus and spinal cord anterior horn, images were taken 10 days after vector delivery by facial vein injection; (C) retina, liver, pancreas, and skeletal muscle, images were taken 12 days after vector delivery by tail vein injection.

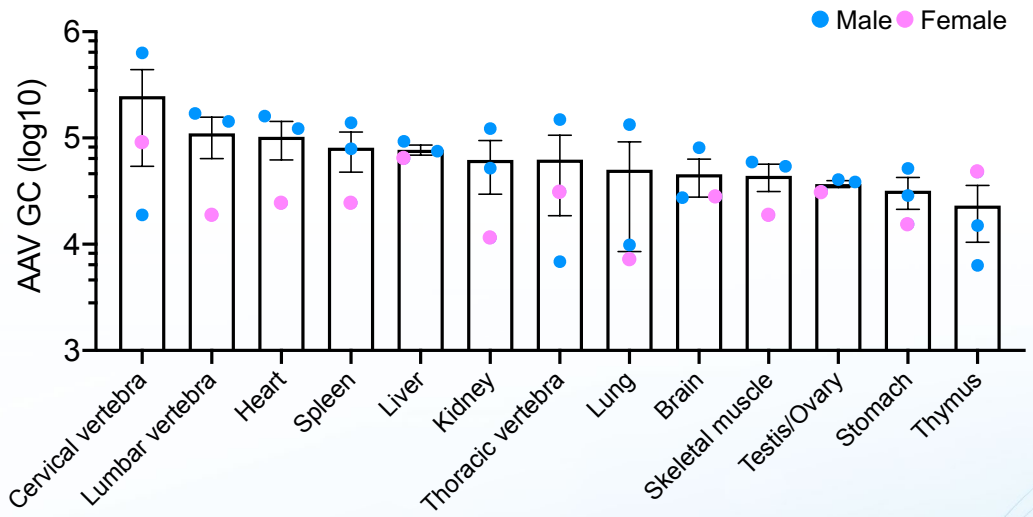


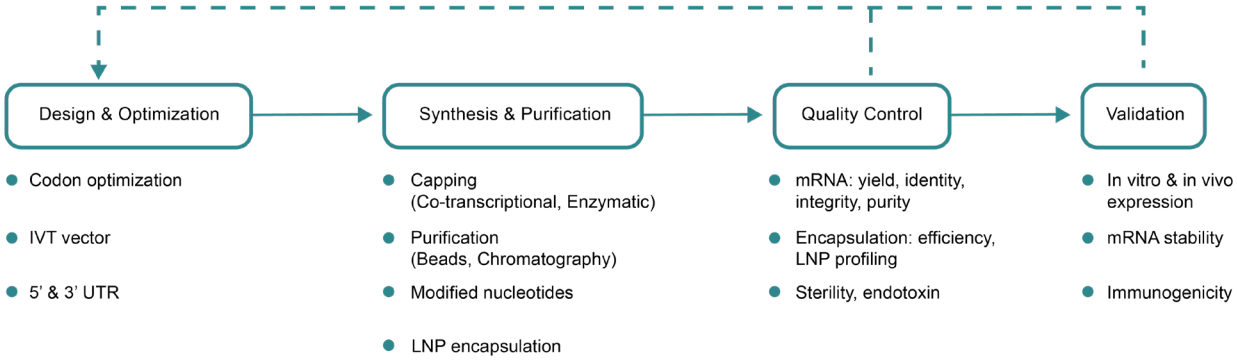
Figure 15. Recombinant AAV9 particles (~1.5X10^{10} GC/mouse) were intravenously administered to three neonatal mice (two male and one female) within 48 h after birth. AAV9 biodistribution in several organs was quantified using qPCR six weeks after the injection.

mRNA Gene Delivery Solutions

VectorBuilder provides a one-stop solution for the development of mRNA-based therapeutics, such as vaccines, gene editing, chimeric antigen receptor (CAR), and protein expression in cells or embryos. Based on extensive design and production experience, our team can support researchers for in vitro transcription (IVT) vector design, vector cloning, in vitro mRNA synthesis, LNP-mRNA production, and in vitro/in vivo functional testing to accelerate the development of mRNA-based vaccines and gene therapy.

Detailed descriptions of our mRNA synthesis services, including ordering information, are available on the VectorBuilder website under ***Products & Services****.*

Experiment-oriented mRNA Development & Optimization



IVT vector design and cloning

- IVT vector design based on our backbone optimized for highly efficient in vitro transcription.
- Variety of in-house validated 5' & 3' UTRs and polyA tails (including a 110 bp polyA tail) available for sourcing.
- Custom IVT vector cloning compatible with downstream linearization, capping, and polyadenylation with rapid turnaround.
- Codon optimization support through literature-based, computational, and experimental approaches.

In vitro and in vivo testing of mRNA-based gene delivery

- Leveraging our high-throughput cloning, production, and testing platforms, we utilize an experiment-oriented strategy to optimize mRNA UTRs, coding sequence, and production methods.
- We have established functional validation platforms for various applications, such as antigen presentation, antibody expression, CAR expression, and CRISPR.
- We offer clinically oriented CRO services to assess mRNA-LNP gene delivery efficacy and safety using animal models including rodents and nonhuman primates (NHPs).

In vitro mRNA synthesis & lipid nanoparticle (LNP) encapsulation

- T7 RNA polymerase-based synthesis for conventional and self-amplifying mRNA of up to 10,000 nt from ug to hundreds of mg scale.
- 5' capping with cap 1 and 3' template-derived 110 nt polyA tail for enhancing mRNA stability and translation.
- Modified nucleotides, such as N1-Methylpseudouridine (m1Ψ) and 5-Methylcytosine (m5C), can be incorporated during synthesis to enhance mRNA translation and immune evasion.
- Variety of RNA purification options including magnetic beads and chromatography.
- High-quality mRNA-LNP encapsulation at mg scale.
- Comprehensive quality controls and LNP profiling.
- Process development and scale-up for large-scale mRNA manufacturing.

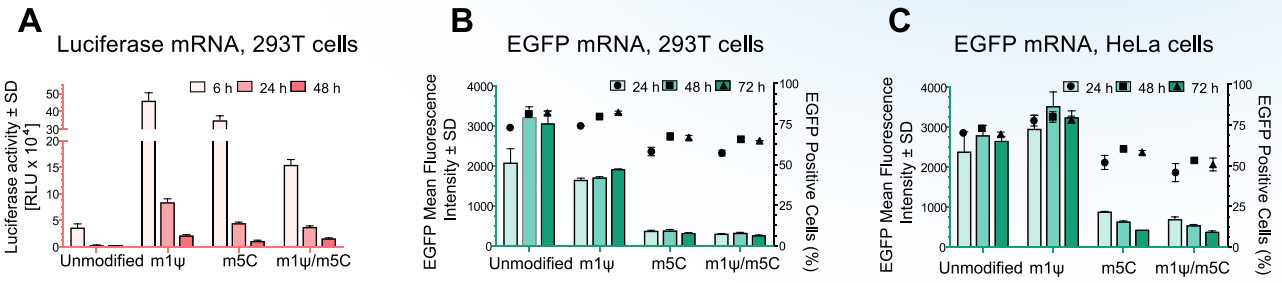


Figure 16. Expression of luciferase and EGFP mRNA in 293T or HeLa cells. The mRNA was generated with or without modified nucleotides, N1-Methylpseudouridine (m1Ψ) and 5-Methylcytosine (m5C). Cells grown on the 12-well plates were transfected with 1 ug of mRNA per well. (A) Luciferase activities in 293T cells at 6 h, 24 h, and 48 h post-transfection. Error bars indicate standard deviations. EGFP expression in 293T cells (B) and HeLa cells (C) at 24 h, 48 h, and 72 h post-transfection quantified by flow cytometry. Mean fluorescence intensities are represented by colored bars and percentages of EGFP positive cells are represented by circles, squares, and triangles. Error bars indicate standard deviations.

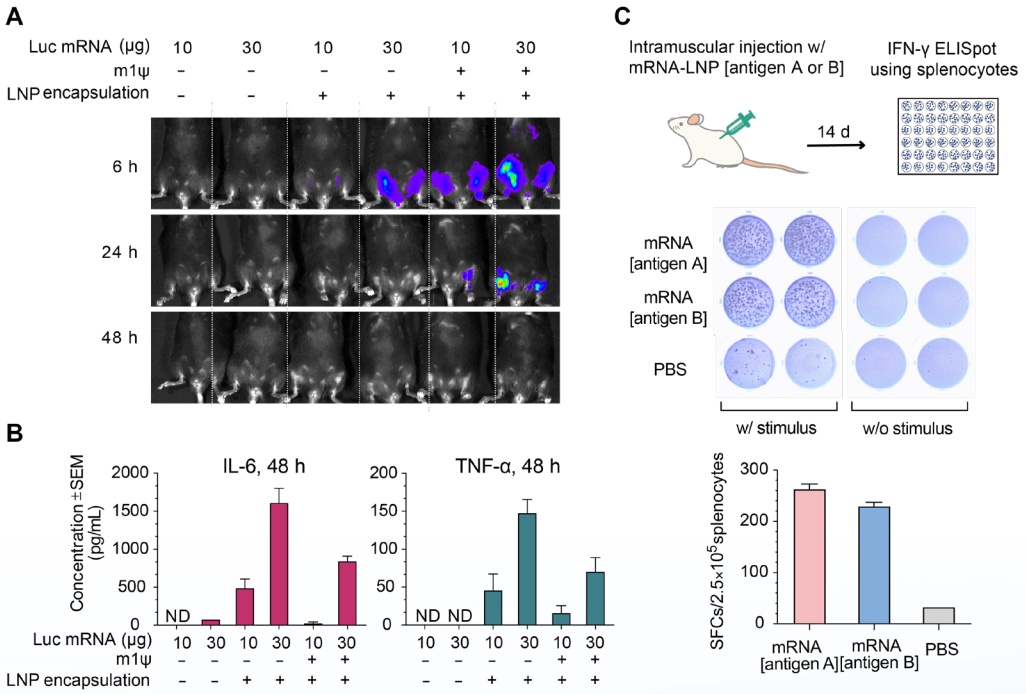


Figure 17. Expression of luciferase (Luc) mRNA and mRNA induced immune response in mice. (A) Luciferase activity visualized by live imaging at 6 h, 24 h, and 48 h post-injection. (B) Two pro-inflammatory cytokines, IL-6 and TNF-α, were quantified in the serum at 48 h post-injection. Error bars represent standard errors. Mice strain: C57BL/6J; mice age: 8 weeks; injection method: intramuscular injection. (C) IFN-γ ELISpot assay of splenocytes derived from Balb/C mice 14 days post intramuscular injection of 30 ug LNP-encapsulated mRNA coding for viral antigen A, viral antigen B, or control PBS.

