



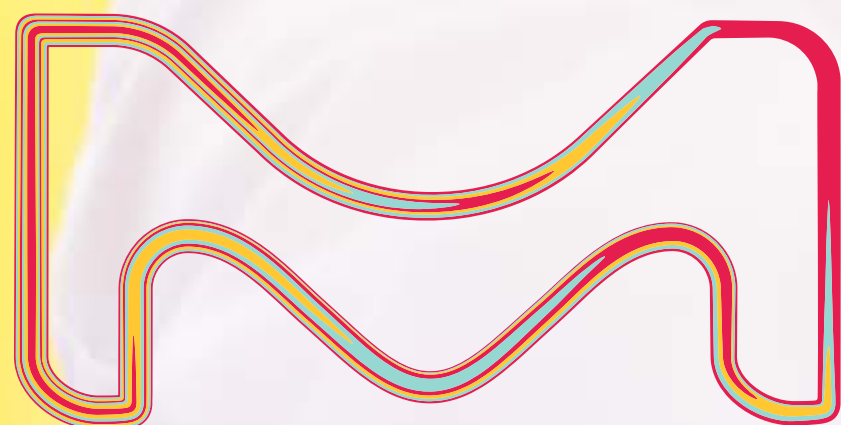
Molecular Essentials Guide



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About this guide

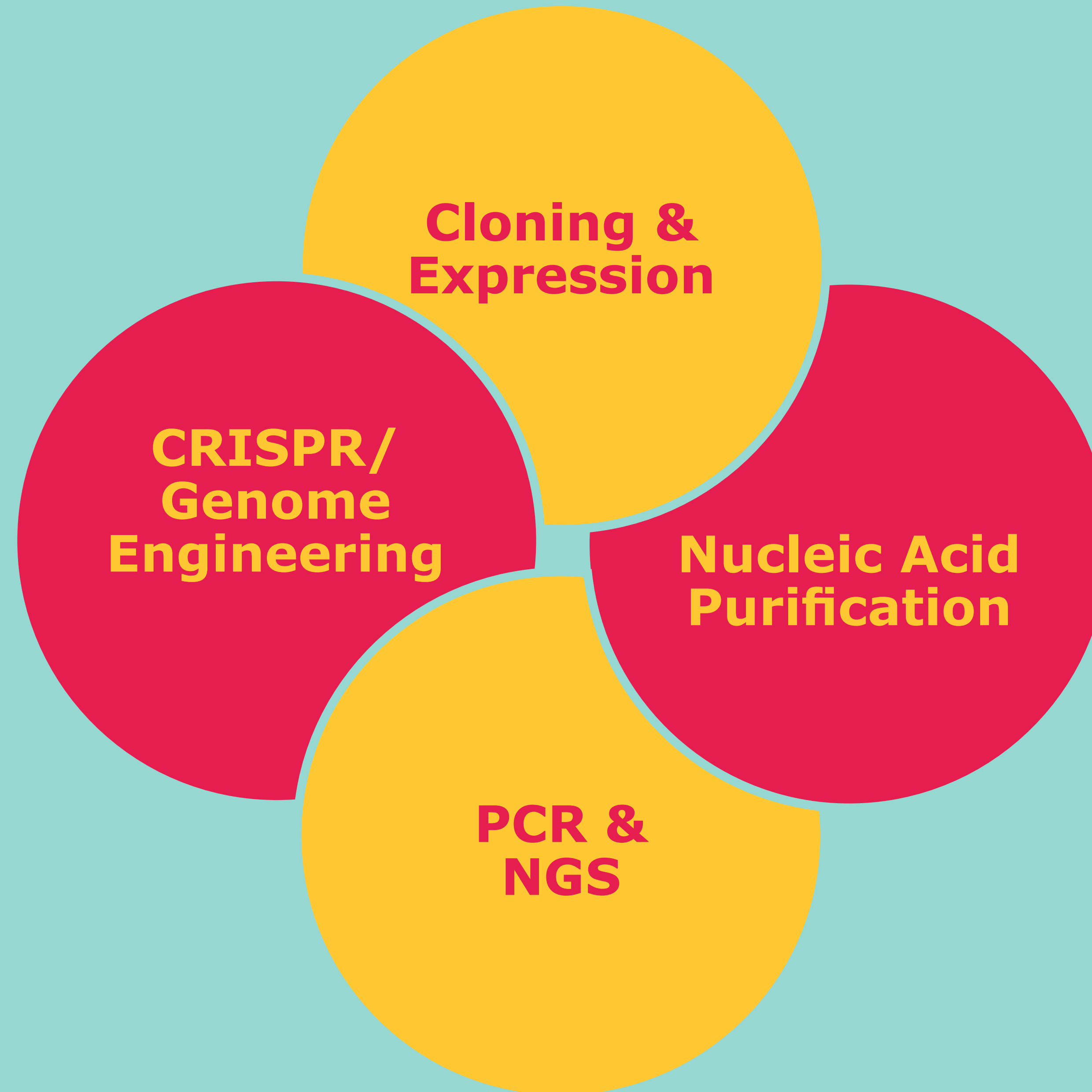


The Life Science business of Merck
operates as MilliporeSigma in the
U.S. and Canada.

Sigma-Aldrich®
Lab & Production Materials

Molecular Essentials Guide

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MOLECULAR ESSENTIALS GUIDE



Our Molecular Essentials Guide is meticulously assembled for the academic researcher or industry professional whose molecular workflow requires easy access to a comprehensive portfolio of consistent, precise, ready-to-use reagents and technical support. From routine cloning, rapid nucleic acid purification, reliable PCR amplification, and novel CRISPR gene editing tools, our global team of technical experts remain committed to offering the time and resource-saving benefits of our molecular tools that are ready when you are. Our highly proven molecular reagents provide a range of “grab-and-go” tools so that you can select from a variety of gold-standard offerings and solutions that scale from bench-top R&D to production-level needs. Explore our robust offering of cloning, expression, nucleic acid purification, PCR, gene editing, and NGS reagents.

For incremental innovations, day after day, choose molecular essentials that are the foundation of great work, not a variable that undermines it.





Cloning & Expression

Nucleic Acid Purification

PCR & NGS

CRISPR/Genome Engineering

Cloning & Expression

Expression
Vectors

Modifying
Enzymes

Selection
Essentials

Transfection
Reagents

Expression
Essentials

Molecular
Biology
Essentials





Expression
Vectors

Modifying
Enzymes

Selection
Essentials

Transfection
Reagents

Expression
Essentials

Molecular Biology
Essentials

Cloning & Expression

Expression Vectors

Novagen® pET System

Driven by powerful bacteriophage T7 promoter and translation signals, the pET System is the gold standard for cloning and expression of recombinant proteins. The Novagen® pET System has been used to express thousands of different proteins in host cells expressing the T7 polymerase. With a variety of pET vector types, host strains, and complementing products, the pET system provides you with the flexibility to design and optimize your cloning and protein expression needs.

Cat. No.	Single Expression Vectors	Key Features & Application
69436	pET-11a	Basic pET vectors offer single BamHI cloning site in three frames
69439	pET-11d	
69660	pET-14b	
69661	pET-15b	Basic cleavable N-terminal His•Tag® fusion vectors, single frame with three cloning sites
69662	pET-16b	
69677-M	pET-19b	
69739	pET-20b(+)	Signal sequence fusion to facilitate export of target proteins to the periplasm. Signal sequence cleaved by signal peptidase upon export
69744	pET-22b(+)	
69753-M	pET-25b(+)	
69862	pET-26b(+)	
69863-M	pET-27b(+)	
69740	pET-21a-d(+)	Combination of N-terminal T7•Tag® epitope and optional C-terminal His•Tag® sequence. Multiple cloning sites in three frames
69745-M	pET-23a-d(+)	
69749	pET-24a-d(+)	
69864	pET-28a-c(+)	Cleavable N-terminal fusion tags and optional C-terminal His•Tag® sequence. Multiple cloning sites in three frames
69871	pET-29a-c(+)	
69909	pET-30a-c(+)	
69952	pET-31b(+)	High yield bioproduction of peptides and small proteins
69015-M	pET-32a(+)	Production of soluble, active target proteins in <i>E. coli</i>
69016	pET-32b(+)	

Cat. No.	Single Expression Vectors	Key Features & Application
70090-M	pET-39b(+)	Dsb tags for export and periplasmic folding of target proteins
70091-M	pET-40b(+)	
70556	pET-41a(+)	Popular GST fusion tags for enhanced production and solubility
70557-M	pET-41b(+)	
70561	pET-42a(+)	
70562	pET-42b(+)	Cloning and high-level expression of polypeptide sequences fused with the 495 aa NusA (Nus•Tag™) protein
70939	pET-43.1a(+)	
70940-M	pET-43.1b(+)	
71122	pET-44a(+)	Nus•Tag™ sequence plus N- and C-terminal His•Tag sequences
71327	pET-45b(+)	His•Tag™ sequence and minimal extraneous sequences
71335	pET-46 Ek/LIC Kit	Ligation-independent cloning, with amino-terminal His•Tag™ sequence (more available)
71461	pET-47b(+)	HRV 3C Protease cleavage site for efficient fusion tag removal
71462	pET-48b(+)	
71463-M	pET-49b(+)	

Explore the full list of offerings here





Cloning & Expression

Expression Vectors

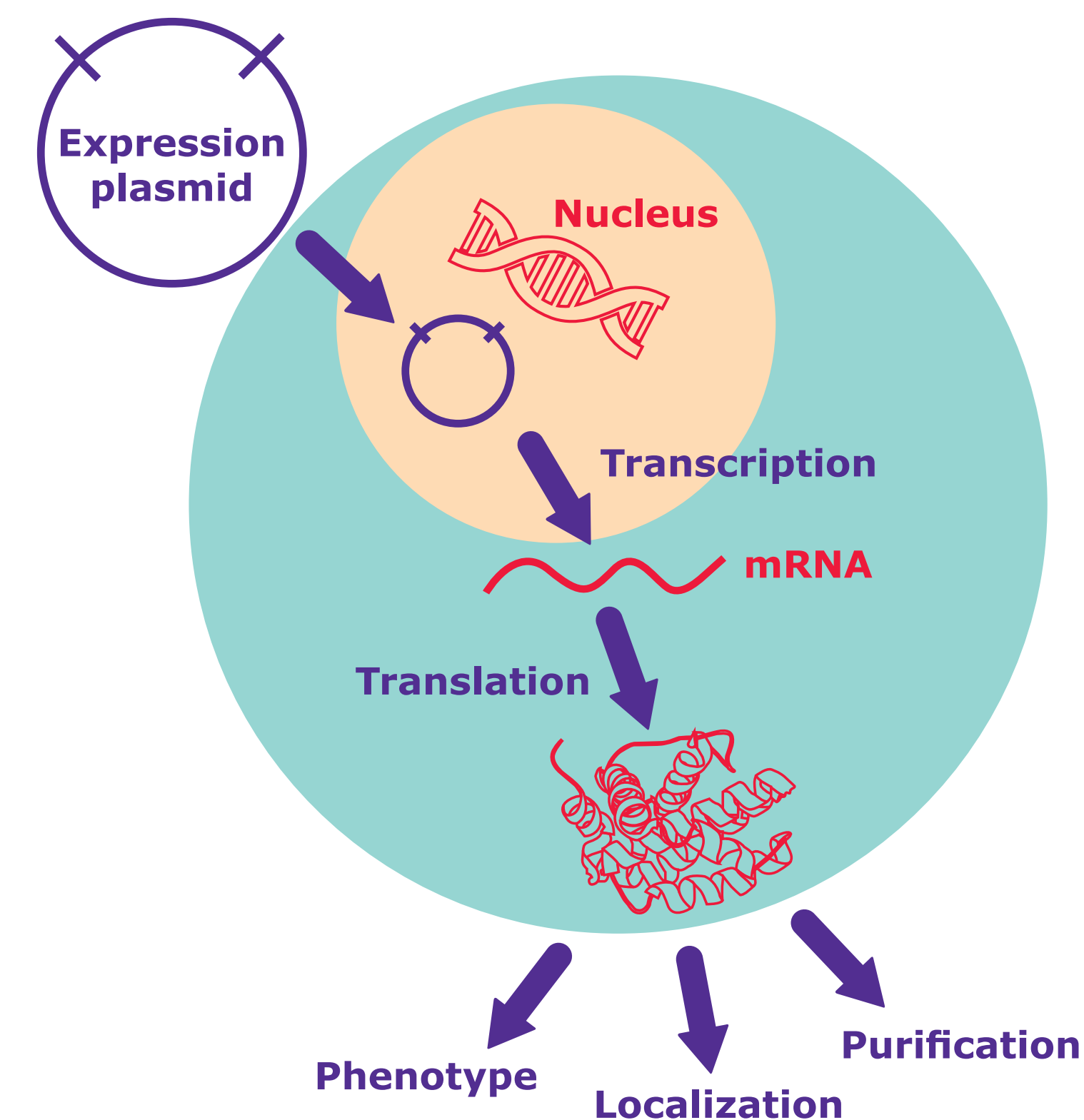
Novagen® pET System

The pET System is the most powerful system for the cloning and expression of recombinant proteins in *E. coli*. Target genes are cloned in pET plasmids under control of strong bacteriophage T7 transcription and (optionally) translation signals; expression is induced by providing a source of T7 RNA polymerase in the host cell. The pET System offers numerous pET vector types, different host strains, and many other companion products designed for efficient detection and purification of target proteins.

Cat. No.	Single Expression Vectors	Key Features & Application
70608	pETBlue™-1	Identify recombinants by traditional blue/white screening (more available)
70609	pETBlue™-2	
71129	pETcoco-1	Precise control of the expression of toxic proteins (more available)
71363-M	pRSF-1b	Express N-terminal His•Tag® fusion proteins containing minimal extraneous sequences (more available)
71330-M	pCDF-1b	

Cat. No.	Co-Expression Vectors	Key Features & Application
71146	pETDuet™-1	Express multiple target proteins in <i>E. coli</i>
71147	pACYCDuet™-1	
71341	pRSFDuet™-1	
71340-M	pCDFDuet™-1	
71406-M	pCOLADuet™-1	

Find the full list of offerings here





Cloning & Expression

Modifying Enzymes

Traditional cloning remains the most popular way to insert your GOI into an expression vector for protein expression in the target cell, whether that is an insect, mammalian, or microbial cell. We carry a variety of enzymes and kits dependent on your research needs.

Additionally, we offer a wide variety of high-fidelity **PCR reagents**

Cat. No.	Cloning Reagents	Application
LIG2	QuickLink™ DNA Ligation Kit	Reagents necessary to perform DNA ligation reactions at room temperature using blunt or sticky ends
D2886	DNA Ligase from T4-infected Escherichia coli	Ligation of cloning vector and restriction insert fragments in a buffered aqueous solution
70099-M	T4 DNA Polymerase, LIC-qualified	Qualified for ligation-independent cloning (LIC), to insert DNA fragments into plasmid vectors without the need for traditional restriction enzyme digestion and ligation
Cat. No.	Additional Reagents	Application
SCR508	TAT-CRE Recombinase	Cell-permeant fusion Cre-recombinase protein known to catalyze the site-specific recombination event between two loxP DNA sites

Polymerases

Colony PCR

Explore the full list of offerings here

Agarose Gel Electrophoresis

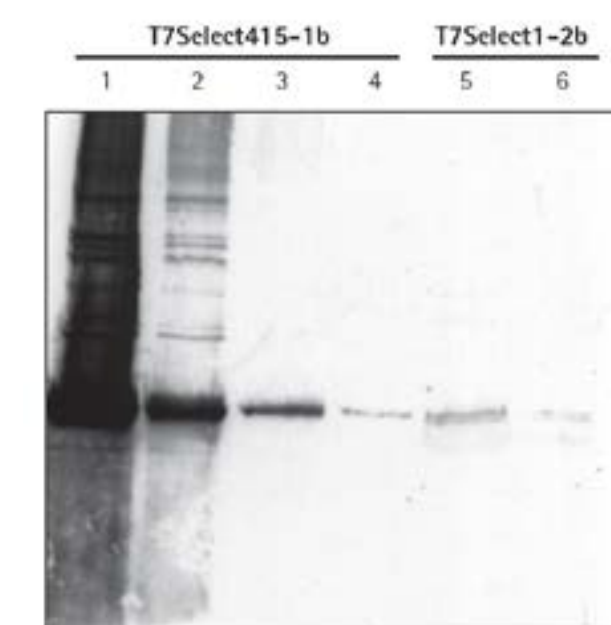
T7Select® Phage Display

The T7Select® Phage Display System is based on bacteriophage T7. This novel phage display system has the capacity to display small peptides in high copy number, and larger peptides or proteins in low-to- mid-copy number range. In contrast to filamentous phage assembly, peptides or proteins displayed on the surface of T7 do not need to be capable of secretion through the cell membrane. Instead, phage assembly takes place in the *E. coli* cytoplasm and mature phage are released by cell lysis. Available in select kit sizes.

Kit	Use	Display Number Per Phage	Amino Acid Display Limit	Host
T7Select® 1-1 Cloning Kit	Peptides or Proteins	0.1 – 1	900 – 1200 aa	BLT5403 and BLT5615 strains
T7Select® 10-3 Cloning Kit	Peptides or Proteins	5 – 15	1200 aa	
T7Select® 415-1 Cloning Kit	Peptides	415	40 – 50 aa	BL21

T7Select® vectors enable varying copy numbers of displayed peptides.

Phage particle proteins were analyzed by Western blot using the HSV•Tag® monoclonal antibody. Lanes 1 and 5 represent the equivalent of 25 µL lysate for the indicated vectors. Lanes 2-4 and lane 6 represent 10-fold serial dilutions. Data confirm that T7Select® 415-1b vector is ideal for high copy number phage display, while T7Select® 1-2b is appropriate for low copy number phage display, (Data courtesy of A. Rosenberg, Brookhaven National Laboratories).





Cloning & Expression

Selection Essentials

Competent Cells, Induction, and Selection Reagents

Novagen® competent cells come in a variety of strains for chemical transformation. Optimized for high transformation efficiency, incorporation of Novagen® competent cells into transformation protocols ensures superior yields of stable, high-quality plasmid DNA and recombinant proteins. For related products, explore our plasmid preparation and additional kits for [nucleic acid research](#).

