



Protein expression

Express yourself

Embrace the creative capabilities of our protein expression workflow solutions to build a healthier world

Accelerate your research by optimizing every step of your protein expression workflow

Whether you want to study the structure and function of specific proteins or exploit their applications in drug discovery and development, achieving optimal and reliable amounts of recombinant protein is key to success. Various factors are important for achieving high-quality protein expression, from choosing the gene of interest, to characterizing the final, purified protein.

We are here to support you through every step of the journey. We offer a wide selection of superior and trusted mammalian, insect, yeast, bacterial, and cell-free protein expression workflow solutions backed by a team of professionals, so you can express the right protein faster at the right volume and confidently accelerate your research to help improve health outcomes.

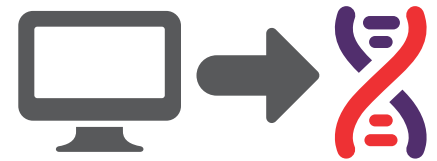
Tools to optimize your cloning step

GeneArt Gene Synthesis and GeneOptimizer software

The power of custom gene synthesis is the ability to design your DNA without the constraints of traditional cloning. Equally important to most researchers, however, is obtaining high yields of mRNA and, ultimately, protein from synthetic genes. We developed [Invitrogen™ GeneArt™ GeneOptimizer™ software](#) to maximize the expression of synthetic genes in all commonly used expression systems.

Tuning the expression level by choosing the optimal promoter and terminator combination can be an essential part of your expression project. The origin of the replication also has a significant influence on the expression level of the foreign protein. We offer a broad range of commercially available, predesigned vectors optimized for various expression systems.

Learn more at thermofisher.com/genesynthesis



Gibson Assembly kits and GeneArt Strings DNA Fragments

Invitrogen™ GeneArt™ Gibson Assembly® cloning kits provide highly efficient, seamless cloning, enabling the assembly of multiple DNA fragments of varying length into any vector.

When combined with [Invitrogen™ GeneArt™ Strings DNA Fragments](#) or [Invitrogen™ GeneArt™ Gene Synthesis](#), these cloning kits can be used to build simple constructs as well as large and demanding constructs from multiple fragments.

Learn more about GeneArt Gibson Assembly cloning kits for protein expression at thermofisher.com/gibsonassembly



Gateway cloning

Invitrogen™ Gateway™ cloning technology is rapid, robust, and suited for high-throughput clone generation for protein production. It allows shuffling between different expression systems in just a few simple steps. Choose from a diverse selection of host systems, including, *E. coli*, yeast, and insect or mammalian cells, each of which utilizes unique destination vectors for all your expression applications. Additionally, the Invitrogen™ Gateway™ Vector Conversion System can convert specialized or customized vectors into an Invitrogen™ Gateway™ destination vector to suit your expression workflow.

Select the right Invitrogen™ Gateway™ vectors for your workflow and review our cloning protocols at thermofisher.com/gateway



One Shot chemically competent *E. coli*

E. coli cells are widely used for production of recombinant proteins quickly, economically, and on a large scale. The most popular strain for recombinant protein expression is BL21 and its derivatives. Invitrogen™ One Shot™ chemically competent cells, such as BL21 Star™ (DE3) or BL21-AI™ cells, are optimized for high-level protein or toxic protein expression from T7 promoters. All are induced with IPTG or L-arabinose and come in the convenient Invitrogen™ One Shot™ format, allowing for transformation and recovery in a single tube.