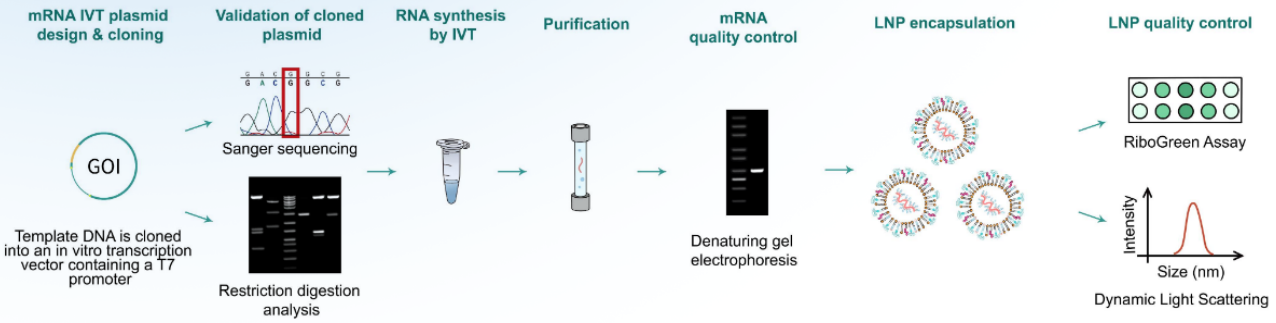


Figure 18. Workflow for production and quality control of mRNA packaging

BAC Recombineering

Bacterial artificial chromosomes (BACs) are DNA vectors suitable for cloning and stably maintaining large DNA inserts of up to 300 Kb in E. coli. BACs can be genetically manipulated relatively easily and quickly to carry any desired modification using a homologous recombination-based genetic engineering technique known as BAC recombineering.

VectorBuilder offers a variety of BAC modification services, including placing reporters behind regulatory sequences on your BAC, introducing point mutations into genes of interest, transferring regions of the BAC onto a plasmid, and adding drug-selection or visualization markers to the BAC backbone. All you will need to do is send us a design request describing your experimental goal and we will take care of the rest for you starting from designing your BAC modification strategy and ordering your BAC to generating and validating your final modified BAC clones.

Detailed descriptions of our BAC recombineering services, including ordering information, are available on the VectorBuilder website under ***Products & Services****.*

Mutagenesis (for Vectors)

If you need to introduce mutations into your vectors, whether for knocking out gene function, mapping protein functional domains, or characterizing gene regulatory elements, VectorBuilder can clone your mutant vectors at unbeatable prices and with rapid turnaround.

Detailed descriptions of our mutagenesis services, including ordering information, are available on the VectorBuilder website under ***Products & Services****.*

Highlights

- Variety of options, including base substitutions, insertions, deletions, and more
- Delivered as E. coli stock to save you time on retransformation
- 100% sequence-verified
- The price for point mutation is starting from $149

Stable Cell Line Generation

VectorBuilder can provide stable cell lines containing customized genetic modifications with competitive prices and rapid turnaround times. Let us help you overcome variations associated with transient transfection and deliver reproducible outcomes in experiments requiring ectopic gene expression or endogenous gene modification.

Detailed descriptions of our stable cell line generation services, including ordering information, are available on the VectorBuilder website under ***Products & Services.***

Price and turnaround

Stable cell line model	Approach	Deliverable	Price	Turnaround
Gene overexpression	Lentivirus-based	Pooled cells	From $3,199	9-15 weeks
		Single clones	From $5,199	12-20 weeks
shRNA gene knockdown	Lentivirus-based	Pooled cells	From $5,899	8-13 weeks
		Single clones	From $7,899	11-18 weeks
Tet inducible gene expression	Lentivirus-based	Pooled cells	From $3,599	10-16 weeks
		Single clones	From $5,899	13-21 weeks
Gene knockout	RNP complexes CRISPR/Cas9-based	Single clones	From $5,999	9-15 weeks
	Lentiviral CRISPR/Cas9-based	Single clones	From $6,999	10-17 weeks
Gene knockin	RNP complexes CRISPR/Cas9-based	Single clones	From $10,099	14-19 weeks
Point mutation	RNP complexes CRISPR/Cas9-based	Single clones	From $9,199	13-19 weeks

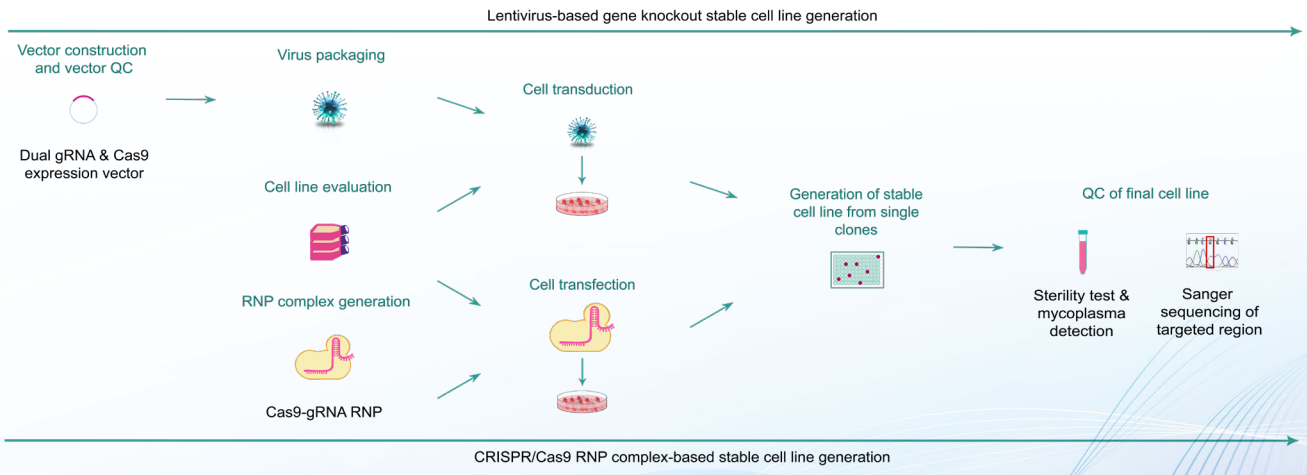
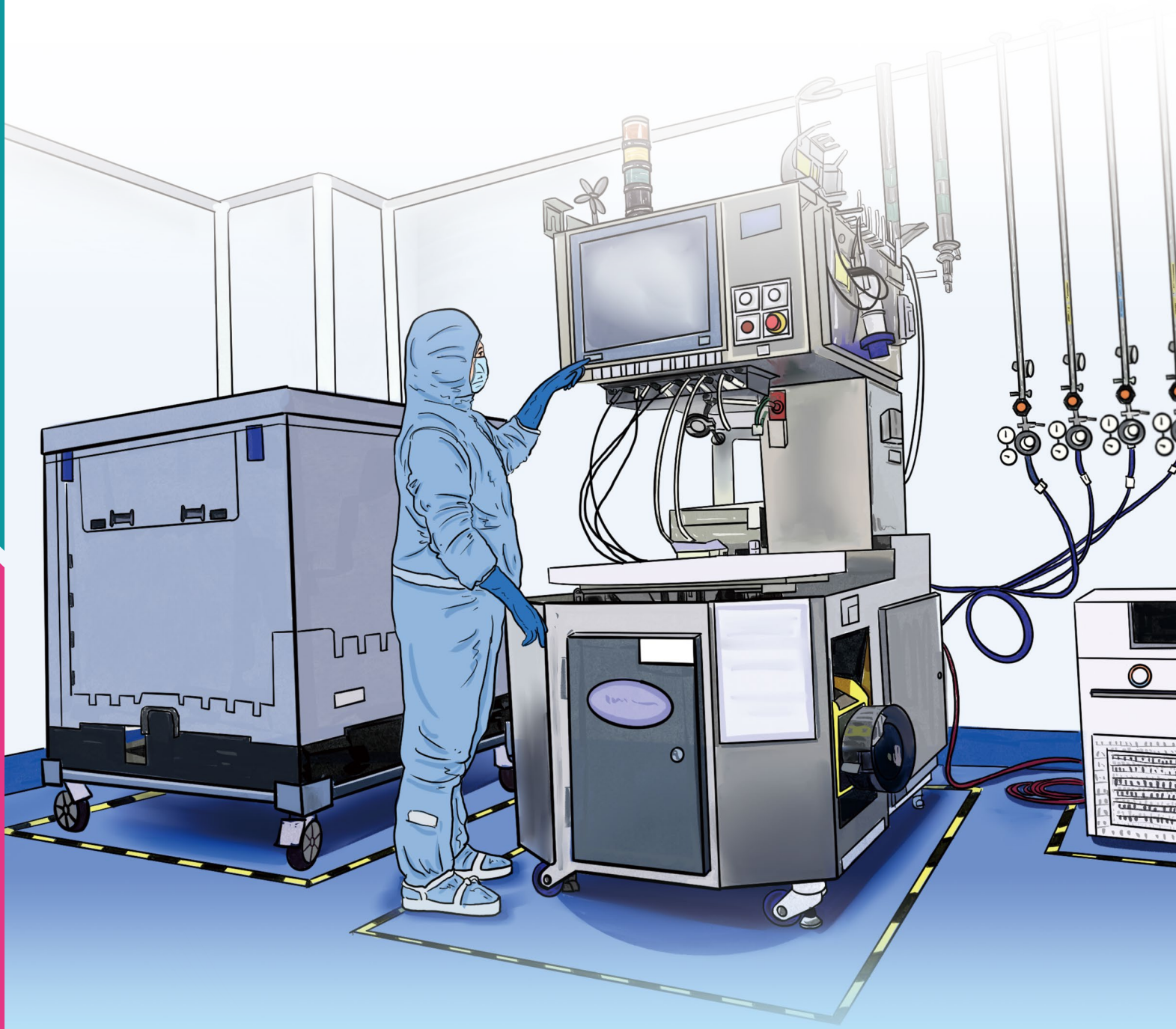


Figure 19. Workflow for our CRISPR knockout stable cell line generation process.