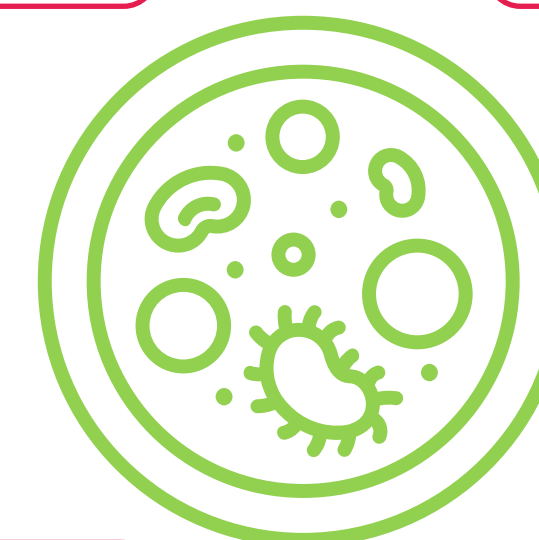
Cat. No.	Induction Reagents	Key Features & Application
70527	100 mM IPTG Solution	Blue/White screening, Induction of protein expression with pET system
I1284	Isopropyl β-D-thiogalactopyranoside solution	Ready-made formulation for Blue/White screening
Cat. No.	Selection Reagents	Key Features & Application
B2904	Bluo-Gal	Designed to replace X-Gal in Blue/White screening of recombinant bacterial colonies
B3928	Blue-White Select™ Screening Reagent	Ready-made formulation with intense color contrast for easy colony selection
71077	X-Gal Solution	Convenient 40 mg/mL concentrate in DMSO for Blue/White screening

BL21 Cells

The gold standard for protein expression from target genes cloned in pET vectors

NovaBlue Cells

For routine molecular cloning applications, blue/white screening and plasmid preparation



ROSETTA™ Cells

To enhance the expression of eukaryotic proteins that contain codons rarely used in *E. coli*

ORIGAMI™ Cells

For proper disulfide bond formation and increasing yields of folded, soluble protein.

Need cells that are manufactured free of animal-derived media and components? Veggie™ Competent Cell versions are available for several strains

[Explore the full list of offerings here](#)[Antibiotics](#)[PCR Cleanup Kits](#)[Plasmid Prep Kits](#)[Microbial Media](#)

Cloning & Expression

Selection Essentials

BL21 Competent Cells

The gold standard for protein expression from target genes cloned in pET vectors.

BL21 has been the gold standard for protein expression since it was first introduced in 1990. Deficient in lon and ompT proteases, BL21 and its derivatives are high-yielding and ideal for many applications.

DE3 indicates that the host is a lysogen of λDE3, and therefore carries a chromosomal copy of the T7 RNA polymerase gene under control of the lacUV5 promoter. Such strains are suitable for production of protein from target genes cloned in pET vectors by induction with IPTG.

pLysS strains express T7 lysozyme, which further suppresses basal expression of T7 RNA polymerase prior to induction, thus stabilizing pET recombinants encoding target proteins that affect cell growth and viability.

Explore



Cat. No.	Host Strains	Derivation	Guaranteed Efficiency	Packaging Format	Resistance	Key Features & Application
69449	BL21 Cells	B834	>2.0 x 10 ⁷	Standard	None	Routine protein expression, control non-expression host
69450-M 70235-M 71012	BL21(DE3) Cells	B834	>2.0 x 10 ⁷	Standard, Singles™, HT96™	None	General purpose expression host
69451-M 70236-M	BL21(DE3) pLysS Cells	B834	>2.0 x 10 ⁷	Standard, Singles™	Cam	High-stringency expression



Cloning & Expression

Selection Essentials

NovaBlue Competent Cells

For routine molecular cloning applications, blue/white screening and plasmid preparation.

For routine cloning, time-tested NovaBlue Competent Cells are ideal. NovaBlue is a K-12 strain ideally suited as an initial cloning host due to its high transformation efficiency, blue/white screening capability (with appropriate plasmids), and recA endA mutations, which result in high yields of excellent quality plasmid DNA.

The DE3 lysogen of NovaBlue is potentially useful as a stringent host due to the presence of the lacIq repressor encoded by the F episome. Blue/white screening is not possible with NovaBlue(DE3) due to the presence of the lacZ α-peptide coding sequences in the lysogenic phage. NovaBlue T1R Competent Cells have the added benefit of being resistant to T1 and T5 phage.

Explore



Cat. No.	Host Strains	Derivation	Guaranteed Efficiency (cfu/μg)	Packaging Format	Resistance	Key Features & Application
69825-M	NovaBlue Cells	K-12	>1.5 x 10 ⁸	Standard, Singles™	Tet	Non-expression host, general purpose cloning host, plasmid preps
69284	NovaBlue(DE3) Cells	K-12	>1.0 x 10 ⁸	Standard	Tet	Stabilizing target plasmids
71227	NovaBlue GigaSingle™ Cells	K-12	>1.0 x 10 ⁸	Singles™	Tet	Non-expression host, high-efficiency cloning
71251-M	Veggie™ NovaBlue Cells	K-12	>1.5 x 10 ⁸	Singles™	Tet	Non-expression host, general purpose cloning host, plasmid preps with non-animal origin components
71318-M	NovaBlue T1R Cells	K-12	>1.5 x 10 ⁸	Singles™	Tet	Non-expression host, general purpose cloning, plasmid preps, T1 and T5 phage resistant



Cloning & Expression

Selection Essentials

Origami™ Competent Cells

For proper disulfide bond formation and increasing yields of folded, soluble protein.

Origami™ 2 and Origami™ B strains have mutations in glutathione reductase (gor) and thioredoxin reductase (trxB), facilitating proper disulfide bond formation. These strains also include the lon and ompT deficiencies of BL21, which increases protein stability.

DE3 indicates that the host is a lysogen of λDE3, and therefore carries a chromosomal copy of the T7 RNA polymerase gene under control of the lacUV5 promoter. Such strains are suitable for production of protein from target genes cloned in pET vectors by induction with IPTG.

Explore



Cat. No.	Host Strains	Derivation	Guaranteed Efficiency (cfu/μg)	Packaging Format	Resistance	Key Features & Application
71344-M	Origami™ 2 Cells	K-12	>2 x 10 ⁶	Standard	Tet + Str	Control non-expression host; kanamycin sensitive
71345-M	Origami™ 2(DE3) Cells	K-12	>2 x 10 ⁶	Standard, Singles™	Tet + Str	General expression host; two mutations in cytoplasmic disulfide reduction pathway enhance disulfide bond formation in <i>E. coli</i> cytoplasm; kanamycin sensitive
71346-M	Origami™ 2(DE3) pLysS Cells	K-12	>2 x 10 ⁶	Standard	Tet + Str + Cam	High-stringency expression host; two mutations in cytoplasmic disulfide reduction pathway enhance disulfide bond formation in <i>E. coli</i> cytoplasm; kanamycin sensitive
70836-M	Origami™ B Cells	Tuner™ (B strain)	>2 x 10 ⁶	Standard	Kan + Tet	Control non-expression host
70837	Origami™ B(DE3) Cells	Tuner™ (B strain)	>2 x 10 ⁶	Standard	Kan + Tet	General expression host; contains Tuner™ lac permease mutation and trxB/gor mutations for cytoplasmic disulfide bond formation
70839	Origami™ B(DE3) pLysS Cells	Tuner™ (B strain)	>2 x 10 ⁶	Standard	Kan + Tet + Cam	High-stringency expression host; contains Turner™ lac permease mutation and trxB/gor mutations for cytoplasmic disulfide bond formation



Cloning & Expression

Selection Essentials

Rosetta™ Competent Cells

To enhance the expression of eukaryotic proteins that contain codons rarely used in E. coli.

Rosetta™ and Rosetta™ 2 host strains are BL21 derivatives designed to enhance the expression of eukaryotic proteins that contain codons rarely used in *E. coli*.

If you’re studying a eukaryotic protein, its open reading frame (ORF) may contain codons that are rarely employed in *E. coli*. Rosetta™ and Rosetta™ 2 strains include a chloramphenicol-selectable plasmid bearing tRNAs for codons that are infrequently used in *E. coli*, thus conferring “universal” translation.

DE3 indicates that the host is a lysogen of λDE3, and therefore carries a chromosomal copy of the T7 RNA polymerase gene under control of the lacUV5 promoter. Such strains are suitable for producing protein from target genes cloned in pET vectors by induction with IPTG.

Cat. No.	Host Strains	Derivation	Guaranteed Efficiency (cfu/μg)	Packaging Format	Resistance	Key Features & Application
70953	Rosetta™ Cells	BL21	>2.0 x 10 ⁶	Standard	Cam	Control non-expression host
70954	Rosetta™(DE3) Cells	BL21	>2.0 x 10 ⁶	Standard	Cam	General expression host; provides six rare codon tRNAs
70956-M	Rosetta™(DE3) pLysS Cells	BL21	>2.0 x 10 ⁶	Standard	Cam	High-stringency, expression host; provides six rare codon tRNAs
70920	Rosetta™(DE3) pLacI Cells	BL21	>2.0 x 10 ⁶	Standard	Cam	-
71402-M	Rosetta™ 2 Cells	BL21	>2.0 x 10 ⁶	Standard	Cam	Control non-expression host
71397	Rosetta™ 2(DE3) Cells	BL21	>2.0 x 10 ⁶	Standard, Singles™	Cam	General expression host; provides seven rare codon tRNAs
71403-M	Rosetta™ 2(DE3) pLysS Cells	BL21	>2.0 x 10 ⁶	Standard, Singles™	Cam	High-stringency, expression host; provides seven rare codon tRNAs
71404-M	Rosetta™ 2(DE3) pLacI Cells	BL21	>2.0 x 10 ⁶	Standard	Cam	-

Explore







Cloning & Expression

Selection Essentials

Microbial Media

Microbial culture is widely used in molecular biology for protein expression in different species, such as bacteria, yeast, or viruses. We offer the microbial media you need for fast and easy growth that leads to reproducible results and high protein yield.

Our culture medium expertise, and stringent quality standards enable us to offer media products with:

- Versatile formulations for different component needs
- Multiple easy-to-use formats (powder, liquid, and plates)
- High-quality media
- Lot-to-lot consistency

Explore



Cat. No.	Microbial Media	Packaging Format	Application
L3522	LB Broth	Powder	Granulated medium for the cultivation of <i>E. coli</i> on scales ranging from small cultures to fermentation. Available in Miller and Lennox formulations.
L3022		Liquid	
L2542		Tablet	
L7275		Plate	
L5542		Plate	
T5574	Terrific Broth	Powder	Highly enriched granulated medium to improve the yield of plasmid DNA from <i>E. coli</i> .
		Liquid	
Y2377	2xYT Broth	Powder	Powdered medium for the enrichment of <i>E. coli</i> .
Y1003		Liquid	
M6030	M9 Minimal Salts	Powder	Suitable for non-selective cultivation of <i>E. coli</i> strains for cloning, production of DNA, plasmid DNA and recombinant proteins.
M9956		Liquid	
H8032	SOB and SOC Medium	Powder	Enables the high efficiency transformation of competent cells.
S1797		Liquid	
N3643	NZCYM Broth	Powder	Suitable for non-selective cultivation of lambda bacteriophage and <i>E. coli</i> strains for cloning, production of DNA, plasmid DNA and recombinant proteins.
Y1250	Yeast Nitrogen Base	Powder	Highly-referenced growth medium used for the cultivation of yeast. The nutrient-rich microbial broth contains nitrogen, vitamins, trace elements and salts. Available with or without amino acids.
Y0626			





Cloning & Expression Selection Essentials

Microbial Media Supplements

We offer a wide array of components, additives, and supplements for your specialized culture needs.

Cat. No.	Microbial Supplements	Packaging Format	Application
MBD0055	MediaBoost	Liquid	A ready-to-use, non-animal, protein-free supplement that amplifies growth of certain gram-positive bacteria, gram-negative bacteria, and yeast species in minimal or standard microbial growth media.
MBD0056	Trace Elements Ready Made Solution	Liquid	A solution comprised of vital minerals to support critical bacterial development. Based on Wolin and Wolfe's recipe, it is suitable for culturing anaerobic bacteria of the human microbiome.
MBD0063	Vitamin Mixture Solution	Liquid	A solution of vitamins, additives, and mineral supplements used for special culturomics growth media to mimic the natural environment of bacteria and fungi for high throughput culturing applications.
Y1625 Y1626	Yeast Extract	Powder	Used as a microbial media component for a variety of microorganisms, molecular genetics applications, and complex media for industrial fermentations.
71279 71280	Veggie™ Yeast Extract and Veggie™ Peptone	Powder	Animal-free media components that can be used as direct replacements for tryptone and yeast extract in microbial growth media.
Y1771 Y1896 Y2021 Y2146	Yeast Synthetic Drop-Out Medium Supplements	Powder	Supplements for rich medium formulations. Used to increase yield, growth rate, and the probability of successful yeast transformations in screening libraries and genetic knock-outs. Available in a variety of formulations.

Explore



Application Data

Compatibility of MediaBoost with Relevant Species and Culture Media.

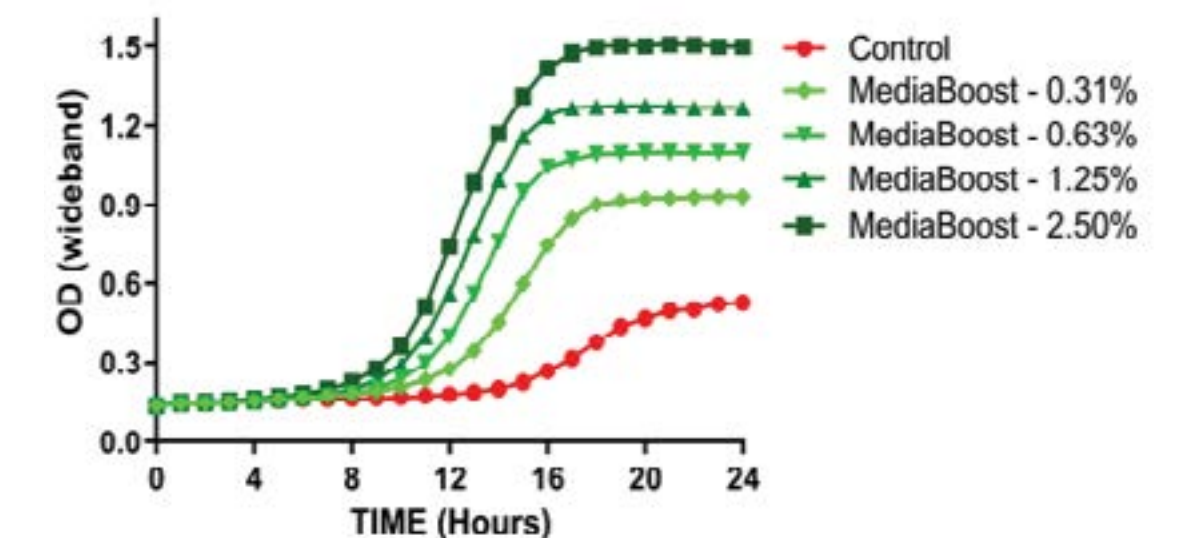
(✓) indicates that a relative increase in growth was observed when compared to media without MediaBoost, and (x) indicates that no growth improvement was observed with MediaBoost. Colored cells indicate media and species not tested together with MediaBoost.

Microbe/ Media Type	LB	1/3 LB	BM2	M9	IMDM	DMEM	YPD	1/3 YPD	MRS	1/3 MRS
Bacillus subtilis	✓				✓	✓				
Lactobacillus rhamnosus	✓	✓	x	x		✓			✓	✓
Lactobacillus reuteri					✓				✓	✓
Lactobacillus salivarius									✓	✓
Bacillus coagulans					✓					
Lactococcus lactis					✓					
Escherichia coli	x				✓					
Saccharomyces cerevisiae	x		✓	✓	✓		✓	✓		
Pseudomonas aeruginosa	x			✓						

Growth of Bacillus subtilis Spores in LB

Bacillus subtilis, a gram-positive species, were cultured in LB media with increasing concentrations of MediaBoost. An untreated neat culture served as a negative control. Data points represent means of triplicate cultures and S.D. did not exceed 10% of mean.

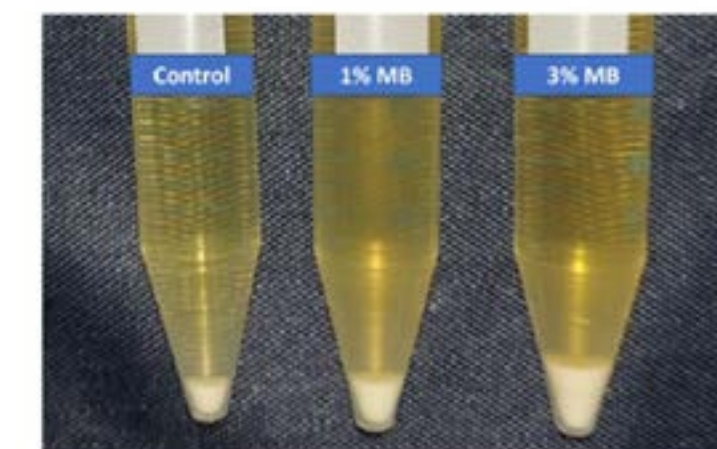
Growth of Bacillus subtilis spores in LB



Growth of Saccharomyces cerevisiae in YPD

Saccharomyces cerevisiae were cultured in YPD media for 24 hours at 32°C in a shaker flask, with 1% (middle tube) or 3% (right tube) MediaBoost (MB). An untreated neat culture served as a negative control (left tube). Aliquots were removed and tubes were centrifuged at high speed to obtain pellets.

Growth of Saccharomyces cerevisiae in YPD



Cloning & Expression

Transfection Reagents

High-efficiency transfection in nearly any cell type is achievable with the wide variety of reagents that we offer. Our portfolio covers a variety of popular transfection reagents, including our Escort™ lipid reagents, RiboJuice™ reagents , and GeneJuice® transfection reagents.

Cat. Number	Transfection Reagent	Application
70967	GeneJuice® Transfection Reagent	Non-lipid based chemical transfection reagent optimized for maximum transfection efficiency, ease-of-use, and minimal cytotoxicity on a wide variety of mammalian cells.
TR-1013	RiboJuice™ mRNA Transfection Kit	Formulated specifically for the delivery of larger RNA species into mammalian cells with high efficiencies and low toxicities.
71115	RiboJuice™ siRNA Transfection Kit	Efficiently delivers siRNA into a wide range of mammalian cell lines for targeted gene suppression.
71281	ProteoJuice™ Protein Transfection Reagent	An effective reagent for the transfection of intact functional protein and peptides into mammalian cells with minimal toxicity and broad cell specificity.
72181	293-Free™ Transfection Reagent	Animal-free polycationic liposomal transfection reagent optimized for the transfection of HEK293 cells grown in suspension culture.

Cat. Number	Transfection Reagent	Application
L3037	Escort™ III Transfection Reagent	Unique formulation of a proprietary polycationic lipid and a neutral non-transfecting lipid. This liposome-forming compound is used for transfection of nucleic acids into primary cells.
L3287	Escort™ IV Transfection Reagent	Unique formulation of a proprietary polycationic lipid and a neutral non-transfecting lipid. This liposome-forming compound is used for transfection of nucleic acids into a wide variety of eukaryotic cell types.
TR-1003	Polybrene Transfection Reagent	A cationic polymer that can greatly enhance the efficiency of the retroviral or lentiviral infection to mammalian cells.
71259	Insect GeneJuice® Transfection Reagent	Optimized for maximal transfection efficiency of Sf9 insect cells for baculovirus protein expression.