Choose chemically competent cells optimized for protein expression at thermofisher.com/compcells



Tools to optimize your expression step

Choosing the right expression system—either stable cell line or transient—is crucial for getting the right protein expression. Factors that can be optimized in transient expression systems include cell density, the expression host, and transfection efficiency. We have developed expression systems that optimize all three of these factors while offering:


















- Higher protein yields (3–20x higher than other systems)
- Faster speed to protein (days vs. weeks or months)
- High cell density
- Lower cost per mg of protein



Gibco™ Expi293™ expression system kits

- Rapid production of protein in just 5–7 days
- Specialized cell lines for structural biology research



Learn more at thermofisher.com/expi293

	 Human (HEK 293)	 Hamster (CHO)
 Expression system	Human (HEK 293)	Hamster (CHO)
 Featured application	Membrane proteins (GPCRs, ion channels, other membrane proteins)	Ig-related proteins
 Other applications	<ul style="list-style-type: none"> • Difficult-to-express proteins • Secreted proteins 	<ul style="list-style-type: none"> • Membrane proteins • Secreted proteins
 Post-translational modifications	Full	Nearly full
 Protein yield	Up to 1 g/L	Up to 3 g/L
 Recommended host system kit	Expi293 expression system kits	ExpiCHO Expression System Kit
 Recommended cells	Expi293F Cells Expi293F GnTI-Cells Expi293F Inducible Cells Expi293F Inducible GnTI-Cells	ExpiCHO-S Cells (cGMP Banked) ExpiCHO-S Cells
 Recommended media	Expi293 Expression Medium	ExpiCHO Expression Medium
 Recommended transfection and delivery	ExpiFectamine 293 Transfection Kit	ExpiFectamine CHO Transfection Kit
 Recommended expression vectors	pcDNA3.4 TOPO vector pcDNA3.3 TOPO vector	pcDNA3.4 TOPO vector pcDNA3.3 TOPO vector
 Recommended cultureware	Nalgene shaker flasks Nunc bioreactor tubes Nunc plates	Nalgene shaker flasks Nunc bioreactor tubes Nunc plates
 Recommended extraction reagent kit	M-PER Mammalian Protein Extraction Reagent	M-PER Mammalian Protein Extraction Reagent
 Recommended protein labeling	Expi293 Met (-) Protein Labeling Kit L-Methionine (Methyl-¹³C) L-Selenomethionine	
 Scale up	Expi293 Expression Medium Single-use bioreactor vessels	ExpiCHO Stable Production Medium EfficientFeed C+ 2X Supplement Efficient-Pro Feed 2 Single-use bioreactor vessels
 Services option	Gene-to-protein services	Gene-to-protein services

Gibco™ ExpiCHO™ Expression System Kit

- Maintain protein quality and function and easily transition from research to production using the Gibco™ ExpiCHO-S™ cGMP-banked cell line and Gibco™ ExpiCHO™ Stable Production Medium
- Get high yields in a transient expression system (up to 3 g/L)

Learn more at thermofisher.com/expicho

 Insect (Sf9, Sf21)	 Yeast	 Bacterial	 Cell-free
Intracellular proteins	Industrial enzymes	Bacterial proteins	Rapid protein expression
<ul style="list-style-type: none"> Toxic proteins Multi-protein complexes 	Low-complexity proteins	Low-complexity proteins	<ul style="list-style-type: none"> Toxic proteins <i>In vitro</i> labeling
Partial	Partial	None	Partial
Up to 900 mg/L	Up to 10 g/L	Up to 10 mg/L	Up to 750 mg/L
ExpiSf Expression System Starter Kit	EasySelect <i>Pichia</i> Expression Kit	Champion pET SUMO Expression System pBAD	Cell-free <i>in vitro</i>
ExpiSf9 cells	PichiaPink Expression Strain Set GS115, <i>Pichia pastoris</i> Yeast Strain X-33, <i>Pichia pastoris</i> Yeast Strain	One Shot BL21 (DE3) Chemically Competent <i>E. coli</i> Cells BL21-AI One Shot Chemically Competent <i>E. coli</i> Cells	HeLa and CHO extracts
ExpiSf CD Medium	PichiaPink Media Kit YPD Broth	MagicMedia <i>E. coli</i> Expression Medium Luria broth (LB)	None required
ExpiFectamine Sf Transfection Reagent	Neon Transfection System	None required	None required
pFastBac 1 vector pFastBac Dual Expression Vector	pPINK (LC and HC) pPICZα A, B and C <i>Pichia</i> Vectors pPICZ A, B, and C <i>Pichia</i> Vectors	Champion pET SUMO vector pBAD_TOPO vector pRSET bacterial expression vectors	T7 cell-free expression vectors
Nalgene shaker flasks Nunc bioreactor tubes Nunc plates	Nalgene shaker flasks	Nalgene shaker flasks	
I-PER Insect Cell Protein Extraction Reagent	Y-PER Yeast Protein Extraction Reagent	B-PER Complete Bacterial Protein Extraction Reagent	None required
ExpiSf CD Medium Single-use bioreactor vessels		Bacto CD Supreme Fermentation Production Medium (FPM) Single-use bioreactor vessels	
Gene-to-protein services			