CDMO Services



CDMO Services for Genetic Medicine

VectorBuilder is a full-service CDMO with extensive expertise in manufacturing GMP-grade gene therapy vectors. We support the full spectrum of vector design, production, and QC needs along the entire gene therapy drug development pipeline. Our highly experienced team has worked with thousands of customers to create research-grade vectors for early discovery, GMP-like vectors for pre-clinical research, and full GMP-grade vectors for clinical applications.

Services Offered

Process development

VectorBuilder has a dedicated process development team with extensive experience in developing optimal manufacturing processes for GMP-grade gene therapy vectors. We consider many factors in our process development, including biological properties, quality and safety requirements, production quantity and scalability needs, regulatory requirements in the intended market, as well as the customer's cost and target timeline. Our process development services include **vector optimization as well as upstream and downstream process development**.

Analytical development

VectorBuilder provides the full range of analytical development services capable of developing, optimizing, qualifying and validating in-process, and release QC assays tailored to individual gene therapy vectors. We also provide drug stability studies to ascertain drug shelf life under various storage and transport conditions.

Plasmid DNA manufacturing

We can manufacture GMP-grade plasmid DNA at various scales, employing antibiotic-free, and animal component-free production methods.

- **GMP-like plasmid DNA** is intended for pre-clinical studies such as animal testing of drug safety. Its production adopts key features of GMP guidelines, including comparable production processes and similar quality attributes. Its production is performed in segregated production suites with document control and traceability. Where appropriate, we produce GMP-like plasmids under antibiotic-free, animal component-free, and RNAase-free fermentation and purification conditions.

- **GMP-grade plasmid DNA** is produced in our certified GMP suite with strict adherence to GMP guidelines A comprehensive quality assurance system is implemented throughout the production process. A wide range of in-process and release QC assays are performed to ensure that the plasmid DNA meets or exceeds the desired quality and safety standards. A batch release report fully documenting the production process and a COA are provided at product release. Other documentation is available upon request.

We implement a comprehensive quality assurance system throughout the production process. We perform a wide range of in-process and releasing QC assays to ensure that plasmid DNA meets the desired quality and safety standards.

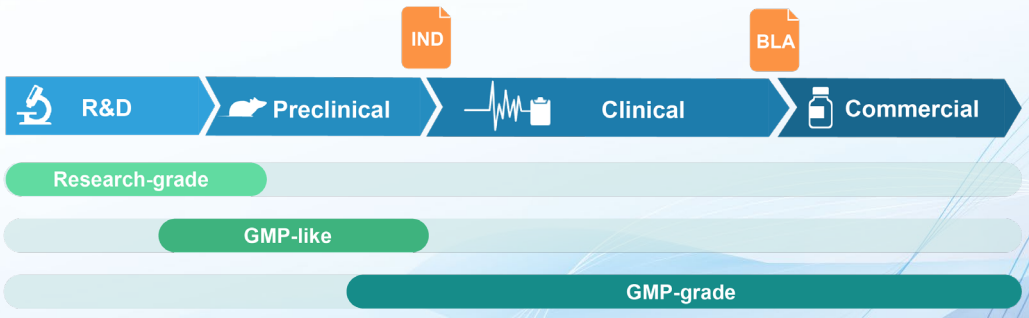


Figure 20. Grades of Plasmid DNA Offered

Virus manufacturing

We provide viruses of different scales and quality attributes to meet the full range of demands throughout the gene therapy drug development pipeline. We have established and validated platform technology for large-scale GMP manufacturing of AAV and lentivirus. We also have experience producing other types of viral vectors, such as adenovirus, MMLV, HSV, and VSV.

- **AAV:** We package AAV in HEK293 cells under either adherent conditions (Cell Factory or fixed-bed bioreactors) or serum-free suspension conditions (up to 200 L single-use bioreactors). We also package AAV in suspension Sf9 insect cells. We can achieve a scale of up to 10^{17} GC AAV per batch.
- **Lentivirus:** We package lentivirus (2nd and 3rd generation, pseudotyped with VSV-G or other viral surface proteins) in HEK293, under either adherent growth conditions (Cell Factory or fixed-bed bioreactors) or serum-free suspension conditions (up to 200 L single-use bioreactors). We can achieve a scale of up to 10^{12} TU per batch.

Cell banking

We can generate GMP-grade Master Cell Banks (MCBs) and Working Cell Banks (WCBs) for E. coli, mammalian cells, and insect cells derived from either our in-house or customer-provided cell lines.

Fill/finish

We can perform manual or automated aseptic filling of the DS/DP into glass vials (0.5 to 2 ml) or cryo bags. We have the capacity to complete 3,000+ vials per day.

Regulatory support

We can work closely with our customers to provide regulatory support at each critical milestone of their drug development process. These include on-site audit, consultation for regulatory strategies, CMC, and BLA documentation support.

Technology transfer

We can provide technology transfer with best practices, including a detailed billl of materials, well-documented production processes, and fully qualified analytical methods used in the manufacturing of the gene therapy vector.

Quality Assurance

Our comprehensive quality system is embedded in every aspect of our GMP manufacturing process, which spans facilities, supplies, production, fill/finish, storage, in-process and release QC, and personnel. Our company culture emphasizes quality, innovation, continuous improvement, and “white-glove” customer service. As such, we consistently meet and exceed customer expectations. We also strive to achieve rapid turnaround and affordable prices while maintaining high quality and full regulatory compliance.

GMP Facilities

VectorBuilder currently has about 100,000 sq ft of modern GMP facilities with advanced designs and state-of-the-art equipment. All our facilities are designed to meet GMP regulations of US, EU, Japan, China and PIC/S. They are suitable for clinical trial Phase I/II/III manufacturing.

VectorBuilder grows together with the exploding demands on contracted manufacturing of gene therapies. Currently our stage 3 cGMP manufacturing campus (500,000 sq ft) with 30 production suites is under construction and will be operational in early 2024.

With all the areas combined, our facilities include:

- **10 GMP manufacturing suites:** Designed for plasmid, viral vector and cell line production at various scales, each with independent airflow; Grade A BSC in Grade B/C environment; BSL-2 certified
- **Fill/finish suites:** Grade A isolator in Grade C environment
- **QC laboratories:** Multiple lab suites totaling 9,500 sq ft for a wide range of QC assays
- **Process and analytical development suites:** Multiple GMP suites totaling 8,000 sq ft for PD/pilot runs; Grade A BSC in Grade C environment; BSL-2 certified

10 GMP manufacturing suites

Fill/finish suites

QC laboratories

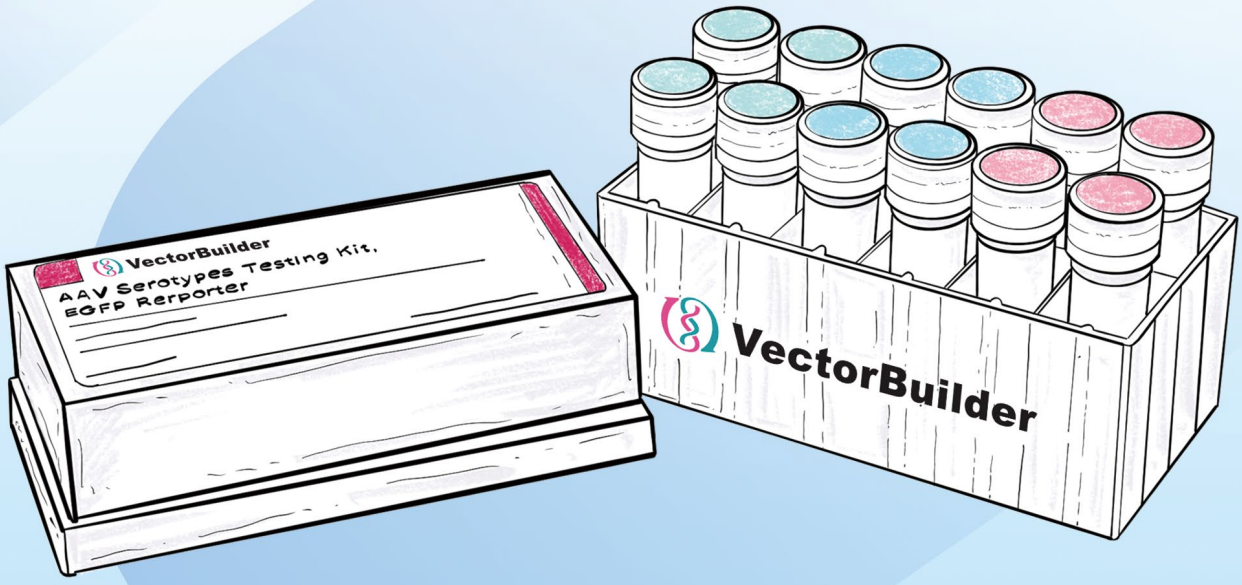
Process and analytical development suites

GMP warehouse

Upcoming expansion

Figure 21. Images of GMP Facilities

Products


VectorBuilder
AAV Serotypes Testing Kit,
EGFP Rerporter
VectorBuilder

Premade shRNA Libraries

VectorBuilder offers high-quality, pooled shRNA lentivirus libraries targeting human and mouse genes at two scales: Whole Genome (~19,000 RefSeq genes) and Elite Gene (~2,000 most frequently cited genes on PubMed Central).

These RNAi libraries are highly efficient tools for performing large-scale loss-of-function screens for genes involved in disease pathways, cell responses to drug treatment, developmental processes, gene regulation, etc.