Transfection





Cloning & Expression

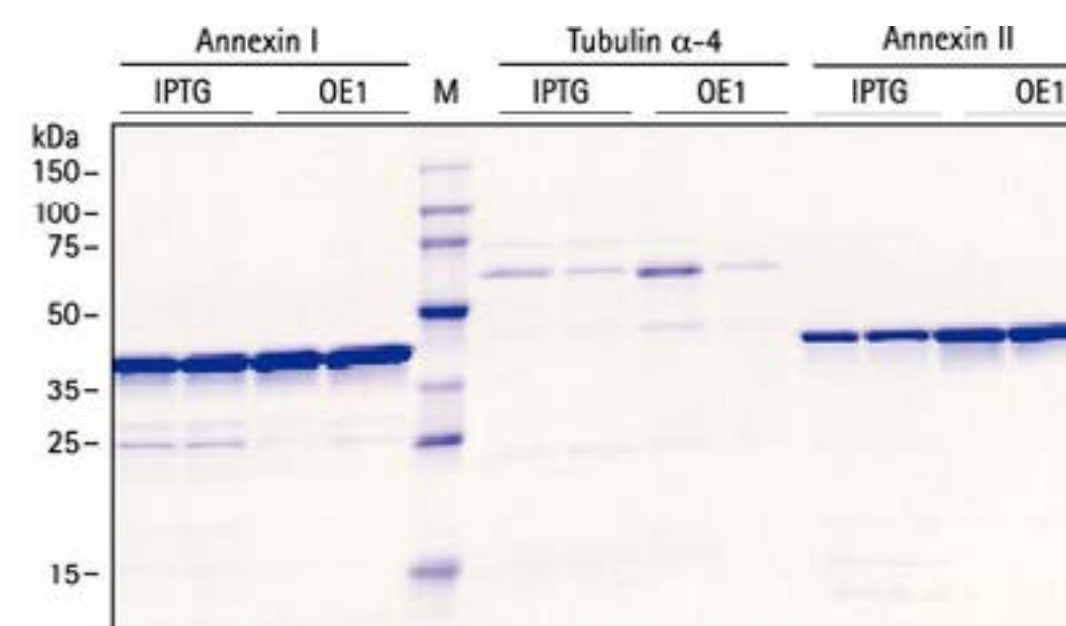
Expression Essentials

Overnight Express™ Platform

Simplify bacterial protein expression and increase soluble protein yields using the Overnight Express™ Autoinduction System. Simply prepare, inoculate, incubate, and harvest. With Overnight Express™, save time and drive your protein research forward. LB, TB, and complete systems are available.

- Effortless protein expression in *E. coli* without the need for monitoring or induction
- Convenient for routine expression of proteins in multiple cultures or for high-throughput parallel analysis
- High cell densities and protein expression levels

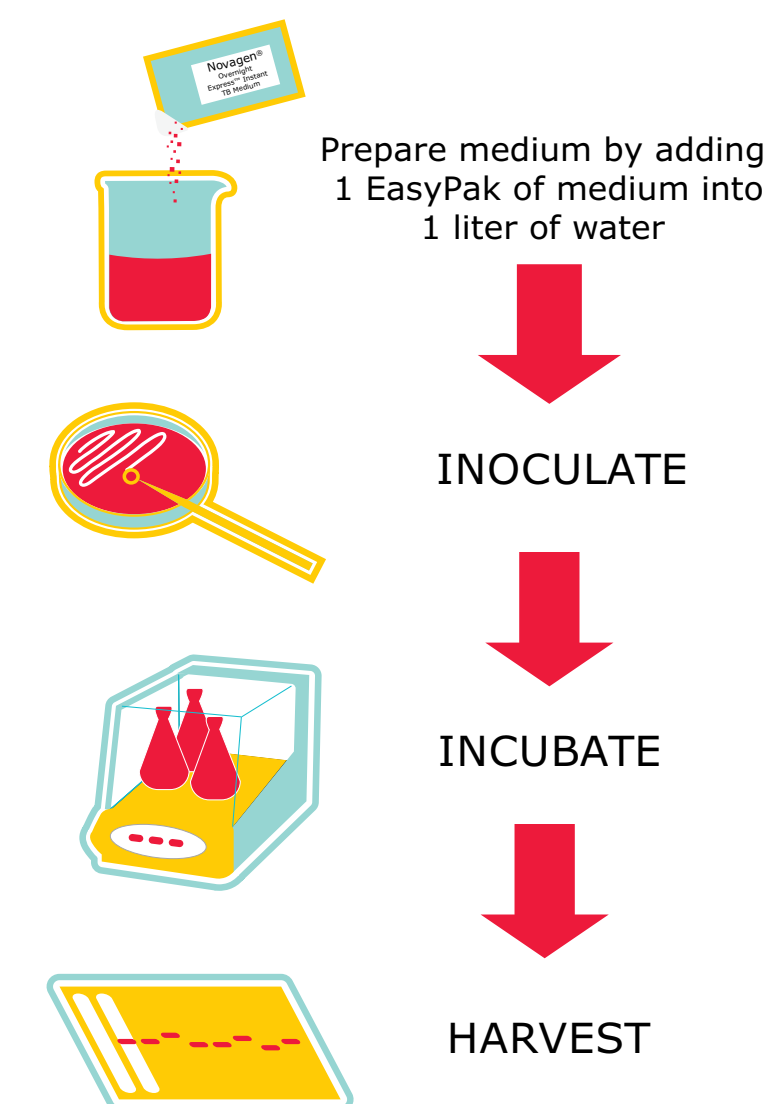
Cat. No.	Product Name	Application
71300-M	Overnight Express™ Autoinduction System 1	Allows the induction of protein expression without monitoring cell density and without conventional induction with isopropyl β-D-1-thiogalactopyranoside (IPTG).
71757-M	Overnight Express™ Instant LB Medium	A complete granulated autoinduction culture medium for high-level protein production in pET and other IPTG-inducible bacterial expression systems.
71491	Overnight Express™ Instant TB Medium	A complete granulated autoinduction culture medium for high-level protein production in pET and other IPTG-inducible bacterial expression systems.



Lanes	Sample volume
Annexin I	4 μL
Tubulin α-4	4 μL
Annexin II	IPTG, 8 μL; OE1, 4.5 μL
Lanes	Sample
IPTG	IPTG induction
OE1	Overnight Express™ Autoinduction System 1
M	Perfect Protein™ Markers, 15-150 kDa

Better yields, better nights' sleep with Overnight Express™ autoinduction. pET recombinants encoding the indicated His Tag® fusion proteins were transformed into BL21(DE3) cells. For Overnight Express System 1 induction, 5 mL medium was inoculated with a single colony and incubated overnight (~16 h) at 30 °C with shaking. For IPTG induction, 5 mL medium was inoculated with a single colony and incubated at 16 °C with shaking to an average OD₆₀₀ of 1.0. IPTG was added to 1 mM final concentration and incubated an additional 16 h. Proteins were purified and then analyzed by SDS-PAGE and Coomassie® blue staining.

Overnight Express™ Protocol





Expression
Vectors

Modifying
Enzymes

Selection
Essentials

Transfection
Reagents

Expression
Essentials

Molecular Biology
Essentials

Cloning & Expression

Molecular Biology Essentials

From setup to clean up, and every step in between, we've got you covered.

Cat. No.	Molecular Biology Reagents	Key Features & Application
R6513	Ribonuclease A from bovine pancreas	Highly stable endoribonuclease suitable for removal of RNA, RNA sequencing, and DNA purification applications
P1585	PMA	Activator of protein kinase C (PKC) used in a variety of molecular and cellular biology research
D8418	Dimethyl Sulfoxide	A highly polar, aprotic organic solvent with many applications in organic chemistry and molecular biology
I9616	2-Propanol	Suitable for use in DNA precipitation using standard protocols and as a solvent for making solutions for molecular biology applications
W4502	Water	0.1 µm filtered, suitable for molecular biology applications. Analyzed for the absence of nucleases and proteases and has undergone bioburden analysis

Cat. No.	Molecular Biology Reagents	Key Features & Application
B0300	Betaine solution	PCR enhancing reagent that is widely used for improving the yield and specificity of PCR products, especially targets rich in GC content or those that form secondary structures resulting in poor yield
R2020	RNaseZAP™ reagent	Purifying agent used for eliminating RNase contamination from glassware, plastic surfaces, reaction vessels, countertops and pipettors
D9542	DAPI	Cell permeable, fluorescent dye that binds to DNA, several times more sensitive than ethidium bromide for agarose gel staining
F3917	Forskolin	Cell-permeable diterpenoid that possesses anti-hypertensive, positive inotropic, and adenylyl cyclase activating properties
F2637	Ficoll® 400 reagent	Non-ionic synthetic polymer of sucrose used for cell separation and organelle isolation



Cloning & Expression



Nucleic Acid Purification

PCR & NGS

CRISPR/Genome Engineering

Nucleic Acid Purification

The purity, quality, and quantity of your nucleic acid samples depend on reliable nucleic acid purification reagents and kits. We offer a variety of suitable nucleic acid purification essentials for your sample needs, including reagents and kits for gDNA, RNA, and plasmid purification, single spin purification, nucleic acid gel extraction, PCR clean-up, and more. Explore our comprehensive offering to maximize the reproducibility of your results and ensure that your purification needs are met day after day.

Essentials

Gold-Standard
Kits

Sustainable
Solutions

Gel
Electrophoresis
Essentials



Nucleic Acid Purification

Essentials

For General Molecular Needs:

Sample stabilization and isolation: Protect your precious samples and optimize your yield.

Product	Application
RNAaseZAP™ Reagent	Keep your surfaces, racks and other implements clean by removing RNases.
Rnase AWAY® Reagent	Remove RNases from surfaces with this ready-to-use solution
Save it for later! Keep your samples in top shape until you can process them.	
RNAlater® Reagent	Stabilize and protect RNA with immediate RNase inactivation
GenElute™-E Tissue Stabilizer	Stabilize your tissue samples prior to DNA or RNA purification



Keep it clean! Decontamination reagents can save your experiments.

Breaking it down: Proteinase K options to fit your needs

Proteinase K	Product Name	Cat. No.	Concentration or Activity	Key Features
Liquid Formulations	Proteinase K from <i>Tritirachium album</i>	P5568	≥10 mg/mL ≥500 units/mL	
	Proteinase K from <i>Tritirachium album</i>	P4850	≥10 mg/mL ≥800 units/mL	Tested for DNase, RNase, endonuclease and nickase
	Proteinase K from <i>Tritirachium album</i>	SRE0005	≥10 mg/mL protein ≥800 units/mL	Tested for DNase, RNase, endonuclease and nickase Designed under ISO13485
	Proteinase K	71049-M	≥ 600 mAnsonU/mL	Tested for DNase, RNase, endonuclease, nickase, and bioburden Highest Quality Level
Lyophilized Powders	Proteinase K from <i>Tritirachium album</i>	P2308	≥30 units/mg protein	Tested for DNase, RNase, endonuclease and nickase
	Proteinase K from <i>Tritirachium album</i>	P6556	≥30 units/mg protein	Water soluble
	Proteinase K from <i>Tritirachium album</i>	SRE0047	≥ 30.0 mAnsonU/mg	Tested for DNase, RNase, endonuclease and nickase Highest Quality Level
	Proteinase K	70663	≥ 30.0 mAnsonU/mg	Tested for DNase, RNase, endonuclease and nickase



Nucleic Acid Purification

Essentials

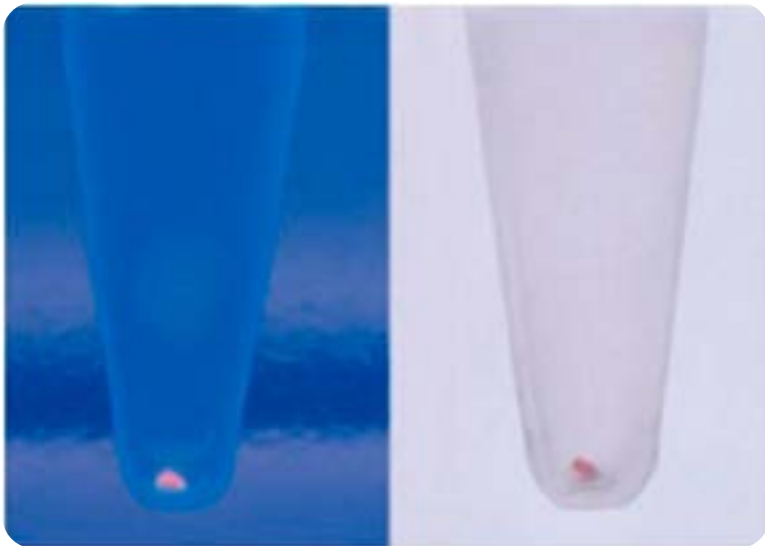
For General Molecular Needs:

Make the most of your samples: TRI Reagent® allows for isolation of DNA, RNA & protein from a single sample, allowing for more data and less effort. RNAzol® isolates small RNA.

Cat. No.	Product Name	Sample Type
T9424	TRI Reagent® solution - For processing tissues, cells cultured in monolyer or cell pellets	Tissues & Cells
93289	TRI Reagent® solution - For DNA, RNA and protein isolation	Various: cells, tissue, yeast, plant, etc.
T3809	TRI Reagent® BD solution - For processing whole blood plasma or serum	Blood, Plasma and Serum
T3934	TRI Reagent® LS solution - For processing fluid samples such as cell suspensions, CSF, and amniotic fluid	Fluid Samples
R4533	RNAzol® RT solution - For processing total and small RNA from human, animal, plant, bacterial, and viral samples	Total small RNA from various samples



Cat. No.	Product Name	Process	Key Features
70748	Pellet Paint® NF Co-Precipitant	Carrier for Nucleic Acid Precipitation	Non-fluorescent visible DNA co-precipitant
P2069	Phenol:Chloroform:Isoamyl Alcohol 25:24:1 Saturated with 10 mM Tris, pH 8.0, 1 mM EDTA	P:C:I for RNA and DNA isolations	pH 6.5-6.9 without buffer, pH 7.8-8.2 with buffer
P3803	Phenol:Chloroform:Isoamyl Alcohol 25:24:1, Saturated with 10 mM Tris, pH 8.0, 1 mM EDTA		pH 6.5-6.9
C0549	Chloroform:Isoamyl alcohol 24:1	Chloroform:Isoamyl Alcohol for DNA isolations and more	0.6-1.0% ethanol as stabilizer
P4557	Phenol solution	Phenol solutions for DNA extractions, plasmid isolations, RNA preps and more	pH 7.7-8.1 equilibrated
P4682	Phenol solution		pH 4.1-4.5 equilibrated



Pellet Paint® NF Co-Precipitant non-fluorescent visible DNA co-precipitant for automated sequencing applications





Essentials

Sustainable Solutions

Gold-Standard Kits

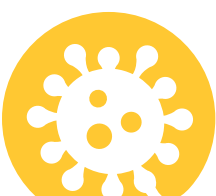
Gel Electrophoresis
Essentials

Nucleic Acid Purification

Sustainable Solutions

GenElute™-E Single Spin Isolation Kits Selection Guide

Reduce hands-on time from 1 hour or more, to just 3 minutes. GenElute™-E single spin purification kits offer up to a 55% reduction in plastic waste for greener purifications.

Viral RNA/DNA		Blood		Tissue	Cells	Plant	Clean Up		
									
EC810/EC848/EC896**		EC100/EC196*	EC200	EC300/EC396*	EC400	EC500/EC596*	EC600	EC700	EC800
Nasopharyngeal swabs in transport media		Blood	Blood high yield	Tissue	Cell Culture	Plant	DNA	DNA with organic solvents	RNA

Safer use*



No hazardous liquid waste by eliminating bind and wash steps containing ethanol and chaotropic salts.

Sustainable packaging



Box and insert with sustainable forestry certification and more than 70% of recycled content. Starch-based, compostable bags for kit components.

Better usability



Simplified workflow with fewer steps.

Waste prevention



55% reduction of the consumption of plastic consumables (tubes, pipet tips).



Comparison of waste generation of traditional silica-based kits (top) and GenElute™-E kits (bottom).

#Viral RNA/DNA kit has some chaotropic salts

*High-throughput options available for increased efficiencies.