Price and turnaround

Product	Target Genes	No. of shRNAs	Scale	Price	Turnaround
Human Elite Gene Pooled shRNA Library	2,161	12,471	Medium (>1.0x10^8 TU/ml, 1 ml)	$1,499	10-20 days
Mouse Elite Gene Pooled shRNA Library	2,233	12,472	Medium (>1.0x10^8 TU/ml, 1 ml)	$1,499	
Human Whole Genome Pooled shRNA Library	18,432	92,917	Medium (>1.0x10^8 TU/ml, 1 ml)	$1,499	
			Plus (>1.0x10^8 TU/ml, 5 ml)	$4,499	
Mouse Whole Genome Pooled shRNA Library	19,790	92,917	Medium (>1.0x10^8 TU/ml, 1 ml)	$1,499	
			Plus (>1.0x10^8 TU/ml, 5 ml)	$4,499	

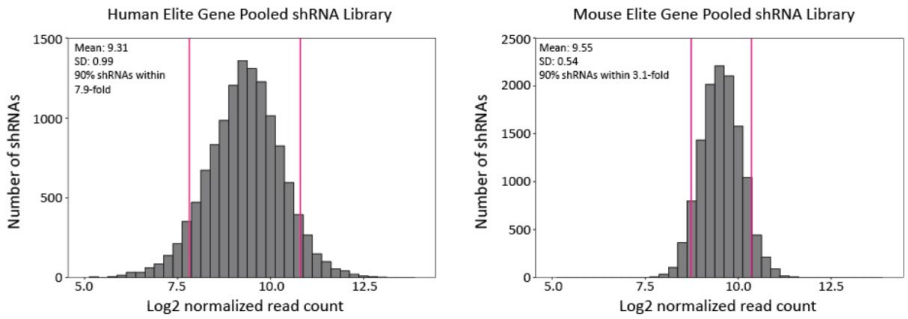


Figure 22. Representation of shRNAs in different pooled plasmid libraries

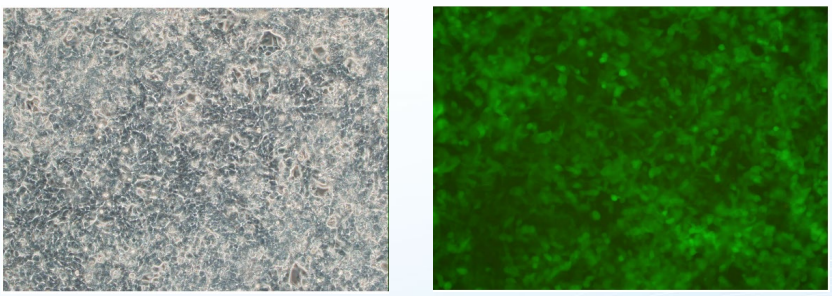


Figure 23. EGFP marker expression in 293T cells transduced with Human (left) or Mouse (right) Elite Gene Pooled shRNA Library (MOI=10) after 4 days of puromycin selection (1.5 ug/ml). Magnification: 200X. Left: bright field. Right: EGFP.

Premade Dual-gRNA CRISPR Knockout Libraries

VectorBuilder offers the only commercially available dual-gRNA lentivirus libraries for CRISPR-based whole-genome knockout screens in human and mouse cells. Each CRISPR vector contains a pair of gRNAs targeting the same gene. Dual-gRNA libraries are more effective compared to single-gRNA libraries for knockout screens because the introduction of large deletions by these libraries can have much higher efficiencies in generating loss-of-function mutations.

Price and turnaround

Product	Target genes	No. of gRNA pairs	Scale	Price	Turnaround
Human Whole Genome Dual-gRNA Library	20,048	91,926	Medium (>1.0x10^8 TU/ml, 1 ml)	$1,499	10-20 days
			Plus (>1.0x10^8 TU/ml, 5 ml)	$4,499	
Mouse Whole Genome Dual-gRNA Library	20,493	90,344	Medium (>1.0x10^8 TU/ml, 1 ml)	$1,499	
			Plus (>1.0x10^8 TU/ml, 5 ml)	$4,499	

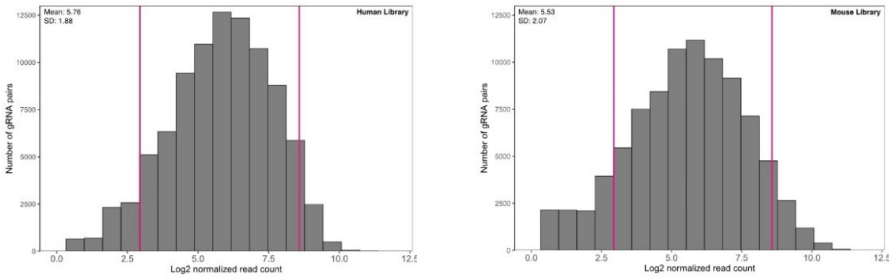


Figure 24. Representation of gRNA pairs in human (left) and mouse (right) pooled libraries.

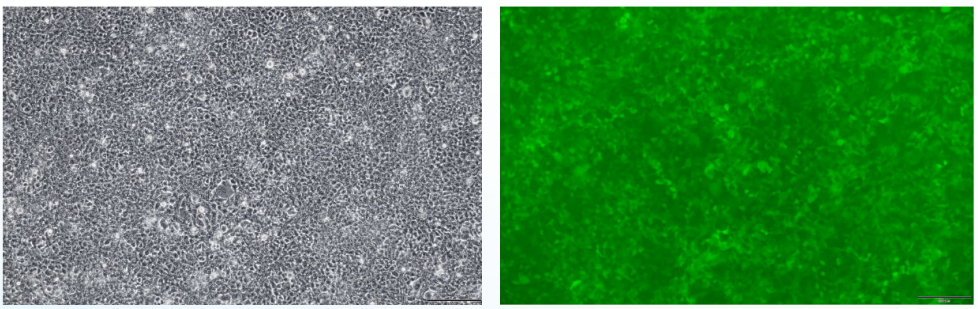
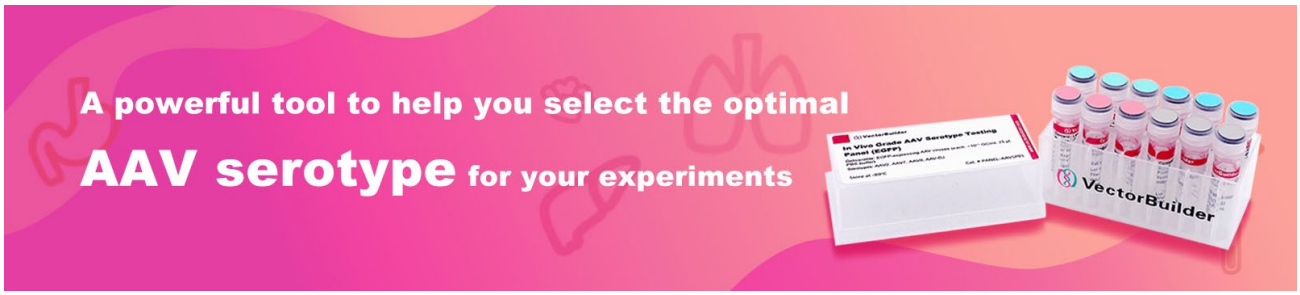


Figure 25. EGFP marker expression in 293T cells transduced with Human Whole-Genome Dual-gRNA Lentivirus Library (MOI=10) after 4 days of puromycin selection (1.5 ug/ml). Magnification: 200X. Left: bright field. Right: EGFP.

AAV Serotype Testing Panel

Adeno-associated viruses (AAVs) have emerged as the most effective viral vectors for gene therapy due to their ability to transduce a wide variety of mammalian cell types and their low immunogenicity in host organisms. VectorBuilder offers the AAV serotype testing panel to enable users to select the optimal AAV serotype for specific applications by systematic comparison of a variety of serotypes in cells or in animals.



Highlights

- High-titer, ready-to-use AAVs
- Option to select between either CMV- or CAG-driven EGFP reporter expression
- Flexibility to choose any 3 or more serotypes of your choice
- In vitro and in vivo grade panels
- Prices start at only $237 for in vitro panel and $417 for in vivo panel
- Comprehensive collection of AAV serotypes to select from

Product	Application	Titer & volume per unit	Unit Price
In vitro grade AAV serotype testing panel (EGFP)	Cell culture	~10^{12} GC/ml, 25 ul	$79 per aliquot
In vivo grade AAV serotype testing panel (EGFP)	Cell culture & in vivo	~10^{13} GC/ml, 25 ul	$139 per aliquot

AAV Virus-Like Particles (VLPs)

VectorBuilder offers premade as well as custom AAV-like particles that can be used for a variety of applications during the development of AAV gene therapy vectors, including optimization of analytical assays, biodistribution assessment, and evaluation of in vivo immune responses of serotype-specific AAV capsids. Our AAV-like particles are extensively characterized and can therefore serve as reliable standards for evaluating the quality of AAV-like particles generated in house. Moreover, they can be used as negative controls in studies intended to demonstrate that an observed effect is caused by the expression cassette harbored by an AAV vector rather than its capsid.

Highlights

- Ready-to-ship AAV-like particles for serotypes 1, 2, 3, 5, 8, 9, 2-retro, DJ, and DJ/8.
- Custom services available for AAV-like particles produced using any desired serotype, production system, purification methods, or QC requirements.
- Thoroughly characterized using various methods including SDS-PAGE, BCA, endotoxin testing, mycoplasma detection, and full/empty capsid ratio analysis

Price and turnaround

Scale*	Volume	Price	Turnaround
10 ug	25 ul	$399	In stock
100 ug	0.1 ml (1x100 ul)	$2,299	In stock
500 ug	0.5 ml (5x100 ul)	$8,399	In stock
1 mg	1 ml (10x100 ul)	$12,599	In stock