Essentials

Sustainable Solutions

Gold-Standard Kits

Gel Electrophoresis
Essentials

Nucleic Acid Purification

Gold-Standard Kits

GenElute™ Kits, Spectrum™ Kits, and Montage® Kits: Classic Solutions

Plasmid



DNA



RNA



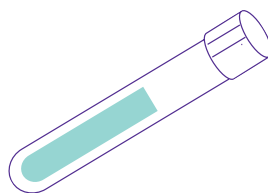
Clean-up



Mini



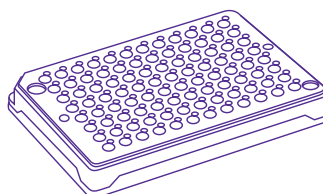
Midi



Maxi



Plate



Nucleic Acid Purification

Gold-Standard Kits

GenElute™ Kits and Montage® Kits: Classic Solutions

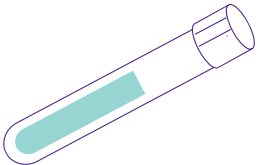
Plasmid



Mini



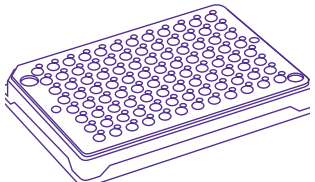
Midi



Maxi



Plate



Plasmid Prep Scale	Product Name	Cat. No.	Key Features
Mini	GenElute™ Plasmid Miniprep Kit	PLN70/PLN350	70 or 350 purification kits available Yield: up to 15 µg
	GenElute™ HP Plasmid Miniprep Kit	NA0150/NA0160	Ultra-fast processing 70 or 350 purification kits available Yield: up to 25 µg
	Montage® Plasmid Miniprep96 kit	LSKP096	96 well plate format Plasmids & BAC isolation
	GenElute™ HP 96-Well Plasmid Miniprep Kit	NA9604	4 96-well purifications Yield: up to 10 µg
Midi	GenElute™ Plasmid Midiprep Kit	PLD35	35 purifications 20-40 mL prep Yield: up to 300 µg

Plasmid Prep Scale	Product Name	Cat. No.	Key Features
Maxi	GenElute™ Plasmid Maxiprep Kit	PLX15	15 purifications 25-200 mL prep Yield: up to 1.2 mg
	GenElute™ HP Plasmid Maxiprep Kit	NA0300/NA0310	10 or 25 purification kits available Rapid lysate clearing step 150 mL prep Yield: up to 1.2 mg
	GenElute™ Endotoxin-free Plasmid Maxiprep Kit	PLEX15	15 purifications 5-40 mL prep Yield: up to 250 µg with endotoxin ≤0.1EU/µg
	GenElute™ HP Endotoxin-Free Plasmid Maxiprep Kit	NA0400/NA0410	10 or 25 purification kits available 150 mL prep Yield: up to 1.2 mg with endotoxin ≤0.1EU/µg
	GenElute™ HP Endotoxin-Free Plasmid Megaprep Kit	NA0600	5 purifications 600 mL-1.2 L prep Yield: up to 15 mg with endotoxin ≤0.1EU/µg
Mega			
Giga	GenElute™ HP Select Plasmid Gigaprep Kit	NA0800	5 purifications 200 mL-1 L prep Yield: up to 5 mg with endotoxin ≤0.1EU/µg



Nucleic Acid Purification

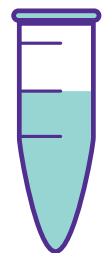
Gold-Standard Kits

GenElute™ Kits: Classic DNA Solutions

Genomic DNA



Mini



Sample Type	Product Name	Cat. No.	Key Features
Mammalian: cells, tissues, blood	GenElute™ Mammalian Genomic DNA Miniprep Kits	G1N70/G1N350	70 or 350 preparation kits available Yield: up to 25 µg (from 2 x 10 ⁶ cultured cells; 30 µg from 25 mg of tissue)
Blood	GenElute™ Blood Genomic DNA Kit	NA02010/NA2020	70 or 350 preparation kits available Yield: up to 10 µg from 200 µL
Bacterial Genomic	GenElute™ Bacterial Genomic DNA Kits	NA2110/NA2120	70 or 350 preparation kits available Yield: up to 20 µg from 1.5 mL of culture
Plant	GenElute™ Plant Genomic DNA Miniprep Kit	G2N70/G2N350	70 or 350 preparation kits available Yield: up to 20 µg from 100 mg plant tissue



Nucleic Acid Purification

Gold-Standard Kits

GenElute™ Kits and Spectrum™ Kits: Classic RNA Solutions

RNA



Sample Type	Product Name	Cat. No.	Key Features
Mammalian	GenElute™ Mammalian Total RNA Miniprep Kit	RTN70/RTN350	70 or 350 preparation kits available Isolate from as few as 100 cells up to 10 ⁷ or 40 mg tissue Yield: up to 150 µg
	GenElute™ 96 Well Total RNA Purification Kit	RTN9604	4 96-well purifications Yield: up to 100 µg (dependent on sample type)
Viral: Saliva, viral transport media, cell suspension, cell culture media.	GenElute™ Viral RNA Miniprep Kit	RNV100	70 or 350 preparation kits available For Viral RNA purification
Plants	Spectrum™ Plant Total RNA Kit	STRN50/STRN250	50 or 250 preparation kits available Yield: up to 60 µg from 100 mg of tissue 30 minute or less prep Works with difficult plant tissues

Mini

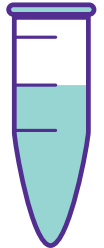
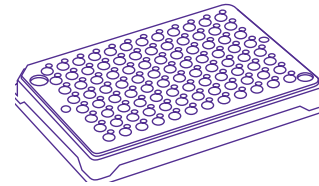


Plate formats





Nucleic Acid Purification

Gold-Standard Kits

GenElute™ Kits and Montage® Kits: Classic Clean-Up Solutions

Clean-Up



Mini

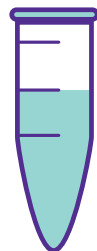
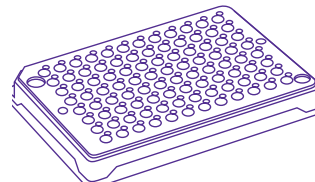


Plate formats



Sample Type	Product Name	Cat. No.	Key Features
PCR Clean-Up	GenElute™ PCR Clean-Up Kit	NA1020	70 preparations
		LSKMPCR	Yield: Purifies up to 100 µL or 10 µg of PCR amplified DNA
		MSNU030	Recovers up to 95% of PCR products between 100 bp and 10 kb
	GenElute™ 96 Well PCR Clean-Up Kit	PCR9604	4 96-well purifications Recovers 75-90% of of PCR products between 100 bp and 10 kb
Gel Extraction	GenElute™ Gel Extraction Kit	NA1111	70 preparations Yield: Binds up or 10 µg of DNA Recovers up to 80% of DNA in gel slices up to 3.5g
	Montage® Gel Extraction Kit	LSKGEL050	50 preparations Recovers up to 75% Unique gel nebulizer extracts DNA
Sequencing	Montage® SEQ96 Sequencing Reaction Cleanup Kit	LSKS096	1, 4 and 24 preparation plate kits available

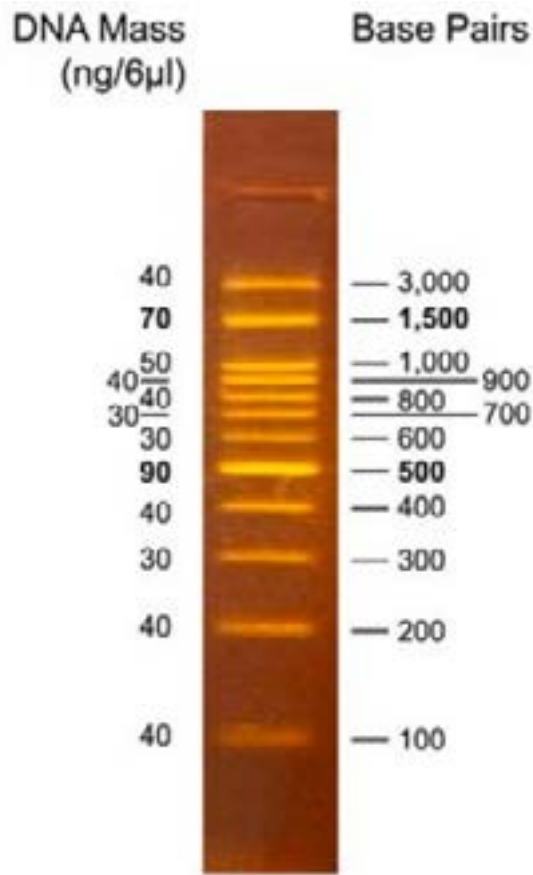


Nucleic Acid Purification

Gel Electrophoresis Essentials

Solutions To Save Time For Quick Results

Electrophoresis Need	Product Name	Cat. No.	Key Features
Safe Gel Stains	GelRed® Nucleic Acid Stain 3X Water	SCT121	Sensitive, stable, and environmentally friendly
	GelRed® Nucleic Acid Stain 10000X DMSO	SCT122	Sensitive, stable, and environmentally friendly
	GelRed® Nucleic Acid Stain 10000X Water	SCT123	Sensitive, stable, and environmentally friendly
	GelGreen® Nucleic Acid Stain 10000X DMSO	SCT124	Sensitive, stable, and environmentally friendly
	GelGreen® Nucleic Acid Stain 10000X Water	SCT125	Sensitive, stable, and environmentally friendly
Ready-to-Use DNA Ladders	DirectLoad™ Plus 100bp High DNA Ladder	DPLUS100H	12 fragments From 3000bp to 100bp Reference bands at 500bp and 1500bp
	DirectLoad™ Plus 100bp High DNA Ladder with fluorescent DNA stains	DPLUS100HS	12 fragments From 3000bp to 100bp Reference bands at 500bp and 1500bp
	DirectLoad™ Plus 100bp DNA Ladder	DPLUS100	11 fragments From 1500bp to 100bp Reference bands at 500bp and 1500bp
	DirectLoad™ Plus 1kb DNA Ladder	DPLUS1K	12 fragments From 10,000bp to 100bp Reference bands at 1000bp and 3000bp
	DirectLoad™ Plus 1kb DNA Ladder with fluorescent DNA stains	DPLUS1KS	12 fragments From 10,000bp to 100bp Reference bands at 1000bp and 3000bp



1.5 % TBE agarose gel
DPLUS100HS DirectLoad™ Plus 100bp High DNA Ladder with fluorescent DNA stains.

Explore our gel reagents and casting systems here 





Essentials

Sustainable Solutions

Gold-Standard Kits

Gel Electrophoresis
Essentials

Gel Electrophoresis Essentials

DirectLoad™ Electrophoresis Systems: CAST LOAD RUN

Gel Systems – what’s included

Loading Guides

Adhesive stickers can be attached to the tank for increased visibility

Gel Tray

Different sizes available:
Mini: 7x7 or 7x10 cm
Midi: 15x7, 15x10 or 15x15 cm

Easy-Click Lid

Single orientation assembly
Auto-disconnects power supply upon removal



Gel Tank

Color-coded for single orientation assembly
Mini and Midi sized tank options

Gel Combs

Height adjustable; invert to use as loading guide.

Gel Tray Dams

Leak-proof design

Gel electrophoresis is used for separating molecules, such as protein, DNA, and RNA, by their size. Enhance your nucleic acid gel electrophoresis workflow with our DirectLoad™ Mini and Midi Horizontal Electrophoresis Systems.

Buffers, ladders, loading dyes, and stains complement a compellingly economical solution for agarose gel electrophoresis. Featuring unprecedented sample throughput and experimental versatility, explore the full list of offerings within the DirectLoad™ lineup of products and optimize your nucleic acid research.

Millipore®

Preparation, Separation,
Filtration & Monitoring Products



- Essentials
- Sustainable Solutions
- Gold-Standard Kits
- Gel Electrophoresis Essentials

Gel Electrophoresis Essentials

DirectLoad™ Electrophoresis Systems

Gel Electrophoresis: Modular Electrophoresis Systems and components

DirectLoad™ Mini Horizontal Electrophoresis Systems DMINI			DirectLoad™ Midi Horizontal Electrophoresis Systems DMIDI		
Product Description		Replacement Cat. No.		Replacement Cat. No.	
Tank (with wired electrodes)		DMS7-TANK		DMS15-TANK	
Lid		DMS7-LID		DMS15-LID	
Trays		7x7 cm: DMS7-TR7 7x10 cm: DMS7-TR10		15x7 cm: DMS15-TR7 15x10 cm: DMS15-TR10 15x15 cm: DMS15-TR15	

DirectLoad™ Mini Horizontal Electrophoresis Systems DMINI			DirectLoad™ Midi Horizontal Electrophoresis Systems DMIDI		
Product Description		Replacement Cat. No.		Replacement Cat. No.	
Gel Tray Dams		DMS7-DAMS		DMS15-DAMS	
Combs		Multiple Sizes available at SigmaAldrich.com			
Loading Guides (stickers)		DMS7-LG		DMS15-LG	
Electrophoresis cables (same for both)		DMS-CABLES		DMS-CABLES	



Cloning & Expression

Nucleic Acid Purification



PCR & NGS

CRISPR/Genome Engineering

PCR & NGS

PCR
Essentials

RT-PCR
Essentials

NGS
Essentials

Isothermal
Amplification
Essentials





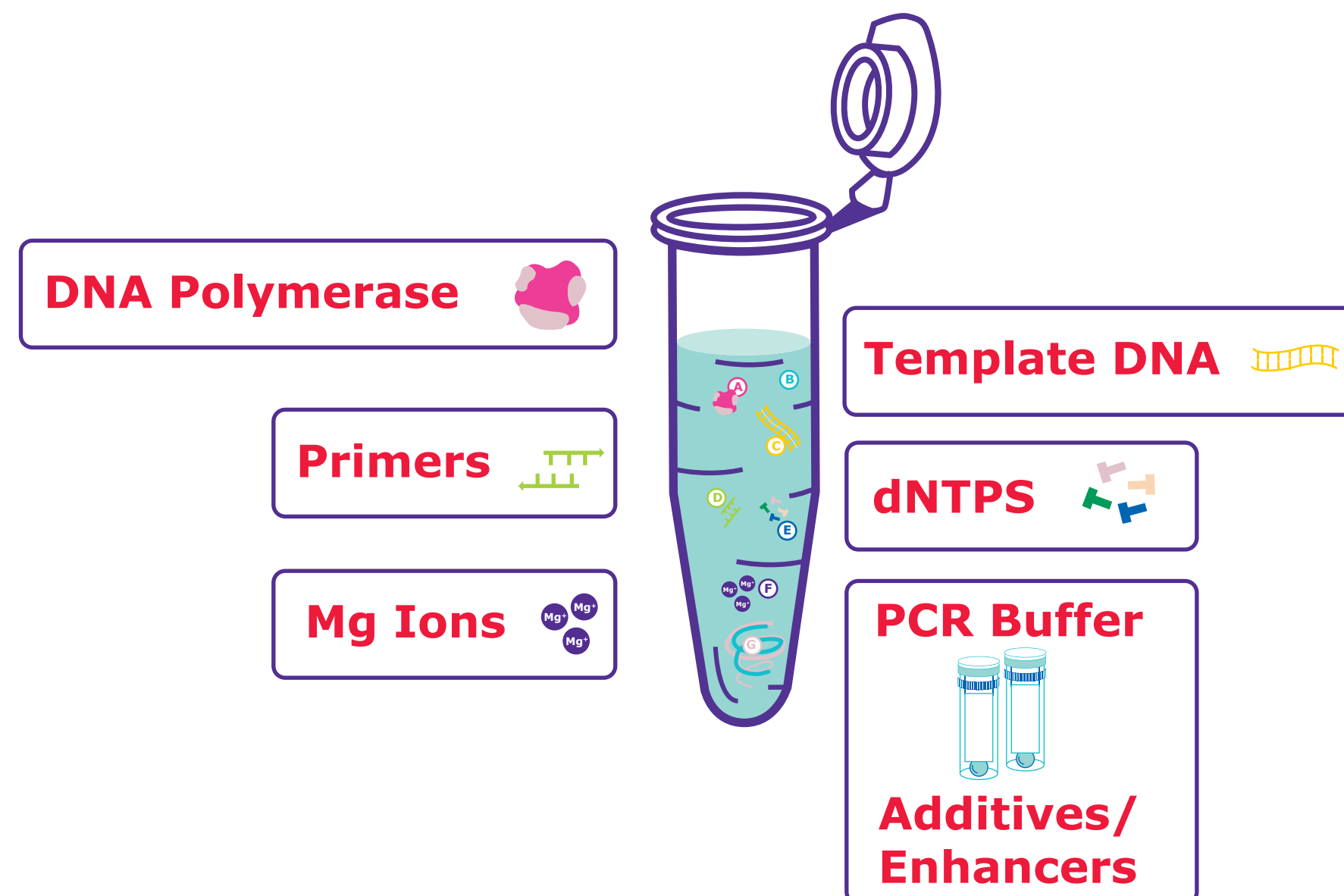
PCR & NGS

PCR Essentials

Nucleic Acid Amplification

PCR consists of repeated cycles of denaturation, annealing, and extension where target sequences are amplified exponentially. A typical PCR reaction mix includes components such as the template, the forward and reverse primers, the polymerase enzyme with a preferred reaction buffer, dNTPs, and optional additives to help boost your PCR. It is important to note that all of these components and the cycle conditions can determine the success of a PCR. Explore our comprehensive PCR essentials and select the right components while designing your assay to achieve optimum results. Click on each element to learn more.

PCR Ecosystem



PCR & NGS

PCR Essentials

Our broad PCR portfolio offers a variety of application options.

Type of PCR	Customer Need	Application
 Standard	Standard	Simple detection (Yes/No)
 Hot Start	Hot Start	Room temp set-up without non-specific amplification
 High Fidelity	High Fidelity	Target DNA must be accurate after amplification
 GC-rich	GC Rich	Amplify targets with high GC content
 Long-range	Long PCR	Synthesize long fragments >20kb
 Multiplex	Multiplex PCR	Amplify multiple targets at one go
 Direct	Direct PCR	Sample-to-answer without purification

Based on the type of application, we offer a broad portfolio of PCR products to meet various research needs. For example, standard PCR, or end-point PCR, is used for simple detection to get a Yes or No answer and is widely used for applications such as gene cloning. Hot start PCR, wherein the Taq DNA polymerase is inactive at room temperature, allows room temperature reaction setup and prevents non-specific amplification. High-fidelity PCR is useful when accuracy is paramount, especially in applications such as NGS. Similarly, we have variations of the DNA polymerase or the buffer formulation to address the need for long PCR where templates greater than >20kb are amplified. Additionally, we offer reagents to enable multiplex PCR, where multiple targets can be amplified simultaneously to save time and resources. Our direct PCR products also address the need for crude sample analysis, where the DNA/RNA is extracted is ready to be amplified directly without any purification step.



PCR & NGS

PCR Essentials

Selector guide based on the type of PCR



Simple end-point detection (Yes/No)

	Cat. No.	Easy MgCl ₂ Optimization	Direct Load	Mastermix	Fidelity compared to Std Taq	Amplicon Size*	Includes separate dNTP mix
Taq DNA Polymerase	D1806				1×	0.1 to >3 (5)	
Taq DNA Polymerase without MgCl ₂	D4545	✓			1×	0.1 to >3 (5)	
REDTaq® DNA Polymerase	D4309		✓		1×	0.1 to >3 (5)	
REDTaq® DNA Polymerase SuperPak™ Reagent	D6063		✓		1×	0.1 to >3 (5)	✓
ReadyMix™ Taq PCR Reaction Mix	P4600			✓	1×	0.1 to >3 (5)	
REDTaq® ReadyMix™ PCR Reaction Mix with MgCl ₂	R2523		✓	✓	1×	0.1 to >3 (5)	

*Two values are provided for the indicated amplification length. The range provided refers to the average length achieved from complex genomic targets, while the number in parentheses refers to lengths routinely achieved with less complicated targets such as plasmid or lambda phage DNA.



PCR & NGS

PCR Essentials

Selector guide based on the type of PCR



Room temp set-up without non-specific amplification

	Cat. No.	Easy MgCl ₂ Optimization	Direct Load	Mastermix	Fidelity compared to Std Taq	Amplicon Size*	3'→5' Exonuclease Activity	Lyo-Ready
JumpStart™ Taq DNA Polymerase	D9307				1×	0.1 to >3 (10)		
JumpStart™ Taq DNA Polymerase without MgCl ₂	D4184	✓			1×	0.1 to >3 (10)		
JumpStart™ REDTaq® DNA Polymerase	D8187		✓		1×	0.1 to >3 (10)		
JumpStart™ Taq ReadyMix™	P2893			✓	1×	0.1 to >3 (10)		
JumpStart™ REDTaq® ReadyMix PCR Reaction Mix	P0982		✓	✓	1×	0.1 to >3 (10)		
JumpStart™ REDTaq® ReadyMix For High Throughput PCR	P1107		✓	✓	1×	0.1 to >3 (10)		
JumpStart™ AccuTaq™ LA DNA Polymerase	D5809				up to 6.5×	0.1 to >20 (40)	✓	
JumpStart™ REDAccuTaq™ LA DNA Polymerase	D1313		✓		up to 6.5×	0.1 to >20 (40)	✓	
Glycerol-free JumpStart™ Taq DNA Polymerase	D9310				1×	0.1 to >3 (10)		✓

*Two values are provided for the indicated amplification length. The range provided refers to the average length achieved from complex genomic targets, while the number in parentheses refers to lengths routinely achieved with less complicated targets such as plasmid or lambda phage DNA.