* 1 mg = $1.6x10^{14}$ VPs

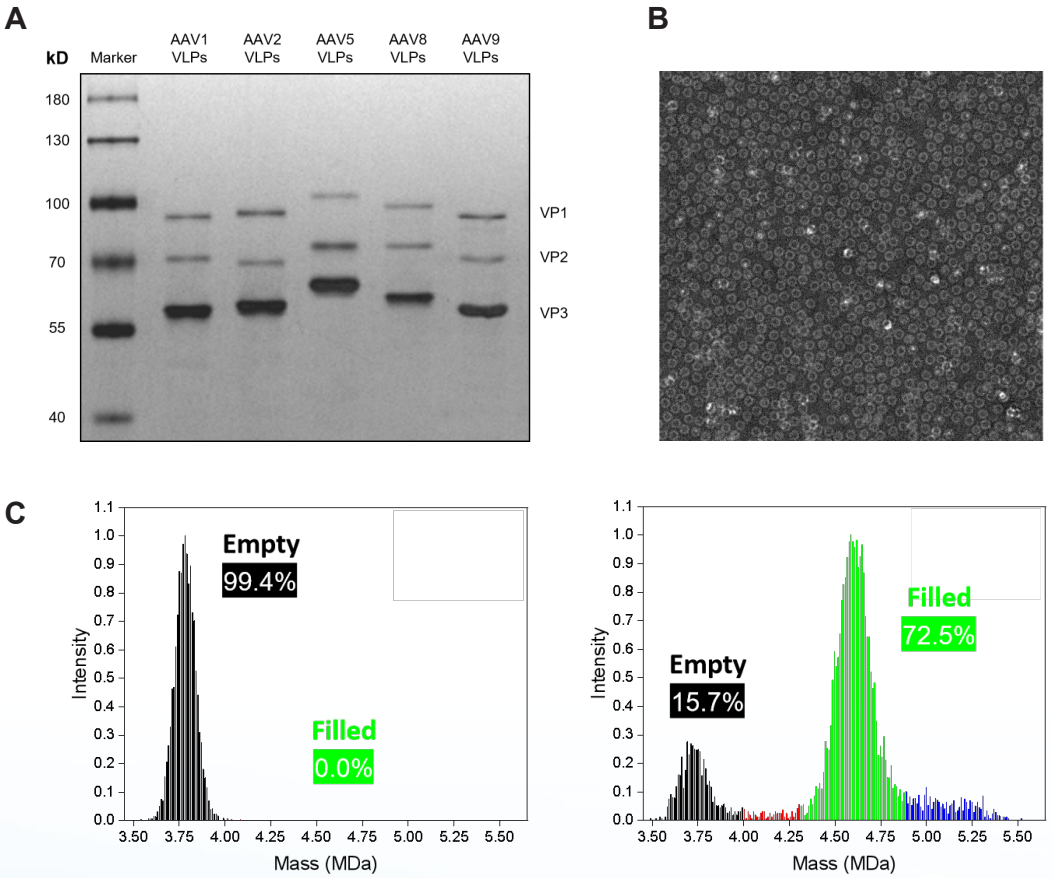


Figure 26. (A) Silver stained SDS-PAGE of ready-to-ship AAV virus-like particles of serotypes 1, 2, 5, 8, and 9. (B) Transmission electron microscopy of serotype 9 AAV virus-like particles showing empty (black-filled spheres) and filled (white-filled spheres) capsids. (C) Charge detection mass spectrometry analysis indicating percentages of empty (black) and filled (green) capsids for AAV virus-like particles and conventional AAV preparations of serotype 8.

Off-the-Shelf IVT mRNA

VectorBuilder offers off-the-shelf mRNA that has been fully validated for high levels of expression in vitro and in vivo, thus, it can be used to assess the efficiency of mRNA-based gene delivery or used as control for your mRNA experiment.

Price and turnaround

Product	Nucleotide	Scale	Price*
EGFP IVT mRNA	Unmodified	100 ug (1 ug/ul, 1x100 ul)	$319
	m1Ψ substitution	100 ug (1 ug/ul, 1x100 ul)	$399
mCherry IVT mRNA	Unmodified	100 ug (1 ug/ul, 1x100 ul)	$319
	m1Ψ substitution	100 ug (1 ug/ul, 1x100 ul)	$399
HiExpress™ Firefly Luciferase IVT mRNA	Unmodified	100 ug (1 ug/ul, 1x100 ul)	$359
	m1Ψ substitution	100 ug (1 ug/ul, 1x100 ul)	$449
HiExpress™ Gaussia Luciferase IVT mRNA	Unmodified	100 ug (1 ug/ul, 1x100 ul)	$359
	m1Ψ substitution	100 ug (1 ug/ul, 1x100 ul)	$449
hSpCas9 IVT mRNA	Unmodified	100 ug (1 ug/ul, 1x100 ul)	$319
	m1Ψ substitution	100 ug (1 ug/ul, 1x100 ul)	$399

* The price shown in the table above applies for mRNA production only and does not include the cost of vector cloning. 5' m^7G-cap and 3' polyA tails are added by default, but additional fees may apply if requesting other RNA modification. While cap 0 is added to mRNAs by default, mRNAs with cap 1 can be provided upon request.

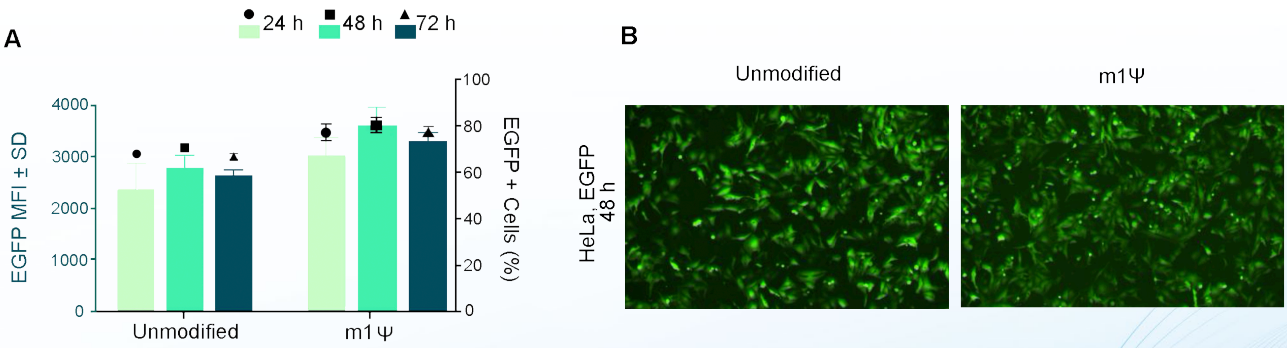


Figure 27. EGFP IVT mRNA expression in HeLa cells. HeLa cells grown on a 12-well plate were transfected with 1 ug of mRNA per well. (A) EGFP expression at 24 h, 48 h, and 72 h post-transfection quantified by flow cytometry. (B) Representative images of HeLa cells transfected with EGFP mRNA at 48 h post-transfection.

VB UltraStable™ Chemically Competent Cells

VB UltraStable™ chemically competent cells are designed for achieving high transformation efficiency (>1 x 10^9 cfu/ug) and propagation of DNA plasmids with unstable elements such as repeated sequences.

Highlights

- Lacks the ability to undergo homologous recombination due to mutations introduced in the recA gene
- Suitable for the cloning and hosting of lentiviral and retroviral vectors as well as vectors with repeated sequences and unstable fragments
- Deficient of the functional ccdAB operon making them suitable for highly efficient Gateway Cloning
- Can produce high-quality plasmid DNA due to the endA mutation (plasmids won't be digested by endonuclease)
- T1 phage resistant due to fhuA mutation
- Can be used for blue/white screening because it expresses the omega fragment of lacZ gene

Product name	Deliverable	Catalog No.	Price
VB UltraStable™ Chemically Competent Cells	10x100 ul	UC001-010	$199

User Testimonials

"It has been a great experience working with VB. I was one of the first to test their empty capsid (AAV VLP) service. For my batch capsids were nearly completely empty (>97% by AUC and TEM) and were thus a huge help for assay development as a negative control. I also want to highlight that my contact Matthew Wheeler was always very helpful and transparent for any queries I had and that the team is very agile. A big plus is also the very intuitive website. Overall, a big thumbs up for VectorBuilder from my side."

Dr. Andrei Hutanu

Analytical Biochemist/QC Method Development, Roche, Switzerland

Featured Offerings

CRISPR Genome Editing Solutions

VectorBuilder offers a variety of CRISPR products and services for in vitro and in vivo genome editing experiments at unbeatable prices and with rapid turnaround. Additionally, our online vector design platform features a free and user-friendly CRISPR design tool that allows you to design CRISPR vectors with high targeting efficiency.

Detailed descriptions of our CRISPR genome editing services, including ordering information, are available on the VectorBuilder website under ***Products & Services****.*

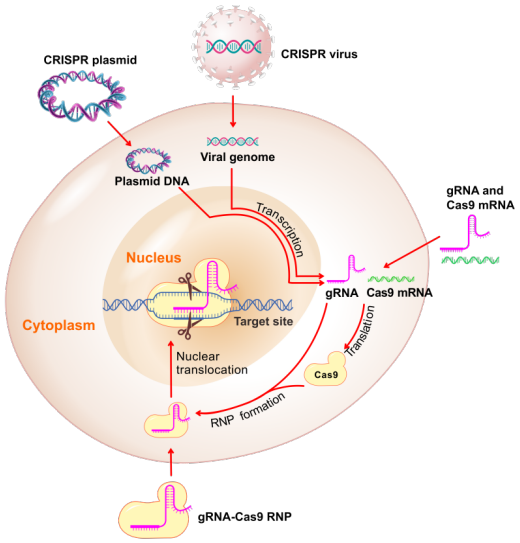


Figure 28. Overview of CRISPR Genome Editing Solutions offered at VectorBuilder

Custom CRISPR vectors

Vector type	Price	Turnaround
gRNA and Cas9* coexpression vectors	From $149	5-10 days
gRNA expression vectors	From $149	
Cas9* expression vectors	From $189	
Gene targeting donor vectors	From $659	10-20 days
CRISPR-based gene activation vectors	From $149	5-10 days
CRISPR-based gene inhibition vectors	From $149	
gRNA sensor vectors	From $299	9-18 days

* We offer a variety of Cas9 variants including hCas9, Cas9(D10A), SaCas9, and many others.

Premade CRISPR vectors

Vector type	Price
Cas9 expression vectors	From $189
Scramble gRNA control vectors	From $149
Cas9 and scramble gRNA coexpression vectors	From $149
CRISPRa and CRISPRi helper vectors	From $189

CRISPR virus

Lentivirus, AAV, and adenovirus are widely used to deliver CRISPR components into mammalian cells. VectorBuilder offers premium-quality virus packaging services for lentivirus, AAV, and adenovirus for achieving highly efficient CRISPR targeting in difficult-to-transfect cells. *(See page 18 for detailed information on our virus packaging services.)*

Cas9 mRNA and gRNA

VectorBuilder provide transfection-ready and microinjection-ready Cas9 mRNA and gRNA specifically designed against user-selected target sites for easy RNA-based delivery of CRISPR components into mammalian cells.

Reagent	Concentration & volume	Price	Turnaround
hCas9 mRNA	>500 ng/ul, 25 ul	$449	2-4 days
Cas9(D10A) mRNA			
Custom gRNA*		$349	

* Cloning of gRNA in vitro transcription vector has an additional cost of $149 and turnaround of 5-10 days.

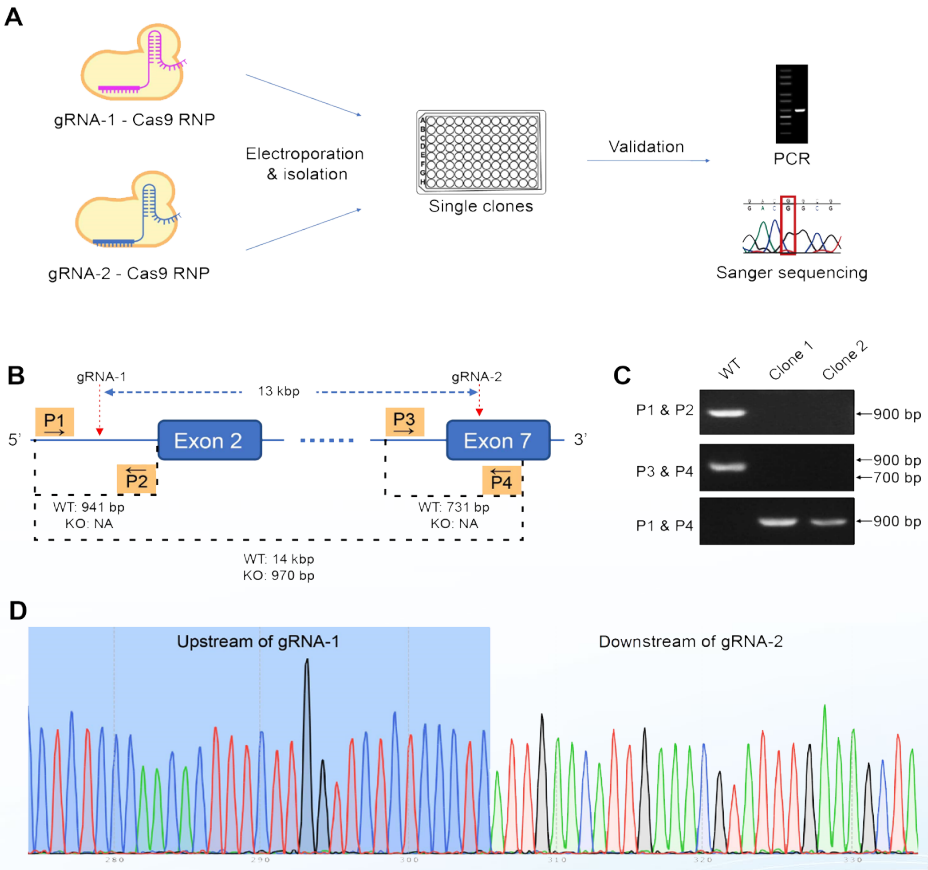


Figure 29. Generating homozygous CD274 knockout (KO) mutants using the gRNA-Cas9 ribonucleoprotein (RNP) approach. (A) The editing RNP is electroporated into target cells, and single clones are isolated and screened. The genotypes of the candidates are validated using PCR and Sanger sequencing. (B) In this case study of editing a murine colon adenocarcinoma cell line, cells were electroporated with RNP binding to two sites on the targeted gene to KO a 13-kbp region. Four primers, P1 to P4, were used in three PCR to differentiate KO and WT clones. Based on the (C) PCR results, clone 1 are validated to be homozygous KO mutants, which is also confirmed by (D) sequencing results.

Cas9 protein

VectorBuilder offers purified wild-type Streptococcus pyogenes Cas9 protein (SpCas9) and the Cas9 nickase (Cas9(D10A)) for preparing preformed Cas9-gRNA RNP to deliver CRISPR components into mammalian cells.

Reagent	Concentration & volume	Price	Turnaround
SpCas9 protein	100 ug	$599	5-7 days
SpCas9(D10A) nickase protein			

Gene targeting donor DNA

VectorBuilder offers donor DNA templates in the form of single-stranded oligodeoxynucleotide (ssODN) or dsDNA from linearized plasmids for guiding HDR-based DNA repair to introduce precise DNA sequence changes at CRISPR cleavage sites.

Reagent	Price	Turnaround
ssODN (normally 120-200 nt)	From $349	2-3 weeks
Gene targeting donor vector	From $659	10-20 days

CRISPR knockout and knockin stable cell lines

VectorBuilder can generate stable cell lines with a permanent knockout of your GOI using a CRISPR-based approach. A pair of gRNAs targeting the GOI is introduced into the cells along with Cas9, which leads to the generation of two cuts on the target gene. Attempts by cells to repair the broken ends of the two cut sites typically result in a large deletion spanning the two sites. In addition, we can generate stable cell lines with permanent knockin of your GOI at desired genomic target sites. Stable knockin of the GOI is achieved by introducing a target site-specific gRNA into the cells along with Cas9 and a donor vector which serves as the template for HDR-mediated gene knockin. Using a similar approach, we can also generate stable cell lines harboring desired point mutations at genomic target sites of interest. In this case, a target site-specific gRNA is introduced into the cells along with Cas9 and a ssODN which serves as the template for HDR-mediated insertion of the point mutation.

The final cell line is evaluated by Sanger sequencing of the targeted locus to confirm knockout, knockin, or the presence of the point mutation. Additionally, a series of standard QC assays, such as sterility tests and mycoplasma detection, are performed before releasing the final cell line products. *(See page 38 for detailed information on our stable cell line generation service.)*

Pooled CRISPR libraries

VectorBuilder specializes in the custom design and construction of a variety of pooled CRISPR libraries such as CRISPR knockout, CRISPRa/i, and CRISPR barcode libraries. In addition to custom pooled CRISPR libraries,

we offer premade dual-gRNA lentivirus libraries for whole-genome knockout screens of human and mouse genes. *(See page 45 for detailed information on our premade dual-gRNA CRISPR libraries.)*

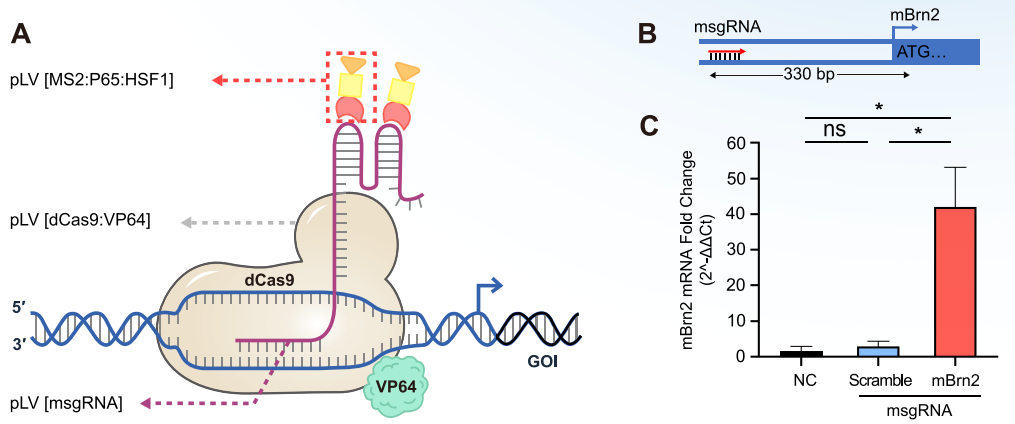


Figure 30. Up-regulation of gene expression achieved by the lentivirus-based CRISPRa. NIH3T3 cells stably expressing SAM complex, dCas9/VP64, and MS2/P65/HSF1 were transduced with msgRNA expression lentivirus followed by antibiotic selection. (A) Illustration of SAM system regulated transcriptional activation. (B) Diagram of msgRNA design targeting the promoter region of the mouse Brn2 gene. (C) Relative gene expression of Brn2 in NIH3T3 cells transduced with scramble or targeting msgRNA or no treatment control (NC).

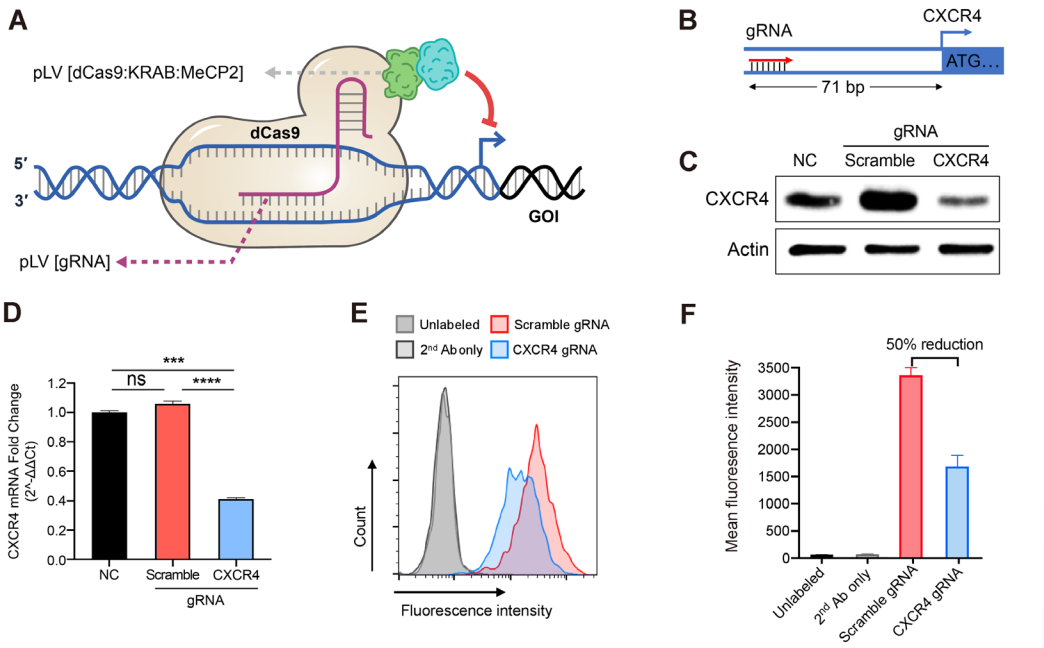


Figure 31. Down-regulation of gene expression achieved by the lentivirus-based CRISPRi. Jurkat cells stably expressing the dCas9/KRAB/MeCP2 transcriptional repressor complex were transduced with gRNA expression lentivirus followed by antibiotic selection. (A) Illustration of dCas9/KRAB/MeCP2 regulated gene transcriptional inhibition. (B) Diagram of gRNA design targeting the promoter region of the human CXCR4 gene. (C) CXCR4 protein levels in Jurkat cells transduced with scramble or targeting gRNA or no treatment control (NC), measured by western blot. (D) Relative CXCR4 gene expression in Jurkat cells transduced with scramble or targeting gRNA or no treatment control (NC), measured by qRT-PCR. Mean±SD, ***P<0.001, ****P<0.0001, ANOVA with Tukey's post hoc test. (E) The surface expressed CXCR4 in the Jurkat cells transduced with scramble or targeting gRNA were quantified by flowcytometry. CXCR4 was labeled with monoclonal primary antibodies (Ab) and fluorophore-conjugated secondary Ab. Unlabeled and secondary Ab only Jurkat cells were used as negative controls. (F) The amount of CXCR4 on the surface of cells transduced with the CXCR4 targeting gRNA was averagely reduced by about 50% compared to the cells transduced with the scramble gRNA. Mean±SD.