PCR & NGS

PCR Essentials

Selector guide based on the type of PCR



Highly accurate amplification

	Cat. No.	Direct Load	Mastermix	Fidelity compared to Std Taq	Amplicon Size (kb)*	3'→5' Exonuclease Activity	Includes dNTPs	Ultra-fast
AccuTaq™ LA DNA Polymerase	D8045			up to 6.5×	0.1 to >20 (40)	✓		
REDAccuTaq® LA DNA Polymerase	D4812	✓		up to 6.5×	0.1 to >20 (40)	✓		
JumpStart™ AccuTaq™ LA DNA Polymerase	D5809			up to 6.5×	0.1 to >20 (40)	✓		
JumpStart™ REDAccuTaq™ LA DNA Polymerase	D1313	✓		up to 6.5×	0.1 to >20 (40)	✓		
KOD Xtreme™ Hot Start DNA Polymerase	71975-M			10×	0.1 to >24 (40)	✓	✓	
KOD Hot Start DNA Polymerase	71086			80×	0.1 to >12 (21)	✓	✓	
KOD Hot Start Master Mix	71842		✓	80×	0.1 to >12 (21)	✓	✓	
KOD One™ PCR Master Mix	KMM-101NV		✓	80×	0.1 to 40	✓	✓	✓
KOD One™ PCR Master Mix -BLUE	KMM-201NV	✓	✓	80×	0.1 to 40	✓	✓	✓

*Two values are provided for the indicated amplification length. The range provided refers to the average length achieved from complex genomic targets, while the number in parentheses refers to lengths routinely achieved with less complicated targets such as plasmid or lambda phage DNA.



PCR & NGS

PCR Essentials

Selector guide based on the type of PCR



Amplify targets with high GC content

	Cat. No.	Direct Load	Mastermix	Fidelity compared to Std Taq	Amplicon Size (kb)*	3'→5' Exonuclease Activity	Includes dNTPs	GC content
KOD Xtreme™ Hot Start DNA Polymerase	71975-M			10x	0.1 to >24 (40)	✓	✓	Up to 90%
KOD One™ PCR Master Mix	KMM-101NV		✓	80x	0.1 to 40	✓	✓	Up to 70%
KOD One™ PCR Master Mix -BLUE	KMM-201NV	✓	✓	80x	0.1 to 40	✓	✓	Up to 70%

*Two values are provided for the indicated amplification length. The range provided refers to the average length achieved from complex genomic targets, while the number in parentheses refers to lengths routinely achieved with less complicated targets such as plasmid or lambda phage DNA.



PCR & NGS

PCR Essentials

Selector guide based on the type of PCR



Synthesize long fragments (> 20kb)

	Cat. No.	Direct Load	Mastermix	Fidelity compared to Std Taq	Amplicon Size (kb)*	3'→5' Exonuclease Activity	Includes dNTPs	Ultra-fast
AccuTaq™ LA DNA Polymerase	D8045			up to 6.5×	0.1 to >20 (40)	✓		
REDAccuTaq® LA DNA Polymerase	D4812	✓		up to 6.5×	0.1 to >20 (40)	✓		
JumpStart™ AccuTaq™ LA DNA Polymerase	D5809			up to 6.5×	0.1 to >20 (40)	✓		
JumpStart™ REDAccuTaq™ LA DNA Polymerase	D1313	✓		up to 6.5×	0.1 to >20 (40)	✓		
KOD Xtreme™ Hot Start DNA Polymerase	71975-M			10x	0.1 to >24 (40)	✓	✓	
KOD XL DNA Polymerase	71087			3x	0.1 to 30		✓	
KOD One™ PCR Master Mix	KMM-101NV		✓	80x	0.1 to 40	✓	✓	✓
KOD One™ PCR Master Mix -BLUE	KMM-201NV	✓	✓	80x	0.1 to 40	✓	✓	✓

*Two values are provided for the indicated amplification length. The range provided refers to the average length achieved from complex genomic targets, while the number in parentheses refers to lengths routinely achieved with less complicated targets such as plasmid or lambda phage DNA.



PCR & NGS

PCR Essentials

Selector guide based on the type of PCR



Amplify multiple targets at one go

	Cat. No.	Direct Load	Mastermix	Fidelity compared to Std Taq	Amplicon Size (kb)*	Multiplexing	Includes dNTPs
JumpStart™ Taq ReadyMix™	P2893		✓	1x	0.1 to >3 (10)	✓	✓
JumpStart™ Taq DNA Polymerase	D9307			1x	0.1 to >3 (10)	✓	
SYBR® Green JumpStart™ Taq ReadyMix™	S4438		✓	1x	0.1 to >3 (10)	✓	✓

*Two values are provided for the indicated amplification length. The range provided refers to the average length achieved from complex genomic targets, while the number in parentheses refers to lengths routinely achieved with less complicated targets such as plasmid or lambda phage DNA.



PCR & NGS

PCR Essentials

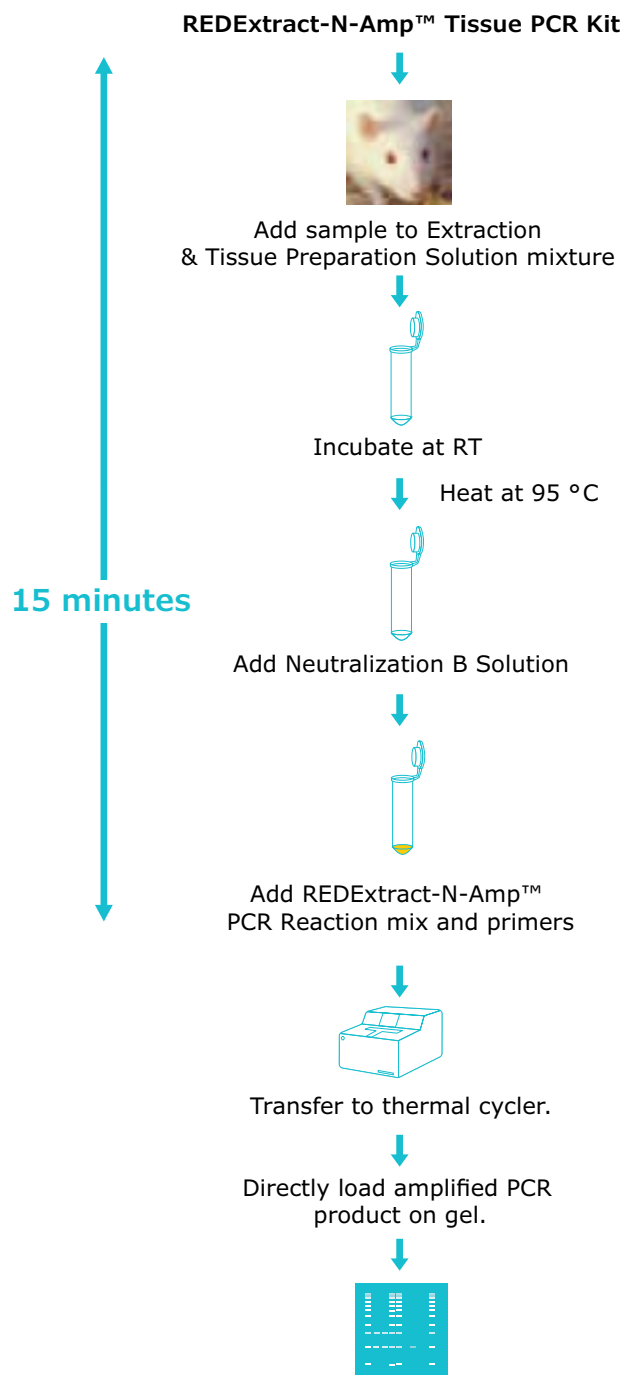
Selector guide based on the type of PCR



Sample-to-answer without purification

	Cat. No.	Sample Type	Direct Load	Mastermix	Kit	Includes dNTPs	Amplicon Size (kb)*
Direct Tissue PCR							
Extract-N-Amp™ Tissue PCR Kit	XNAT2	• Mouse-tails			✓	✓	0.1 to >3 (10)
	XNAT2R	• Hair			✓		
REExtract-N-Amp™ Tissue PCR Kit	XNAT	• Animal Tissue	✓		✓	✓	0.1 to >3 (10)
Extract-N-Amp™ PCR ReadyMix™	E3004	• Saliva		✓		✓	0.1 to >3 (10)
REExtract-N-Amp™ PCR ReadyMix™	R4775	• Buccal Swabs	✓	✓		✓	0.1 to >3 (10)

*Two values are provided for the indicated amplification length. The range provided refers to the average length achieved from complex genomic targets, while the number in parentheses refers to lengths routinely achieved with less complicated targets such as plasmid or lambda phage DNA.



PCR & NGS

PCR Essentials

Selector guide based on the type of PCR

Sample-to-answer without purification

	Cat. No.	Sample Type	Direct Load	Mastermix	Kit	Includes dNTPs	Amplicon Size (kb)*
Direct Plant PCR							
Extract-N-Amp™ Plant PCR Kit	XNAP2	Plant leaves			✓	✓	0.1 to >3 (10)
	XNAR						
	XNAP2E						
REExtract-N-Amp™ Plant PCR Kit	XNAPR						0.1 to >3 (10)
	XNAP		✓		✓	✓	
	XNAPS						
	XNAPE						
Extract-N-Amp™ PCR ReadyMix™	E3004			✓		✓	0.1 to >3 (10)
REExtract-N-Amp™ PCR ReadyMix™	R4775		✓	✓		✓	0.1 to >3 (10)

*Two values are provided for the indicated amplification length. The range provided refers to the average length achieved from complex genomic targets, while the number in parentheses refers to lengths routinely achieved with less complicated targets such as plasmid or lambda phage DNA.

S

Standard

HS

Hot Start

HF

High Fidelity

GC

GC-rich

L

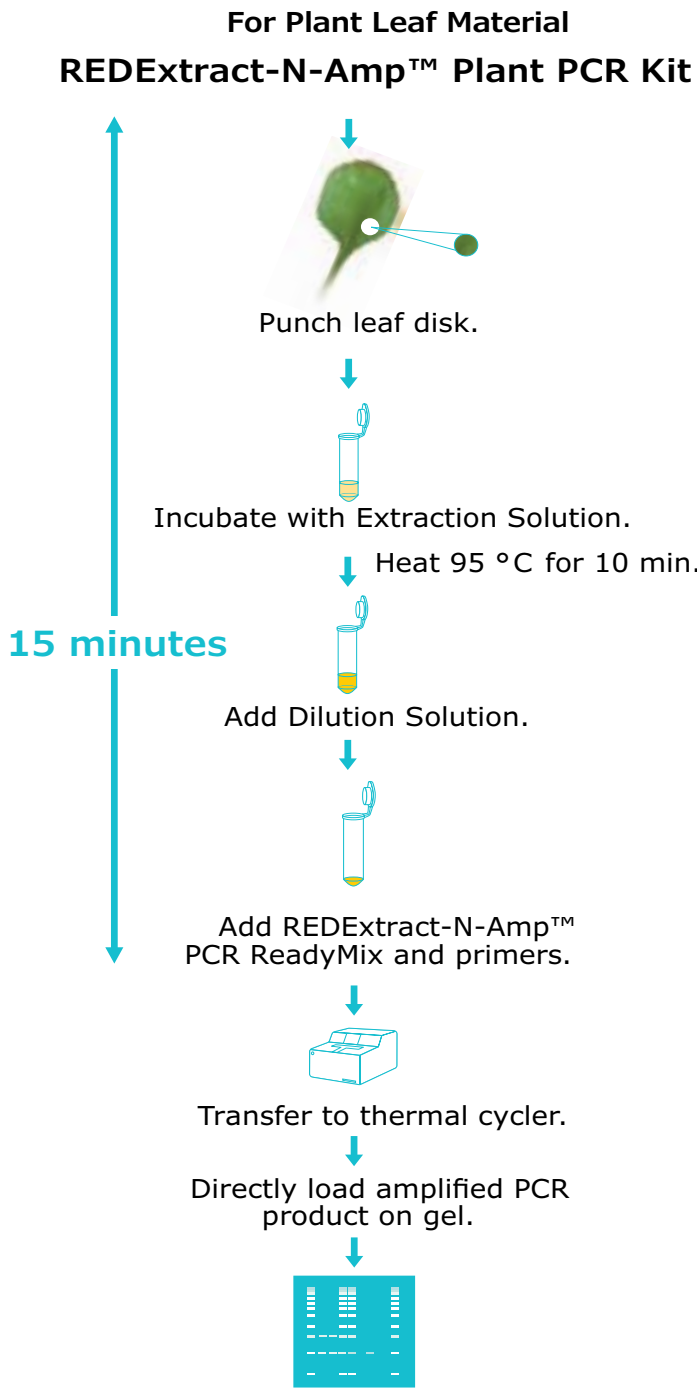
Long-range

M

Multiplex

D

Direct



PCR & NGS

PCR Essentials

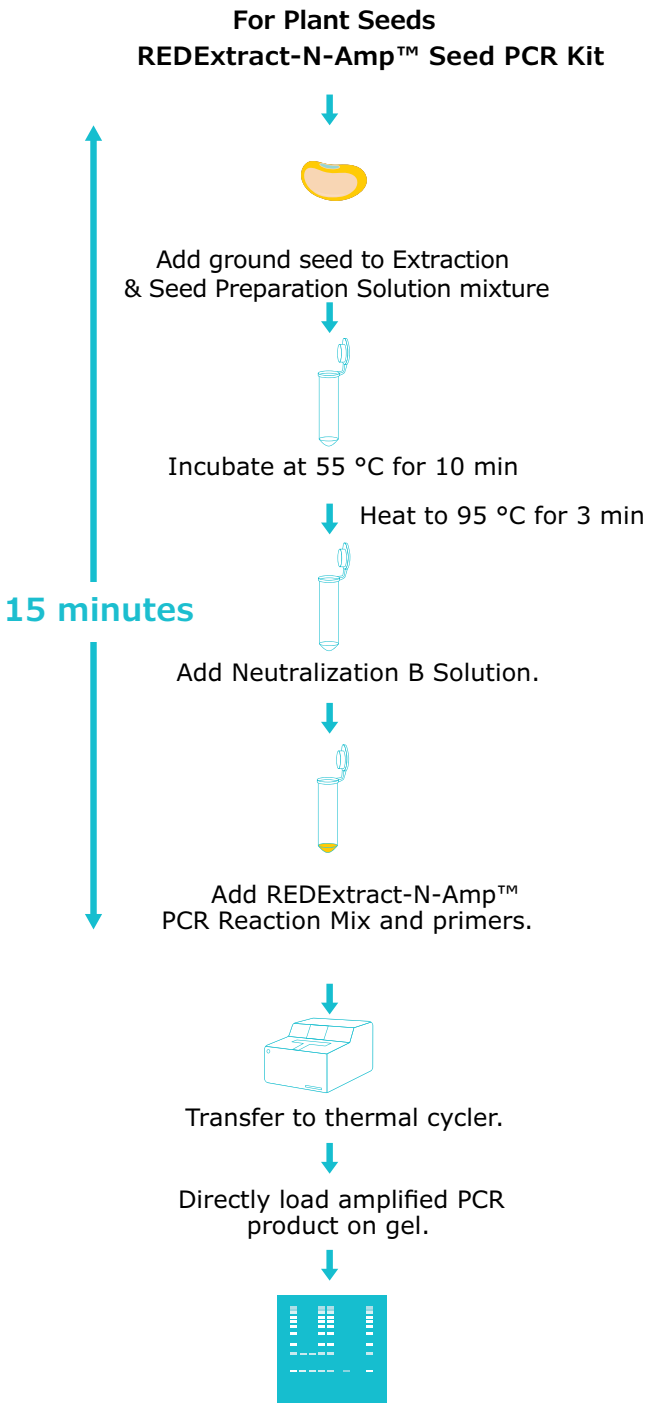
Selector guide based on the type of PCR



Sample-to-answer without purification

	Cat. No.	Sample Type	Direct Load	Mastermix	Kit	Includes dNTPs	Amplicon Size (kb)*
Direct Seed PCR							
Extract-N-Amp™ Seed PCR Kit	XNAS2	Plant seeds			✓	✓	0.1 to >3 (10)
REExtract-N-Amp™ Seed PCR Kit	XNASS		✓		✓	✓	0.1 to >3 (10)
	XNAS						
Extract-N-Amp™ PCR ReadyMix™	E3004			✓		✓	0.1 to >3 (10)
REExtract-N-Amp™ PCR ReadyMix™	R4775		✓	✓		✓	0.1 to >3 (10)

*Two values are provided for the indicated amplification length. The range provided refers to the average length achieved from complex genomic targets, while the number in parentheses refers to lengths routinely achieved with less complicated targets such as plasmid or lambda phage DNA.