Inducible Gene Expression Solutions

VectorBuilder offers a comprehensive collection of Tet-inducible gene expression system reagents to help you achieve nearly complete silencing of your GOI in the absence of tetracycline or its analogs (e.g. doxycycline), and rapid, robust expression in response to the addition of tetracycline or its analogs.

Highlights

- Utilizes the rtTA/tTS fusion cassette to achieve maximal induction in the presence of tetracycline and minimal leaky expression in its absence
- Available in dual-vector and all-in-one formats
- Low-leak, tissue-specific vectors available with minimal leaky expression in non-target tissues in the absence of tetracycline
- Available in a variety of backbones, including regular plasmid, lentivirus, AAV, adenovirus, and piggyBac

Custom Tet vectors

Vector type	Price	Turnaround
All-in-one Tet-On vectors	From $239	5-10 days
Tet regulatory protein expression vectors	From $189	
TRE driven GOI expression vectors		
Low-leak Tet-On vectors		

Popular Tet vectors

Vector type	Price
Tet-inducible vectors for EGFP, mCherry, TagBFP, or luciferase	$189
All-in-one Tet-On vectors for EGFP, mCherry, TagBFP, or luciferase	$239
Tet regulatory protein expression vectors	$189

Tet-inducible stable cell lines

VectorBuilder can custom-build Tet inducible gene expression stable cell lines with minimal background expression and high induction of your GOI(s). Additionally, we can generate Tet regulatory protein expression stable cell lines (e.g. rtTA, tTS/rtTA, etc.) which can then be transfected and transduced with plasmids and viruses carrying TRE-driven GOI(s) for flexible experimental design and reliable Tet inducible gene expression. For Tet-On stable cell lines, induction of the GOI is validated by RT-qPCR. What's more, a series of standard QC assays, such as sterility tests and mycoplasma detection, are performed before releasing the final cell line products.

Tet-inducible virus

VectorBuilder can design, construct, and package a variety of viral vectors expressing the components of the Tet-inducible system to help you achieve virus-mediated inducible expression of your target genes in difficult-to-transfect cell lines. We can package recombinant lentivirus, AAV, adenovirus, MMLV, and MSCV retrovirus. *(See page 18 for detailed information on our virus packaging services.)*

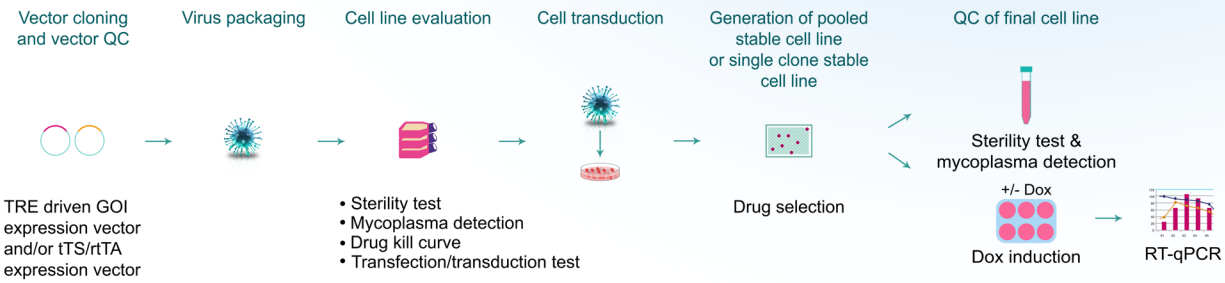


Figure 32. Workflow for Tet inducible cell line generation process.

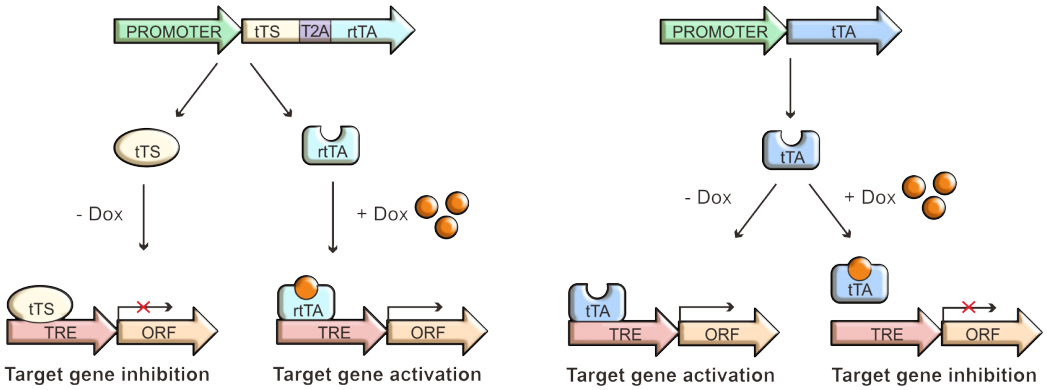


Figure 33. Mechanisms of Tet regulated gene expression using Tet-On and Tet-Off systems. Dox: doxycycline (a tetracycline analog)

shRNA Gene Knockdown Solutions

VectorBuilder offers a comprehensive collection of shRNA reagents to provide you with the ideal tools for your gene knockdown experiments. We can provide both U6-based and miR-30 based shRNA systems to give you the flexibility to control shRNA expression in different ways based on your experimental needs. Additionally, our online vector design tool is integrated with shRNA databases, enabling you to easily select suitable shRNAs targeting your GOI while designing your shRNA vectors.

Highlights

- Free and intuitive vector design tool with integrated shRNA databases for human, mouse, and rat models
- Versatile control of shRNA expression by either U6 or miR30
- Vast collection of backbones, including regular plasmid, lentivirus, AAV, adenovirus, and piggyBac
- Premade and custom-made shRNA library options
- Powerful technical support for shRNA selection, vector design, and troubleshooting

Custom shRNA vectors

Vector type	Price	Turnaround
U6-based shRNA vectors	From $149	5-10 days
miR30-based shRNA vectors	From $299	9-18 days
U6-based inducible shRNA vectors	From $149	5-10 days
shRNA sensor vectors (for testing shRNA efficiency)	Please inquire	

Popular shRNA vectors

Vector type	Price
Scramble shRNA vectors	From $149
Anti-EGFP shRNA vectors	
Anti-mCherry shRNA vectors	
Anti-luciferase shRNA vectors	
Anti-lacZ shRNA vectors	

shRNA knockdown stable cell lines

VectorBuilder can custom-build shRNA knockdown stable cell lines for applications requiring long-term knockdown of your GOI. We identify the top three candidate shRNAs based on the knockdown score to ensure efficient knockdown of your GOI. We then use the shRNA with the best knockdown efficiency to generate the stable cell line via lentivirus transduction. The knockdown level of the cell line is validated by RT-qPCR. Additionally, we perform a series of standard QC assays, such as sterility tests and mycoplasma detection, before releasing the final cell line products. *(See page 38 for detailed information on our stable cell line generation services.)*

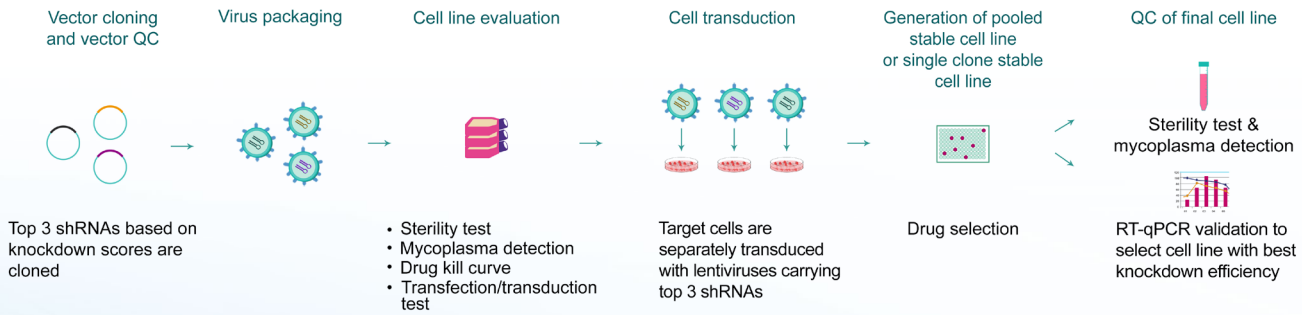


Figure 34. Workflow for our shRNA knockdown stable cell line generation process

shRNA virus

Viral vectors are the preferred shRNA delivery vehicles given their ability to efficiently transduce a wide variety of cell types and achieve long-term knockdown of the targeted genes. We can design and construct shRNA vectors in various viral vector formats, including lentivirus, AAV, and adenovirus. *(See page 18 for detailed information on our virus packaging services.)*

Pooled shRNA libraries

VectorBuilder specializes in the design and construction of pooled shRNA libraries to perform large-scale, loss-of-function screens in mammalian cells. In addition, VectorBuilder offers premade whole-genome shRNA libraries for human and mouse genes that have been validated by NGS. *(See page 29 for detailed information on our library construction services.)*

shRNA (3+1) virus packaging

VectorBuilder offers shRNA (3+1) virus packaging services which include 3 custom shRNA viruses targeting your GOI and 1 scramble control virus, enabling you to test multiple shRNA against your target genes at highly affordable prices.