PCR & NGS

PCR Essentials

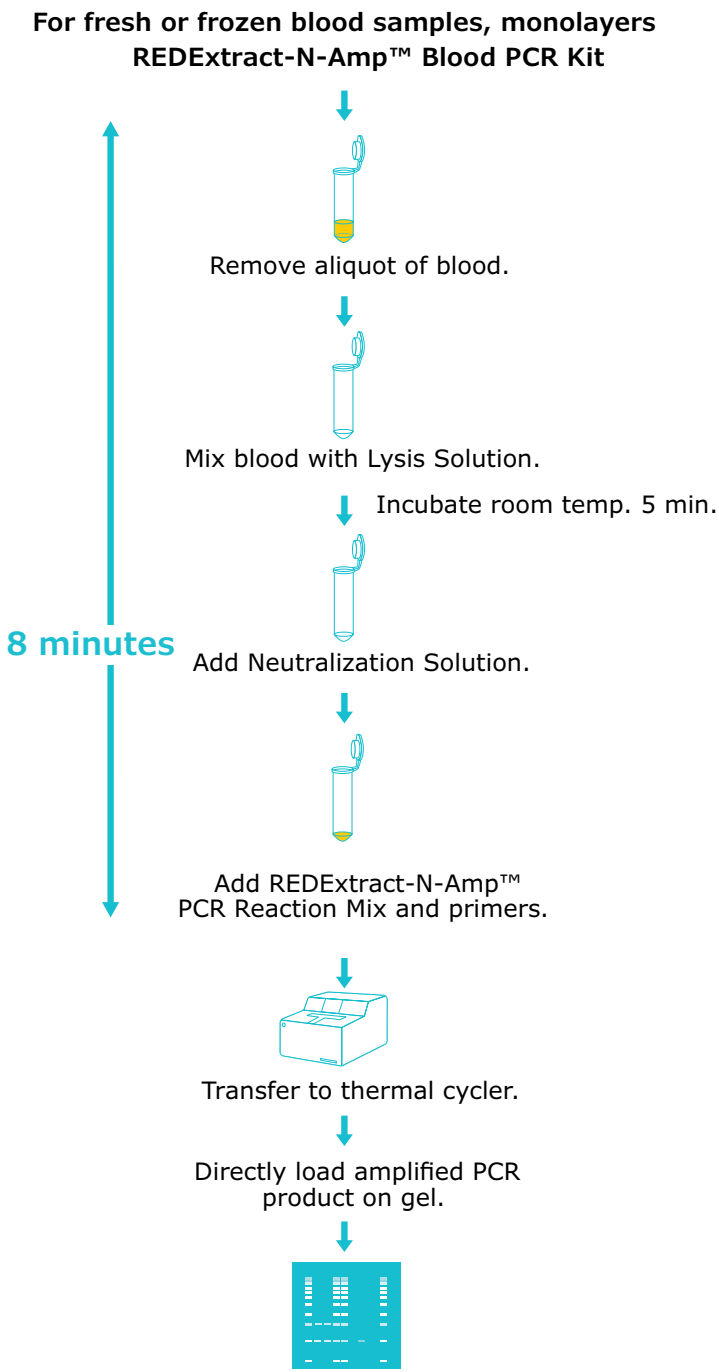
Selector guide based on the type of PCR



Sample-to-answer without purification

	Cat. No.	Sample Type	Direct Load	Mastermix	Kit	Includes dNTPs	Amplicon Size (kb)*
Direct Blood PCR							
Extract-N-Amp™ Blood PCR Kit	XNAB2	- Whole blood - Whole blood dried on a blood card - Cultured mammalian cells	✓		✓	✓	0.1 to >3 (10)
	XNAB2R						
REExtract-N-Amp™ Blood PCR Kit	XNABE				✓	✓	0.1 to >3 (10)
	XNAB						
	XNABS						
	XNABR						
Extract-N-Amp™ PCR ReadyMix™ for Blood	P8115			✓		✓	0.1 to >3 (10)
REExtract-N-Amp™ PCR ReadyMix™ for Blood	P8240		✓	✓		✓	0.1 to >3 (10)

*Two values are provided for the indicated amplification length. The range provided refers to the average length achieved from complex genomic targets, while the number in parentheses refers to lengths routinely achieved with less complicated targets such as plasmid or lambda phage DNA.



PCR & NGS

PCR Essentials

Selector guide based on the type of PCR

 Standard

 Hot Start

 High Fidelity

 GC-rich

 Long-range

 Multiplex

 Direct

Sample-to-answer without purification

Cat. No.	Sample Type	Stand-alone Reagent	Compatibility	Sensitivity Range
Direct RNA Extraction & Stabilization				
Extract-N-Amp™ Cellular RNA Lysis Buffer XNACRL	Adherent and non-adherent mammalian cell lines	✓	qRT-PCR, RT-LAMP, and NGS Library Prep	10-100k cells
Viral RNA Extraction Buffer VRE100	Enveloped viral particles in saliva, saline, Amies medium, and viral transport medium	✓	qRT-PCR and RT-LAMP	1.5x10 ³ in saline to 5x10 ⁴ in saliva (particles per mL)



PCR & NGS

PCR Essentials

Depending on your assay conditions, choose the right kind of PCR additive to boost your PCR results.

Essential components for a successful PCR

	Cat. No.	Key Features
10 mM Deoxynucleotide Mix	D7295	Building block
25 mM Deoxynucleotide Mix	D7297	Building block
100 mM Deoxynucleotide Set (0.25 mL each)	DNTP100	Building block
100 mM Deoxynucleotide Set (1 mL each)	DNTP100A	Building block
Betaine solution (5 M)	B0300	Reduces duplex stability and facilitates the GC-rich amplification
Magnesium chloride solution (25 mM)	M8787	Enhances PCR specificity and yield
Magnesium chloride solution (1 M)	M1028	Enhances PCR specificity and yield
Amplification Grade DNase 1	AMPD1	Digestion of DNA during isolation and purification of RNA
JumpStart™ Taq Antibody	A7721	Adds hot-start capabilities to any Taq DNA Polymerase
Dimethyl sulfoxide	D8418	Reduces secondary structures in GC-rich templates
Mineral oil	M8662	Prevents evaporation of reaction mix
Single-strand Binding Protein	S3917	Enhances PCR specificity
Heat-labile Cod Uracil-DNA Glycosylase	SRE0111	Prevents false-positives by eliminating carry-over contamination
Heat-labile Cod Uracil-DNA Glycosylase (Glycerol-free)	SRE0112	Prevents false-positives by eliminating carry-over contamination
Water	W4502	Nuclease-free water for dilution
10X PCR Buffer	P2192	Optimized for routine PCR with MgCl ₂ included
10X PCR Buffer without MgCl ₂	P2317	Optimized for routine PCR





PCR & NGS

PCR Essentials

PCR Master Mix Calculator

Performing calculations for large scale PCR reactions can be cumbersome and tedious. Ensure your success of scaled up reactions by using the PCR Master Mix Calculator. This online tool will calculate the amounts of components needed to create your PCR master mix.

PCR Master Mix Calculator

PCR Master Mix Calculator

Composition of PCR reaction		PCR MasterMix Formulation for PCR reactions	
Template DNA	µl	Template DNA	µl
PCR Buffer	µl	PCR Buffer	µl
Forward Primer	µl	Forward Primer	µl
Reverse Primer	µl	Reverse Primer	µl
dNTP mix	µl	dNTP mix	µl
DNA Polymerase	µl	DNA Polymerase	µl
PCR grade Water	µl	PCR grade Water	µl
Total Number of Reactions		Total PCR Reaction Volume	µl
		TOTAL VOLUME	µl

The fields are not editable



PCR & NGS

PCR Essentials

Specialty Enzymes – KOD DNA Polymerase and Master Mix

Product Name	Cat. No.	Fidelity	Efficiency	Velocity (Extension time)	Target size	Crude sample	Hot-start	Key Applications	Key Feature
KOD One™ PCR Master Mix	KMM-101NV	80-fold ++++	+++	5 sec/kb ++++	~40 kb	++++	✓	- Crude samples - Long targets - Templates with high GC content	Ultra-fast; High Fidelity
KOD One™ PCR Master Mix - Blue	KMM-201NV								
KOD Hot Start Master Mix	71842	80-fold ++++	++	1 min/kb +	~12 kb	+	✓	- Cloning: Plasmid DNA up to 21 kbp - cDNA amplification including GC-rich regions	High fidelity
KOD Hot Start DNA Polymerase	71086								
KOD Xtreme™ Hot Start DNA Polymerase	71975-M	11-fold +++	+++	1 min/kb +	~24 kb	+++	✓	- Crude samples - Long targets - Difficult and GC-rich targets (up to 90% GC content)	High success-rate DNA polymerase (GC-rich and crude sample)
KOD XL DNA Polymerase	71087	3-fold +	+++	≤0.5 min/kb +++	~18 kb	++	-	Crude samples, multiplex, incorporation of derivatized dNTPs	High Speed & Efficient DNA polymerase
KOD DNA Polymerase	71085	3-fold +	++	1 min/kb +	~6 kb	-	-	- Cloning - cDNA amplification	2X higher elongation rate and 3X higher fidelity than <i>Taq</i> DNA polymerase

++++: Best, +++: Excellent or Strong, ++: Good or Moderate, +:Satisfactory, -: Not recommended, ✓: Applicable

KOD DNA Polymerase is an ultra-high-fidelity, thermostable DNA polymerase. Numerous independent studies have also verified the superior high-fidelity of KOD DNA Polymerase compared to other thermophilic polymerases. In addition to a low mutation frequency, the fast extension rate and high processivity of KOD polymerase results in higher yields of full-length product in fewer reaction cycles. Combined, these make KOD DNA polymerases the PCR enzyme of choice when speed and fidelity matter. Explore our new KOD One™ PCR Master Mix, a ready-to-use 2x PCR master mix containing a novel, genetically modified KOD DNA polymerase (UKOD), along with a new elongation accelerator, enabling fast PCR with an extension time of 5 sec/kb for template DNA <10kb.





PCR Essentials

RT-PCR Essentials

NGS Essentials

Isothermal
Amplification Essentials

PCR & NGS

RT-PCR Essentials

To amplify mRNA, use reverse transcription PCR (RT-PCR). This method involves converting RNA into complementary DNA (cDNA) by using a reverse transcriptase enzyme. Standard PCR then uses the cDNA as a template to produce double-stranded DNA (dsDNA) of the target sequence for analysis.

Category	Product	Cat. No.	Features
Stand-alone Reverse Transcriptase	M-MLV Reverse Transcriptase	M1302	Thermostable reverse transcriptase active at 37 °C Generates first strand cDNA up to 7 kb
	Enhanced Avian Reverse Transcriptase [eAMV™ RT]	A4464	Greater sensitivity for low abundance mRNA Efficient generation of full-length cDNA, up to 14.1 kb
cDNA Synthesis Kit	Enhanced Avian First Strand Synthesis Kit	STR1	Produces high quality full-length cDNA from total RNA or poly(A)+ RNA Enhanced ability to transcribe through difficult secondary structure at elevated temperatures (up to 65 °C)
	ReadyScript® cDNA Synthesis Mix	RDRT	Sensitive and easy-to-use solution for two-step RT-PCR ReadyScript™ Enzyme is an RNase H (+) modified M-MuLV RT





PCR & NGS

RT-PCR Essentials

qPCR and RT-qPCR Kits

We offer a broad array of qPCR kits for all detection chemistries, including probe-based or SYBR[®] Green-based applications, and instrument platforms.

Choose between SYBR[®] Green and probe-based detection, and select from the following formats:

- Standard qPCR – Flexibility to optimize RT and PCR reactions separately
- One-step RT-qPCR – Combine the effect of reverse transcriptase with hot-start Taq DNA Polymerase in convenient master mix formats.



PCR & NGS

RT-PCR Essentials

Product Name	Cat. No.	SYBR® Green Reagent	Probe Based	ROX™ Reagent	Instrument Compatibility
KiCqStart® SYBR® Green qPCR ReadyMix™ Reagent	KCQS00	✓			Bio-Rad, Cepheid, Eppendorf, Illumina, Corbett, and Roche systems
	KCQS01			Low ROX™ Reagent	ABI and Stratagene instruments
	KCQS02			With ROX™ Reagent	ABI instruments
	KCQS03				iQ™ technology, with fluorescein for Bio-Rad systems
KiCqStart® Probe qPCR ReadyMix™ Reagent	KCQS04		✓		For Bio-Rad, Cepheid, Eppendorf, Illumina, Corbett, and Roche systems
	KCQS05			Low ROX™ Reagent	with Low ROX for ABI and Stratagene instruments
	KCQS06			With ROX™ Reagent	with ROX for ABI instruments
KiCqStart® One-Step Probe RT-qPCR ReadyMix™ Reagent	KCQS07		✓		for Bio-Rad, Cepheid, Eppendorf, Illumina, Corbett, and Roche systems
	KCQS08			Low ROX™ Reagent	ABI and Stratagene instruments
	KCQS09			With ROX™ Reagent	ABI instruments
LuminoCt® qPCR ReadyMix™ Reagent	L6544	✓	✓	Separate reference dye	Compatible with any qPCR instrument. Select the proper final ROX concentration based on your instrument.
	L6669				
SYBR® Green JumpStart™ Taq ReadyMix™ Reagent	S5193 S4438	✓		Separate reference dye	Compatible with any qPCR instrument. Select the proper final ROX concentration based on your instrument.
JumpStart™ Taq ReadyMix™ for Quantitative PCR	D7440		✓	Separate reference dye	Compatible with any qPCR instrument. Select the proper final ROX concentration based on your instrument.
SYBR® Green Quantitative RT-qPCR Kit	QR0100	✓		Separate reference dye	Compatible with any qPCR instrument. Select the proper final ROX concentration based on your instrument.
Quantitative RT-PCR ReadyMix™	QR0200		✓	Separate reference dye	Compatible with any qPCR instrument. Select the proper final ROX concentration based on your instrument.





PCR & NGS

Next-Generation Sequencing Essentials

Whole Genome Amplification

Genomic testing and characterization have become an important tool for understanding biological systems. Often, such analysis is hampered by the number of samples examined and the availability of sufficient quantities of genomic DNA. This challenge is particularly challenging for rare and archived sources of DNA. The GenomePlex® Whole Genome Amplification (WGA) kits are a high-throughput system for the rapid and highly representative amplification of genomic DNA from trace amounts of starting material. These kits are suitable for microarray, qPCR and cloning.

The GenomePlex® Single Cell Whole Genome Amplification Kit (**WGA4**) amplifies the genome of a single cell, resulting in a million-fold amplification yielding microgram quantities of genomic DNA.

The SeqPlex™-I DNA Amplification Kit for whole genome amplification (WGA) facilitates Illumina® next-generation sequencing (NGS) from minuscule quantities or degraded/highly fragmented DNA.

Choosing a Whole Genome Amplification Kit

Starting material	Suitable for microarray, qPCR and cloning	Compatible with any sequencing platform	Compatible with Illumina® sequencers
Fragmented DNA		SeqPlex™ Reagent (SEQXE)	SeqPlex™-I Reagent (SEQXI)
Intact genomic DNA	GenomePlex® Reagent (WGA2)	SeqPlex™ Reagent (SEQXE)	SeqPlex™-I Reagent (SEQXI)
Single cell; low concentration template	GenomePlex® Reagent for Single Cells (WGA4)	SeqPlex™ Reagent (SEQXE)	SeqPlex™-I Reagent (SEQXI)





PCR & NGS

Next-Generation Sequencing Essentials

Whole Transcriptome Amplification

Whole transcriptome amplification (WTA) kits have been developed to generate sufficient transcript targets from minute amounts of RNA. Successful WTA requires accurate replication of representative transcripts present in a sample – without dropout or bias of specific mRNAs. Our WTA kits provide a precise, fast, and simple method of amplifying total RNA from a variety of sources including blood, fixed and frozen tissue, cell culture, FACS-sorted cells, plants, and microorganisms. Additionally, the WTA (**WTA1**, **WTA2**, **SeqR**) kits provide rapid amplification of total RNA in less than 4 hours without 3'-bias. Amplified RNA (cDNA) is suitable for qPCR, microarray analysis, and traditional cloning. The SeqPlex™-I RNA Amplification Kit (SeqRI) for whole transcriptome amplification (WTA) is designed to facilitate Illumina® next-generation sequencing (NGS) from extremely small quantities or degraded/highly fragmented DNA and RNA.

Choosing a Whole Transcriptome Amplification Kit

Starting material	Suitable for microarray, qPCR and cloning	Compatible with any sequencing platform	Compatible with Illumina® sequencers
• Total RNA blood, fixed and frozen tissue, cell culture, FACS sorted cells, plants and microorganisms	TransPlex® Reagent (WTA2)	SeqPlex™ Reagent (SEQR)	SeqPlex™-I Reagent (SEQRI)
• Intact or fragmented RNA samples • FFPE RNA • RNA immunoprecipitation (RIP) samples		SeqPlex™ Reagent (SEQR)	SeqPlex™-I Reagent (SEQRI)





PCR & NGS

Next-Generation Sequencing Essentials

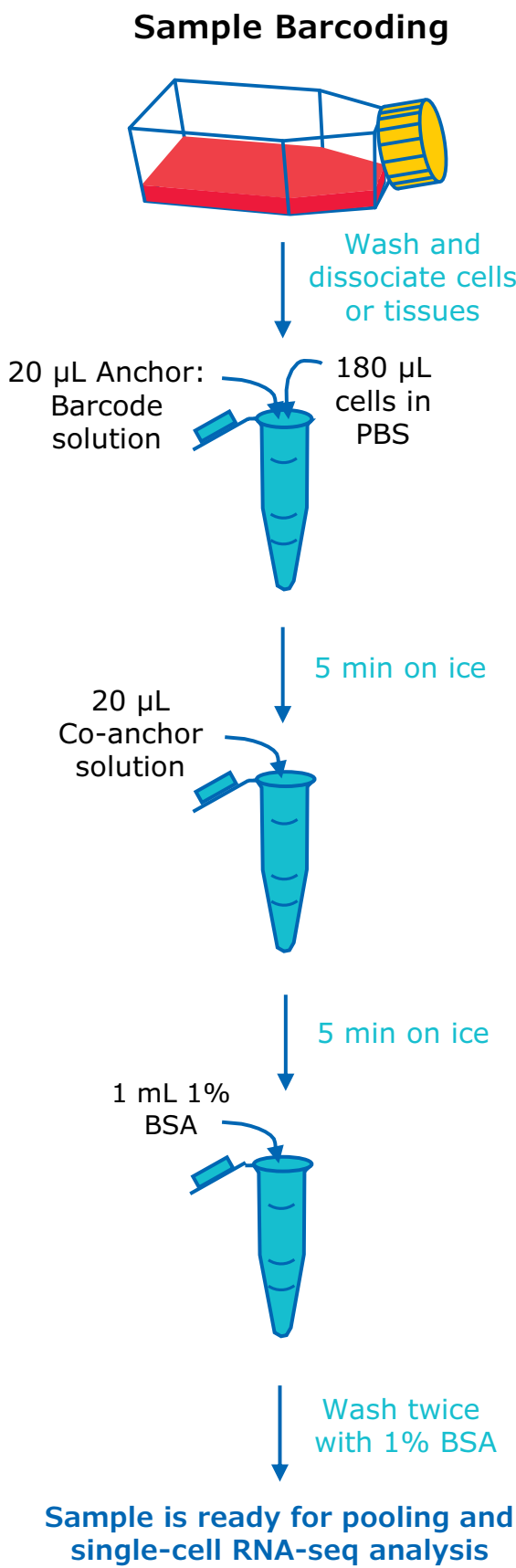
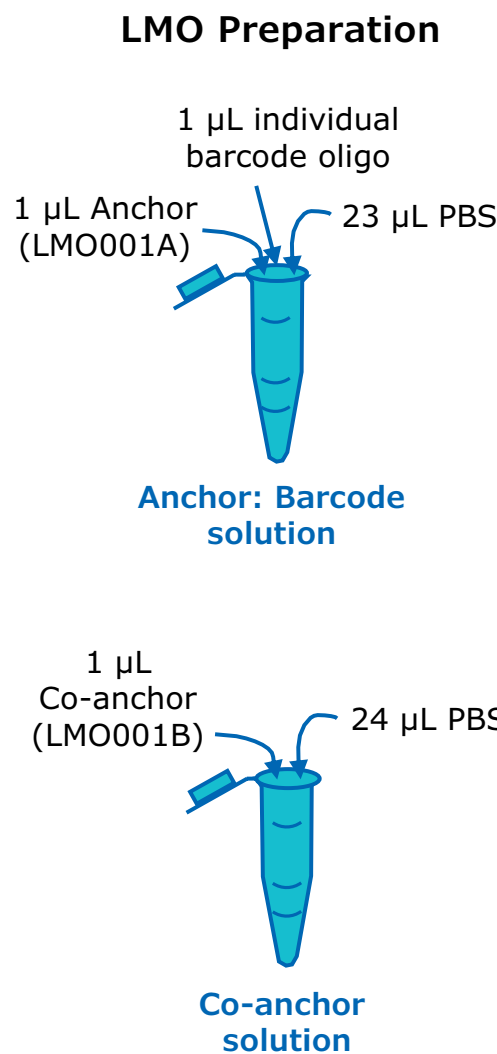
Single Cell Analysis - MULTI-seq Sample Multiplexing

Single-cell RNA-seq (scRNA-Seq) is a powerful but relatively low-throughput tool to analyze gene expression at the single-cell level. MULTI-seq was developed to multiplex sample types using lipid-modified oligonucleotides (LMOs) complexed with unique DNA sample barcodes, allowing for multiple samples to be pooled together in the same single-cell analysis workflow. Sample multiplexing reduces associated costs and provides the additional power of identifying artifacts such as cell doublets in single-cell sequencing and single-nucleus sequencing (snRNA-Seq) applications.

To learn more about scRNA-seq and snRNA-seq sample multiplexing using lipid-tagged indices, click on the product below.

Cat. No.	Product Name	Description
LMO001	MULTI-seq Lipid-Modified Oligos	For Single Cell and Single Nucleus Multiplexing

Labeling samples with MULTI-seq LMOs





PCR & NGS

Isothermal Amplification Essentials

Isothermal Amplification - Bst Max DNA Polymerase

Loop-mediated isothermal amplification (LAMP) has emerged as a key alternative to polymerase chain reaction (PCR)-based techniques for amplifying nucleic acids. While conventional PCR employs a thermal cycler for repetitive cycling temperatures when amplifying, isothermal amplification techniques such as LAMP occur at a single and fixed temperature, allowing the use of simple, portable, and more robust instruments for fast and exponential amplification.

The Bst Max DNA polymerase is an in-silico designed homolog of Bst DNA Polymerase (large fragment) suitable for DNA amplification at elevated temperatures with an optimum of 65 °C. Bst Max DNA polymerase is a salt-tolerant recombinant polymerase (optimal salt concentration 50-350 mM) with more than two-fold enhanced strand-displacement activity and processivity compared to Bst polymerase. The Bst Max enzyme is active from 25 to 65 °C. It is ideal for isothermal applications such as LAMP and RT-LAMP for its superior amplification performance and robustness.



Product Name	Cat. No.	Application	Key Features
Bst Max DNA Polymerase	SRE0113-1600U	LAMP	- Strong strand displacement activity - High salt and inhibitor tolerance - Ideal for amplification of most sample types, especially small and impure samples



Cloning & Expression

Nucleic Acid Purification

PCR & NGS

 **CRISPR/Genome Engineering**

CRISPR/Genome Engineering

**RNAi and
CRISPR
Essentials**

**shRNA
Essentials**

**CRISPR
Screening
Essentials**

**CRISPR Gene
Editing
Essentials**

**Guide RNA
Essentials**





CRISPR/Genome Engineering

RNAi and CRISPR Essentials

Functional Genomics

CRISPR gene editing technology is a multicomponent system that accomplishes specific and targeted changes to a DNA sequence through two main molecular components: a guide RNA (gRNA), and a bacterially-derived nuclease (Cas9). The CRISPR system is often used to add, remove or modify DNA. Our CRISPR reagents and support offer reliable genome engineering tools and services to ensure reliable results. Additionally, our lentivirus-based shRNA libraries deliver unparalleled coverage and are available in multiple formats that include whole-genome, individual RNAi clones/vectors, and gene family sets. These innovative products are available in standard glycerol format or higher quality DNA and lentiviral formats. Whether you are looking to knockout, knock-in, knockdown, or overexpress your targets, our comprehensive suite of CRISPR gene-editing tools, and our shRNA library essentials are designed to ensure reliable results when your work demands them.

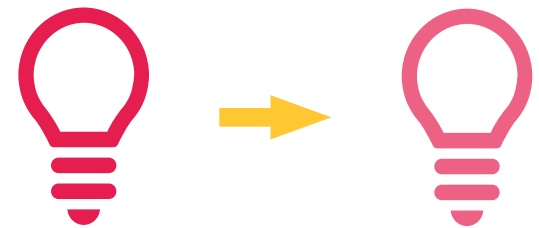




CRISPR/Genome Engineering

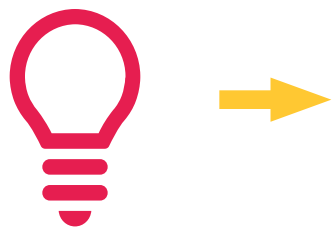
RNAi and CRISPR Essentials

Functional Genomics



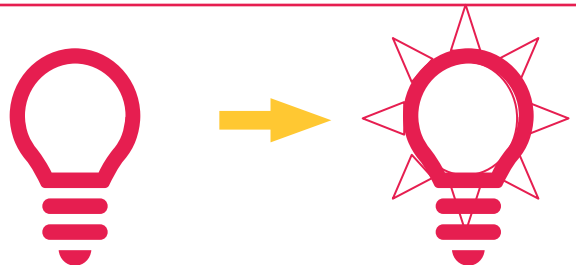
Knock-down: reduce gene expression

- shRNA libraries and shRNA clones
- CRISPRi libraries including the Dolcetto Library, 10X Compatible clones, and more on our website



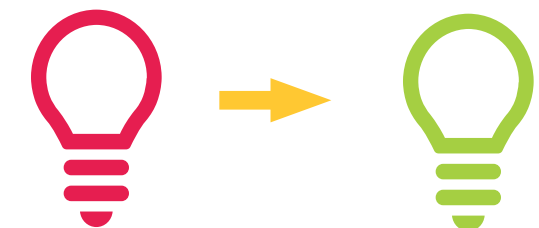
Knock-out: eliminate gene expression

- Design your gRNA
- Order our trusted pre-designed gRNAs or your own custom sequences
- Find your Cas editor and increase your efficiency with PEXBUF



Activator: increase gene expression

- CRISPRa Calabrese genome library Human
- CRISPRa Caprano whole genome library Mouse
- More options available on our website



Knock-in: insert new genetic information

- Design your gRNA
- Order our trusted pre-designed gRNAs or your own custom sequences
- Find your Cas editor and increase your efficiency with PEXBUF



RNAi and CRISPR
Essentials

shRNA Essentials

CRISPR Screening
Essentials

CRISPR Gene Editing
Essentials

Guide RNA Essentials

CRISPR/Genome Engineering

shRNA Essentials: Foundational Tools for Experimental Success

Expert Bioinformatics Analysis to enable your discovery

Analysis solutions: Deconvolution Services for shRNA and CRISPR pooled libraries

Sample Type	Product Name	Cat. No.	Key Features
shRNA libraries	MISSION® LentiPlex® Complete Human Pooled shRNA Library	SHPHLIBR	Featuring rapid, convenient genome-wide shRNA screens with 125,000 shRNA constructs from the TRC collection targeting 20,000+ human genes.
	MISSION® LentiPlex® Human Pooled shRNA Library	SHPH01	“Featuring rapid, convenient genome-wide shRNA screens with 75,000 shRNA constructs from the TRC collection targeting 15,000+ human genes. Full Selection of shRNA libraries here. Custom options also available in pooled and arrayed formats.
shRNA clones		Glycerol Stocks Purified DNA Lentiviral Particles	Convenient glycerol, DNA and lentiviral formats available, with shRNAs and gRNAs predesigned for human and mouse. Many controls available
Packaging Mix	MISSION® Lentiviral Packaging Mix	SHP001	Optimized plasmid formulation to allow for lentiviral packaging and pseudo-typing. This product is suitable for use in conjunction with transfer vectors.



RNAi and CRISPR
Essentials

shRNA Essentials

CRISPR Screening
Essentials

CRISPR Gene Editing
Essentials

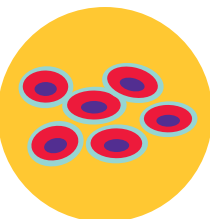
Guide RNA Essentials

CRISPR/Genome Engineering

CRISPR Screening Essentials

The Researcher's Guide to CRISPR Screening

STEP 1



Determine Cell Line

Identify which cell lines will work for your requirements.

1. Ensure the cell line is a good model in terms of relevance, biological process & genotype
2. Do you need a primary, transformed or stem cell platform?
3. Determine if the cell line can be adapted to your workflow
4. Consider the doubling time and ploidy of the cell line

STEP 2



Design/Choose a gRNA Library and Screening Strategy

CRISPR libraries typically contain thousands of plasmids and multiple gRNAs per target gene. First you need to select an appropriate library.

1. Are you interested in the whole genome or a more focused pathway?
2. Lentivirus or ribonucleoprotein?
3. Pooled or arrayed?
 - Pooled: maximize the number of gRNA per gene target
 - Arrayed: optimize the gRNA design
4. Controls: use non-targeting guides and consider controls for enrichment and depletion depending on your screening approach
5. Use optimal designs for gRNA and—if designing your own libraries—spread them to avoid clusters in inaccessible genomic regions

STEP 3



Determine Optimal Conditions

Low transduction efficiency can result in insufficient representation of the modified cell population.

1. Perform a kill curve to determine the concentration of selection antibiotic needed to kill the untransfected or untransduced cells
2. Determine the functional titer in your intended cell line using
 - A colony forming unit assay based on antibiotic resistance, or
 - A vector containing a fluorescence marker like GFP
3. Use a control vector to optimize the multiplicity of infection (MOI). Use the lowest MOI that offers one gRNA per cell

STEP 4

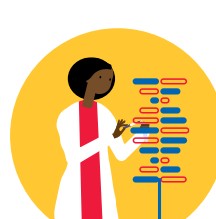


Evaluate Your Cas9 Source

Establish a Cas9-expressing cell line or provide in an "all-in-one" vector.

1. Cas9 expressing cell lines: perform clonal isolation or use the mixed population of Cas9 expressing cells for screening.
2. All-in-one vectors: deliver both the Cas9 effector and gRNA by introducing one construct
3. Considerations for the optimal Cas9 source:
 - Ensures constant expression levels in a uniform genetic background
 - Eliminates concerns about co-transduction of gRNAs
 - Supports high-throughput sgRNA applications

STEP 5



Perform Your Screen

Pooled and arrayed screens have similar workflows with some differences:

STEP	POOLED	ARRAYED
Library Preparation	1000s gRNAs	per tube 1 gRNA per well
Library Delivery	Lentivirus required	Multiple feasible formats
Screen Duration	Efficient whole genome screening	Time to screen increases with the number of clones
Screen Capability	<i>in vivo</i> screening possible	<i>in vivo</i> screening not possible
Analysis	Deep sequencing/deconvolution required to analyze data/identify hits	NGS is not required to understand results
Readout	Limited options (e.g. cell death or proliferation) but can be coupled with single cell analysis	Multiple options e.g. fluorescence, luminescence, high content, live cell imaging



RNAi and CRISPR
Essentials

shRNA Essentials

CRISPR Screening
EssentialsCRISPR Gene Editing
Essentials

Guide RNA Essentials

CRISPR/Genome Engineering

CRISPR Screening Essentials

Pooled

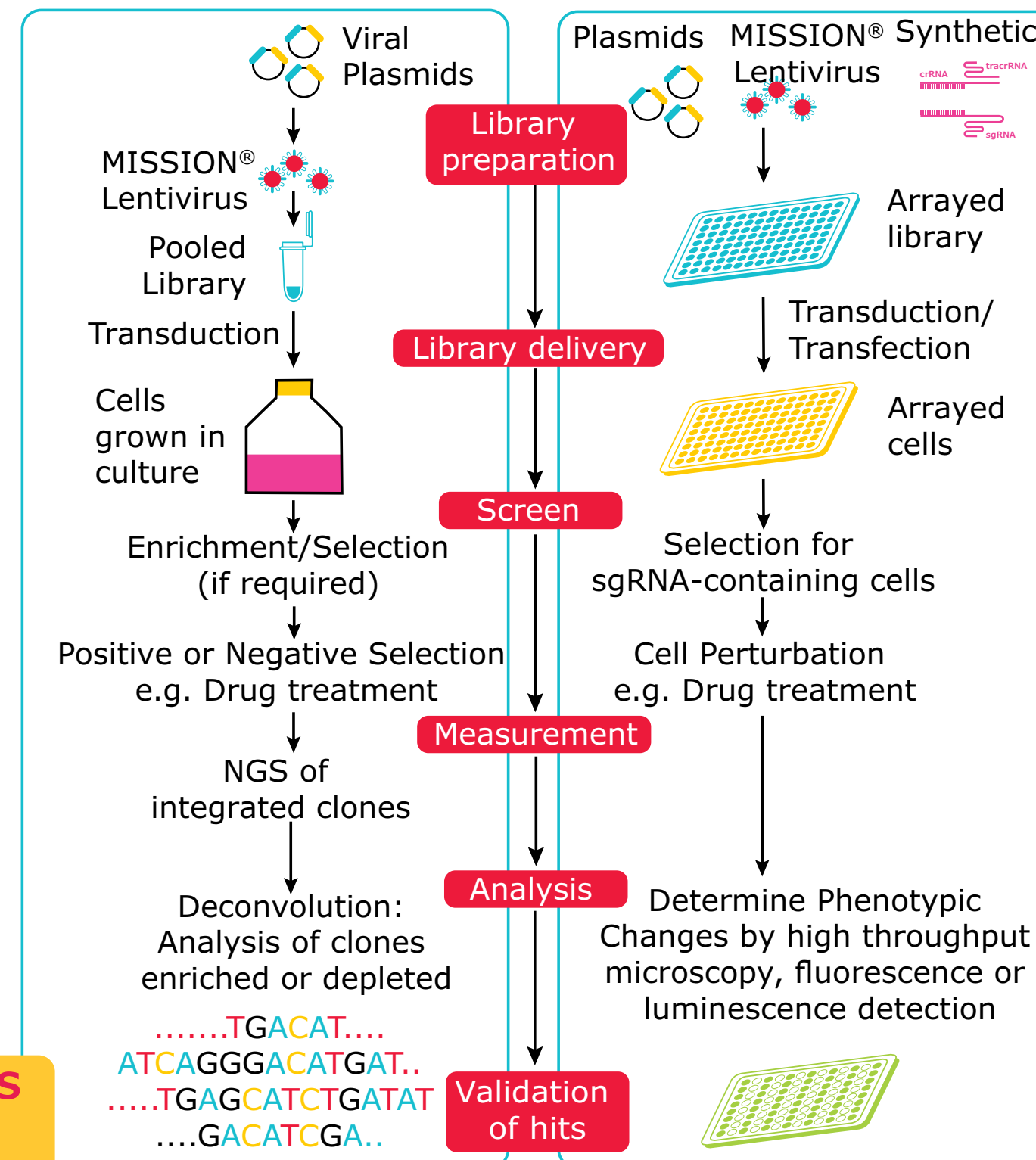
1000s of gRNAs in one tube

Lentivirus required

Whole genome can be screened efficiently

In vivo screening possibleDeconvolution/NGS required to analyze
data/identify hitsLimited options for phenotype/readout
e.g., cell death or proliferation**Deconvolution Services: Expert Bioinformatics
Analysis to enable your discovery**

Pooled library screening



Arrayed library screening

Arrayed

1 gRNA per well

Multiple format options

Time to screen increases with # of clones

In vivo screening not possible

No NGS required to understand results

Multiple options for phenotype/readout
e.g., fluorescence, luminescence,
high content imaging**CRISPR Products
and Services**



RNAi and CRISPR
Essentials

shRNA Essentials

CRISPR Screening
Essentials

CRISPR Gene Editing
Essentials

Guide RNA Essentials

CRISPR/Genome Engineering

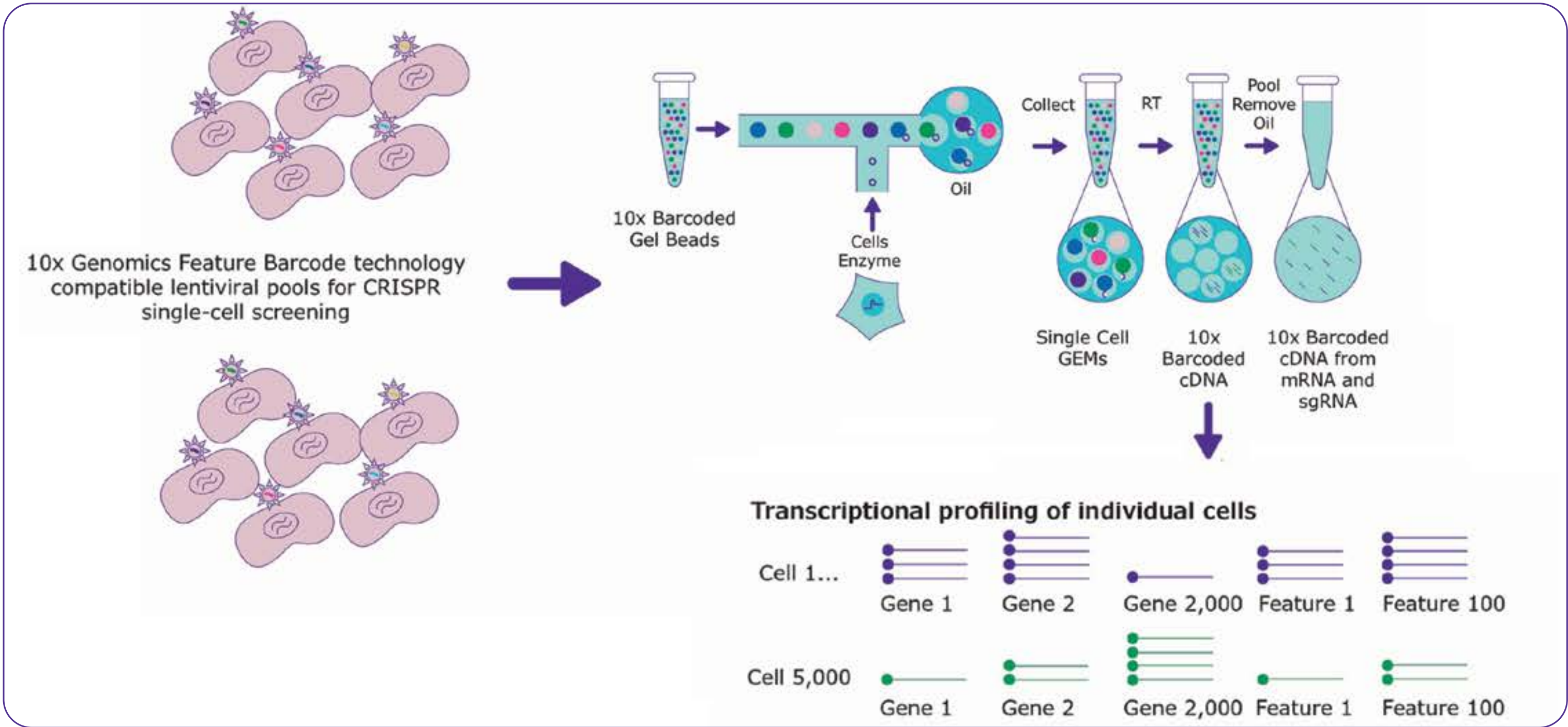
Single Cell Analyses

10x Reagents Feature Barcode Technology

10X Genomics Compatible Products*

	10X CRISPRi Feature Barcode Optimization Kit Includes Positive and Negative Controls	Individual Clones	Custom Pools (20-2000 clones)
Viral Titer (by p24)	1 x 10 ⁶	1 x 10 ⁶	5 x 10 ⁸
Volume	20 µL	200 µL	200 µL