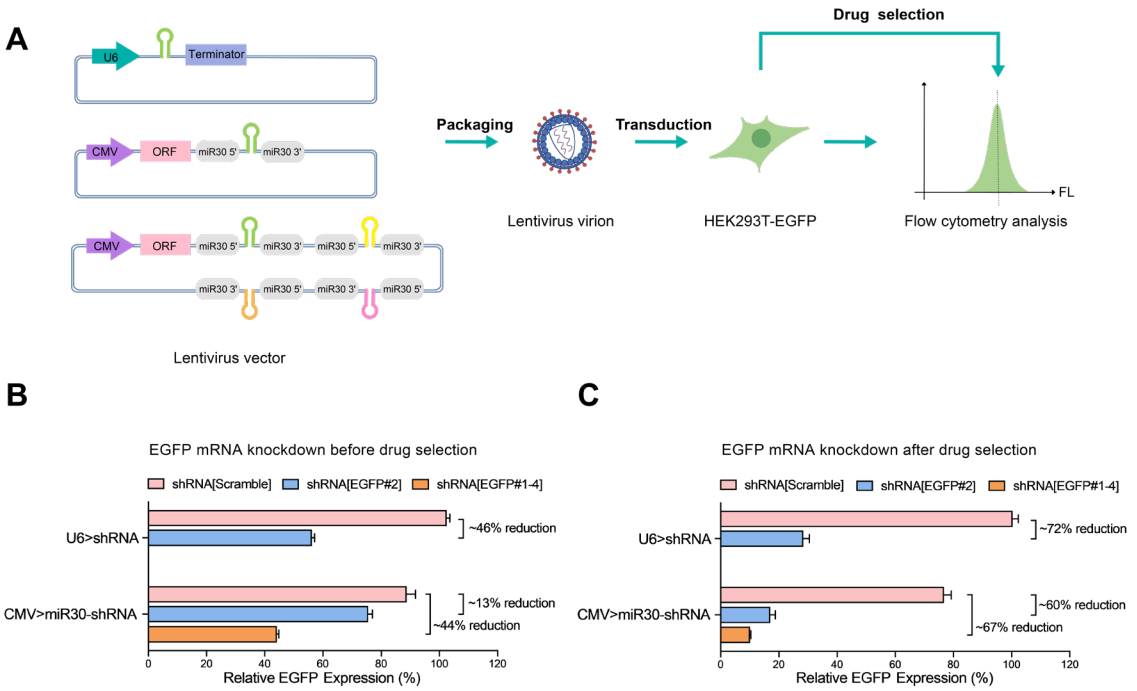


Figure 35. EGFP knockdown with the lentivirus IPTG-inducible shRNA vector system. (A) Lentiviral vectors carrying IPTG-inducible U6-based scramble or EGFP-targeting shRNA expression cassettes were packaged into the corresponding lentiviral particles and transduced into HEK293T cells stably expressing EGFP. Antibiotic selection with appropriate antibiotics, puromycin (Puro) or blasticidin (Bsd), was performed to isolate positively transduced cells followed by treatment with 1mM IPTG to induce shRNA expression. Medium fluorescence intensity (MFI) of EGFP was quantified for all experimental groups using flow cytometry (FCM); (B) Cells expressing an inducible EGFP shRNA cassette showed a ~42% reduction in EGFP MFI upon IPTG induction. This observation was consistent across inducible shRNA vectors carrying either a puromycin or blasticidin resistance gene. Inducible shRNA vectors expressing a non-targeting scramble shRNA had no effect on EGFP MFI upon IPTG induction. Moreover, in cells transduced with an inducible shRNA vector lacking the LacI repressor, the induction function of the vector was lost and EGFP expression was constitutively inhibited by the EGFP shRNA both with and without IPTG induction.

shRNA (3+1) Virus Packaging

The knockdown effects of empirically designed shRNAs are often limited by variations in specificity and efficiency observed from one shRNA to another. Therefore, it is important to test multiple shRNAs to find the most potent shRNA for knocking down your GOI. VectorBuilder's shRNA (3+1) virus packaging services enable you to select optimal shRNAs for your target genes at highly affordable prices. This offering includes cloning and packaging three custom shRNA viruses targeting your GOI and one scramble control virus. Currently available viral types include lentivirus, AAV and adenovirus.

Price and turnaround

Virus Type	Scale	Application	Price*	Turnaround**
Lentivirus	Pilot	Cell culture	$1,499	13-26 days
	Medium		$1,999	
	Large		$2,999	
	Ultra-purified medium	Cell culture & in vivo	$3,999	
	Ultra-purified large		$4,799	
AAV	Pilot	Cell culture	$1,499	13-26 days
	Medium		$1,999	
	Large		$2,999	
	Ultra-purified pilot	Cell culture & in vivo	$4,199	17-34 days
	Ultra-purified medium		$5,699	
	Ultra-purified large		$8,799	
Adenovirus	Pilot	Cell culture	$2,399	36-57 days
	Medium		$3,599	
	Large		$4,699	
	Ultra-purified medium	Cell culture & in vivo	$6,199	38-61 days
	Ultra-purified large		$7,499	

* Price includes the cost of both vector cloning and virus packaging.

** Turnaround includes the production time for both vector cloning and virus packaging.

COVID-19 Coronavirus Solutions

Lentivirus and VSV Pseudotyped with Coronavirus Spike (S) protein

VectorBuilder offers lentivirus and VSV pseudotyping services with coronavirus spike (S) proteins from a wide range of coronavirus species, thereby providing powerful and safe tools to study mechanisms of coronavirus cell entry and the evolution of viral tropism.

Detailed descriptions of our lentivirus and VSV pseudotyping services, including ordering information, are available on the VectorBuilder website under ***Products & Services****.*

Highlights

- Highly optimized pseudotyping protocols for achieving high transduction efficiency
- High-titer lentivirus and VSV pseudotyped with SARS-CoV-2 S protein or its variants (see variant list below)
- Pseudotyping available for S proteins derived from other coronavirus species
- Options to customize pseudotyped virus to express reporters such as EGFP or luciferase for easy viral entry analysis
- Bald lentivirus or VSV lacking viral envelope protein to be used as negative controls
- Safe to be handled in any regular BSL-2 facility
- ACE2-expressing cell lines optimized for transduction with SARS-CoV-2 S protein or VSV-G pseudotyped virus available

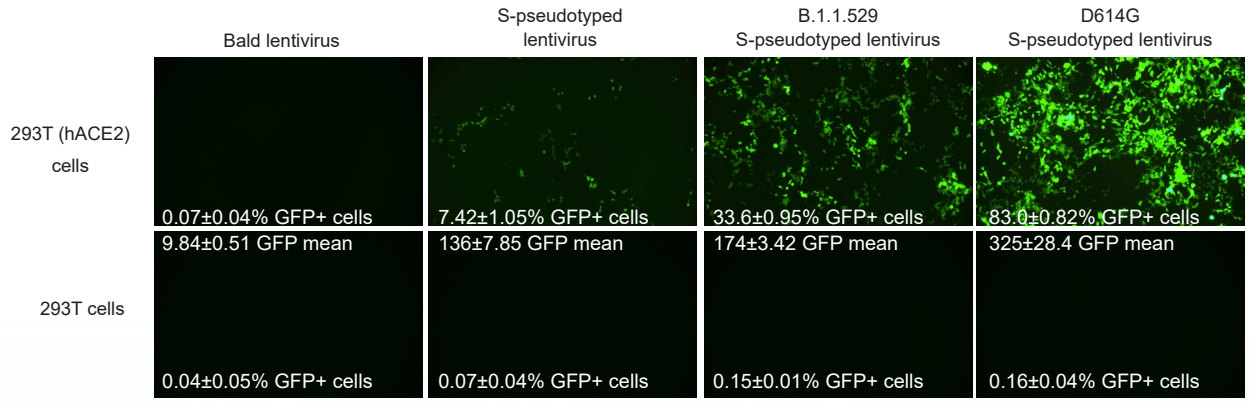


Figure 36. 293T or human ACE2 receptor (hACE2) expressing 293T cells were transduced with EGFP expressing lentivirus pseudotyped with SARS-CoV-2 wildtype (WT), B.1.1.529 (omicron), or D614G S protein. Bald lentivirus was used as a negative control. Images were taken 72 hours post-transduction.

Save Money with VectorBuilder Store Credit

Desired Credit	You Pay	You Save
$10,000	$9,419	$581
$20,000	$18,523	$1,477
$30,000	$27,444	$2,556
$40,000	$36,196	$3,804
$50,000	$44,891	$5,109
$60,000	$53,511	$6,489
$70,000	$62,021	$7,979
$80,000	$70,532	$9,468
$90,000	$79,043	$10,957
$100,000	$87,553	$12,447
$200,000	$171,146	$28,854

Vectorbuilder Store Credit is calculated using a graduated bonus rate system.

Our Client Testimonials

I must say, having dealt with many vector suppliers up until now, VectorBuilder has been by far the best to communicate rapidly, listening to client requests and going above and beyond wet lab work. As a relatively new company - Their Future is bright.

Alan Griffith
Purespring Therapeutics, UK

Vectorbuilder's service is extremely consistent. We started with regular plasmids and AAV plasmids. Since last year we have ordered many piggybac plasmids. All worked as expected.

Shu-Hsien Sheu
Janelia Research Campus, USA

VectorBuilder has been the partner every researcher would wish for during those dark moments of paper revision. They offer the complete package: a wide range of viral vector design options, an extremely user-friendly and intuitive website, direct communication, personal and knowledgeable step-by-step guidance throughout the designing and ordering process, accountability, amazing discounts, unique customer support, fast shipping, and guaranteed virus titers and efficiency. So here's my big thumbs up for a great product and service provider who has proven indispensable in addressing my research questions!

Evgenia Salta
Katholieke Universiteit Leuven/VIB, Belgium

VectorBuilder has provided incredible value and customer service throughout the entire process from product selection, custom design assistance, order submission, status reports and ultimate delivery management. The custom products I purchased from them performed exactly as advertised and in fact surpassed my expectations. I would recommend VectorBuilder to anyone requiring this type of product.

Frank Borriello
Alloplex Biotherapeutics, USA

I readily recommend a Vector Builder. My company has used them to produce research great plasmids and AAV vectors. They are helpful and responsive and have always delivered on time and on budget.

Mike McDonald
Maavrx Ltd, UK

We do frequent new vector design and creation for our products. I ordered several custom vectors from Vector Builder using their evolutional platform. That platform is easy to put my gene interested and indicator. They synthesis, sequencing my genes to verify their sequence no mistake and make plasmid for me. Everything is wonderful. More important is the vector expression at high level to meet my requirement. I really recommend to use Vector Builder as your vector designing and creating candidate.

Ying Lin
T-CURE, USA

Before using VectorBuilder, producing lentiviral overexpression vectors for our in vitro models was a recurring and time-consuming enterprise. We faced frequent challenges in every experimental step, which made it difficult to plan the actual experiments. Setting up the process with VectorBuilder was very efficient, thanks to their great expertise and support. Once we started using VectorBuilder's services, we noticed a substantial increase in productivity as well as a more uniform and predictable transduction pattern of our target cells.

We went on to use VectorBuilder for a large-scale CRISPR screen with a custom library spanning over 1,600 genes. With the provided virus, we were able to easily maintain cell representation and we derived a number of interesting hit genes, which we are excited to follow up on. A big thank you to the entire VectorBuilder Team!

Dominic Schmid
University of Basel

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cro@vectorbuilder.com (for CRO inquiry)

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cdmo@vectorbuilder.com (for CDMO inquiry)
cro@vectorbuilder.com (for CRO inquiry)

To inquire about our GMP manufacturing services email us at cdmo@vectorbuilder.com.
To inquire about our CRO services email us at cro@vectorbuilder.com.

May 2023 (EN)