*All products contain Feature Barcode technology



10xCRISPRpools



RNAi and CRISPR
Essentials

shRNA Essentials

CRISPR Screening
Essentials

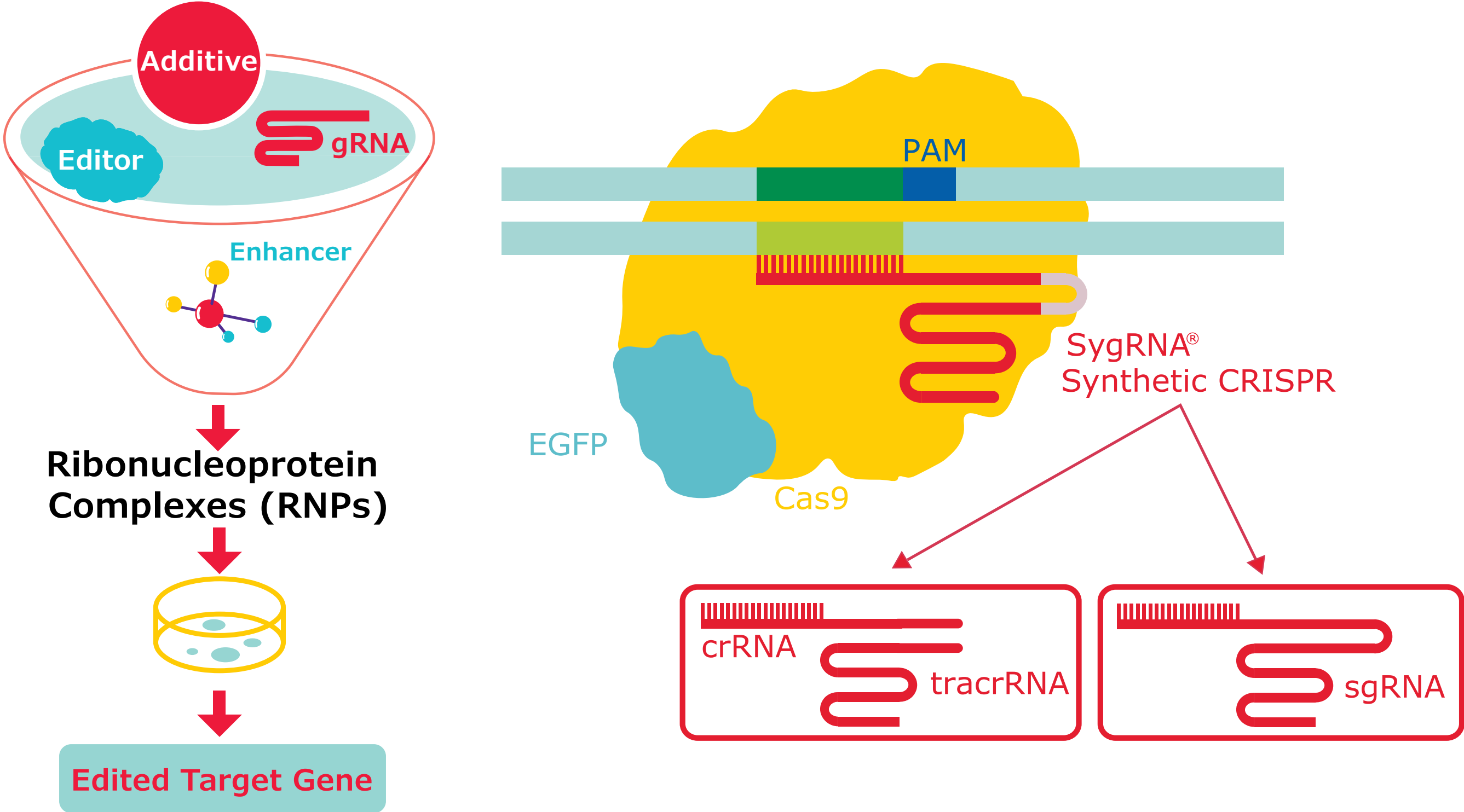
CRISPR Gene Editing
Essentials

Guide RNA Essentials

CRISPR/Genome Engineering

CRISPR Gene Editing Essentials

Ribonucleoprotein (RNP) complexes for enhanced safety and efficacy



Workflow components	Recommended Reagents and Tools		
gRNA	Order our pre-designed gRNAs here	Design your own gRNA here	Order your own gRNA design here
Editor	Best-in-class editor: PURedit® Cas9 Protein reagents	spCas9 standard: Cas9 Protein	spCas9 GFP fusion: Cas9-GFP Protein
Additive	Transfection Reagent: GeneJuice® Transfection Reagent	Increase Transfection Efficiency: PEXBUFF Transfection Enhancer	
Detect your edit	Check your editing events by looking for indels without NGS: T7 Endonuclease Detection Assay		



RNAi and CRISPR
Essentials

shRNA Essentials

CRISPR Screening
EssentialsCRISPR Gene Editing
Essentials

Guide RNA Essentials

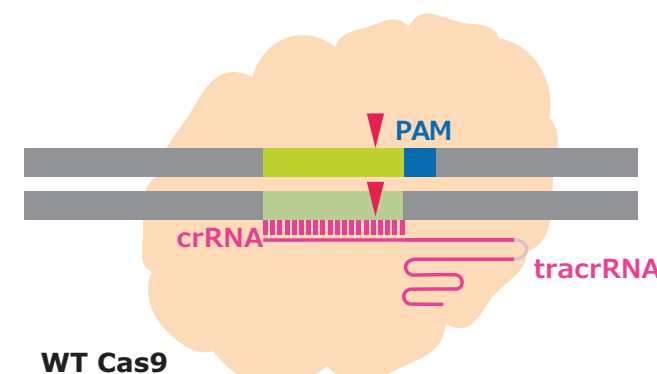
CRISPR/Genome Engineering

CRISPR Gene Editing Essentials

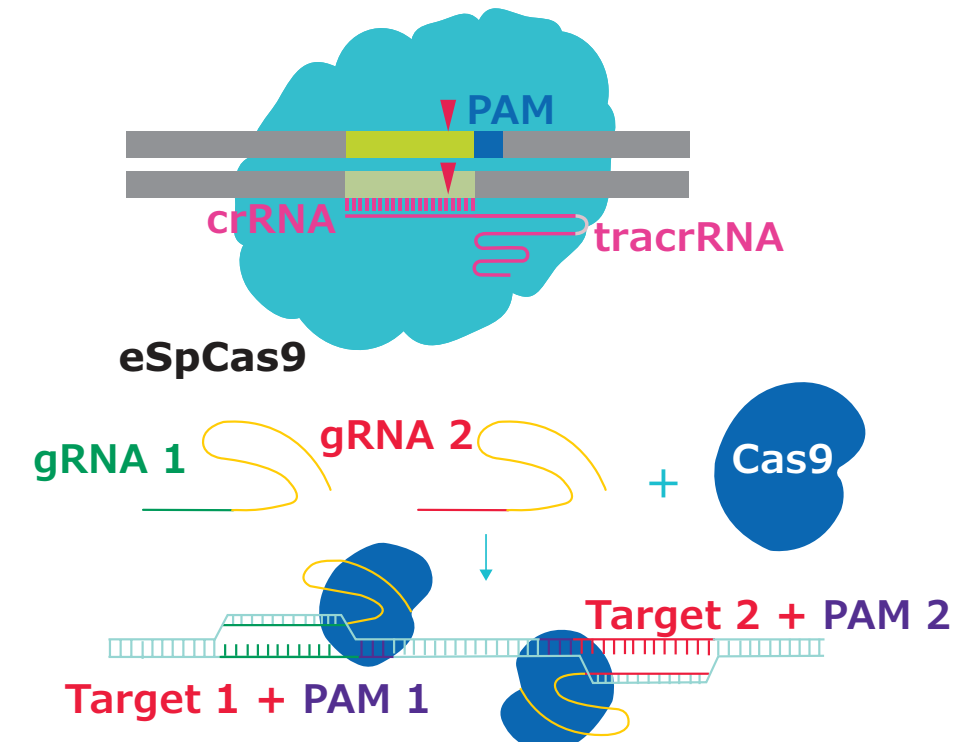
Cas9 & sgRNA Essentials – Options To Optimize

Cas9 Cutting

Cas9 Protein (CAS9PROT)

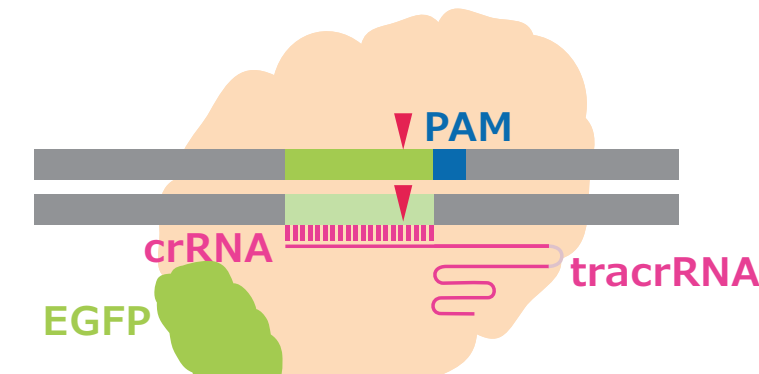


WT Cas9

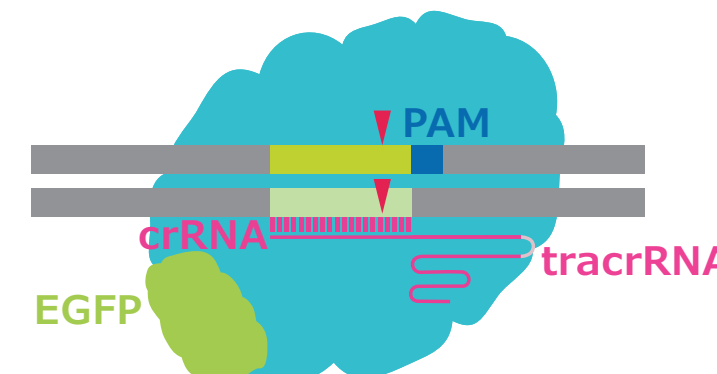
Cas9 Plus Protein (CAS9PL)
PURedit® Cas9 Protein (PECAS9)
eSpCas9 Protein (ESPCAS9PRO)

Cas9 Tracking

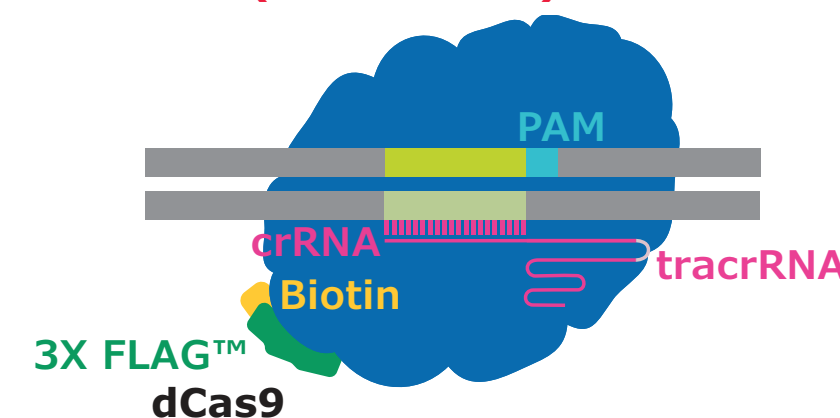
Cas9-GFP Protein (CAS9GFPPRO)

SpCas9-EGFP
Fusion

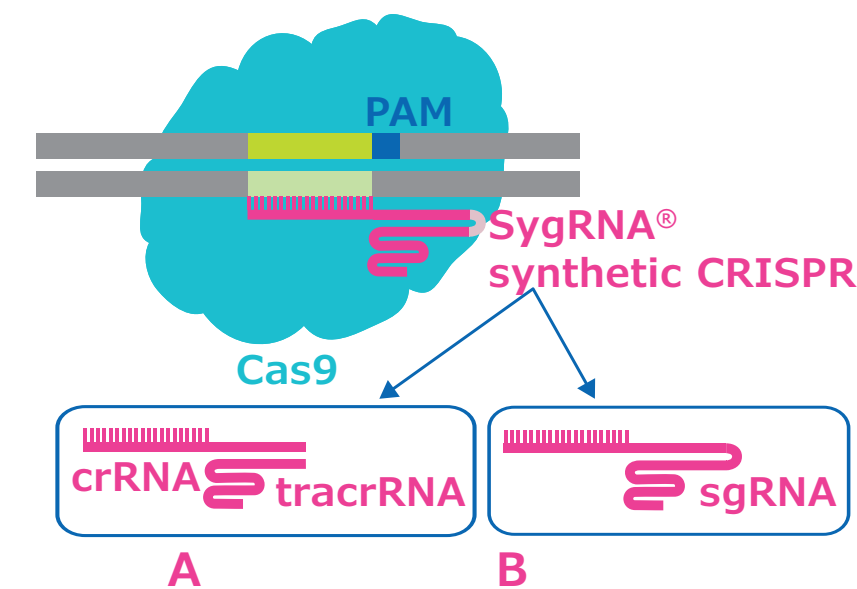
eSpCas9-GFP Protein (ECAS9GFPPR)

eSpCas9-EGFP
Fusion

Cas9 Recognizing

dCas9-3XFLAG™-Biotin Protein
(DCAS9PROT)

sgRNA and crRNA/SygRNA™ Cas9 Synthetic tracrRNA (tracrRNA) – custom and pre-designed



Product Guarantee

We are so confident in the performance of our SygRNA® products, that we fully guarantee the quality and performance of any gRNA we produce, including custom sequences. If your crRNA or sgRNA do not yield detectable cleavage at the intended target site, we will provide you a one-time replacement, free of charge.

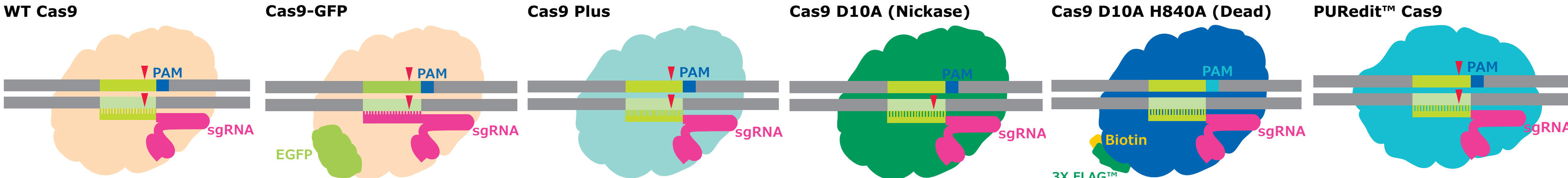
To qualify for this guarantee, please send an image or sequencing data from a single experiment demonstrating detectable cleavage using one of our positive controls, side-by-side with the negative results from your SygRNA® gRNA. To receive your replacement, simply email oligotechserv@merckgroup.com and include sample data from a representative experiment (T7E1, TIDE, or NGS).



CRISPR/Genome Engineering

CRISPR Gene Editing Essentials

Cas9 Protein Essentials



	WT Cas9	SpCas9-EGFP Fusion	Cas9 Plus	CAS9D10A	3X FLAG™ dCas9	PURedit™ Cas9
Description	WT SpCas9	WT SpCas9 fused to GFP	SpCas9 protein with both high editing activity and on-target specificity	Cas9 mutated to nick one DNA strand	Cas9 with mutation inhibiting cutting but not DNA binding	SpCas9 with highest activity and specificity; enhanced quality control
Recommended Use	Early evaluation of gRNA targets	Optimizing conditions and new delivery mechanisms	Experiments that cannot compromise activity or specificity	HDR applications; requires 2 target sites for modification	Activation/inhibition of target expression	Pre-clinical and early clinical research
Features	1x NLS	3x NLS Enhanced GFP	Activity- and specificity-enhancing mutations 1x NLS	D10A mutation 1x NLS	D10A and H840A mutations 1x NLS 3x FLAG™-biotin tag	Activity- and specificity-enhancing mutations Higher MQ rating 1XNLS
Gene Editing Activity	+++	+++	+++	++	N/A	++++
On-Target Specificity	++	++	++++	+++	N/A	++++



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Formats and Purity For Success

Feature	Standard sgRNAs	PURedit™ sgRNAs
Differentiators	Lowest price in the market with higher activity than competitors; Useful in variety of applications	High purity sgRNAs manufactured under higher quality standards
Purification	Standard (RP1)	PURedit™ sgRNAs (HPLC)
Gene Editing Activity	+++	++++
Stabilizing Modifications Available	Yes	Yes
Quality Standard	ISO 9001	ISO 9001 with enhanced quality control required for preclinical & early clinical research

Home > Custom Products > CRISPR & Gene Editing > Guaranteed Predesigned CRISPR gRNA

Guaranteed Predesigned CRISPR gRNA

1 Product Search

2 Select Clones

3 Specifications

4 Review & Confirm

Specifications

[View Our Performance Guarantee](#)

Physical Material

Synthetic RNA

Recommendations based on application

CRISPR Species

☒ SpCas9

Structure

- ☒ sgRNA (crRNA +tracrRNA as one)
☐ crRNA (tracrRNA sold separately)

Synthesis Scale

- ☐ 2 nmol
☒ 3 nmol
☐ 5 nmol

Help

 custsvc@milliporesigma.com

 1-800-234-5362

Modified

- ☐ Yes
☐ No

Purification

- ☐ Standard
☐ PURedit™

Format

Dry

Continue

To learn more, please visit:
SigmaAldrich.com/molecularbiology



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