Gibco™ ExpiSf™ Expression System Kit

- First chemically defined baculovirus expression system
- Generate 3x more protein compared to existing insect expression platforms

Learn more at thermofisher.com/expisf



Tools to optimize your purification and analysis steps

Protein extraction reagents and protease inhibitors

Choose reagents optimized for your host system to deliver efficient, high-yield protein extraction and targeted inhibition of unwanted protease and phosphatase activity.

Learn more at thermofisher.com/proteinextraction



Electrophoresis welcome packs for protein expression

The Invitrogen™ Bolt™ Mini Bis-Tris Welcome Pack and Invitrogen™ NuPAGE™ Midi Bis-Tris Welcome Pack are designed for use with any protein expression application. These kits are:

- **Comprehensive**—include all necessary gels, reagents, buffers, a 12-minute stain, and an Invitrogen™ Mini Gel Tank or Invitrogen™ SureLock™ Tandem Midi Gel Tank
- **Flexible**—multiple chemistries designed to fit your specific application, including broad range, high- or low-molecular weight separations, SDS-PAGE, native PAGE, or IEF
- **High-performing**—the Bis-Tris chemistry used in the 4–12% acrylamide gradient gels delivers sharp, well-resolved bands in just 20–35 minutes
- **Performance guaranteed**—our protein gels are designed and tested to deliver superior performance, reliability, reproducibility, and consistency of quality. We guarantee it. Learn more about the performance guarantee at thermofisher.com/proteingelsguarantee



Find out more at thermofisher.com/proteingelwelcome

iBlot 2 Starter Kit

The Invitrogen™ iBlot™ 2 Starter Kit includes an Invitrogen™ iBlot™ 2 Gel Transfer Device and iBlot™ 2 Transfer Stacks. Utilizing a dry blotting system, this starter kit is:

- **Fast**—high-performance transfer of protein gels in just 7 minutes
- **Easy**—uses preassembled iBlot 2 Transfer Stacks with transfer buffer incorporated into the gel matrices
- **Sensitive**—high-efficiency protein transfers for high downstream detection sensitivity

Find out more at thermofisher.com/iblot2



iBright imaging systems

Simplify your gel and western blot imaging with Invitrogen™ iBright™ imaging systems. These revolutionary devices are:

- **Simple to use**—boasts intuitive interface and workflows
- **Powerful**—9.1 MP camera delivers crisp, clear, publication-quality images
- **Versatile**—choose from 5 imaging modes to capture gel and blotting data, as well as colony plates, efficiently and easily
- **Streamlined**—utilizes Invitrogen™ iBright™ Analysis Software for efficient image analysis

Find out more at thermofisher.com/ibright





GeneArt gene-to-protein services

Expedite your protein and antibody workflows from discovery to commercialization with our Invitrogen™ GeneArt™ gene-to-protein services. Partnering with us can help accelerate your discovery process toward rapid expression and purification of your desired protein from transiently transfected mammalian cells.

Learn more at [thermofisher.com/g2pservice](https://www.thermofisher.com/g2pservice)

Ordering information

Description	Quantity	Cat. No.
Invitrogen™ cloning products		
GeneArt™ Gibson Assembly® HiFi™ Cloning Kit, chemically competent cells	10 reactions	A46624
GeneArt™ Gibson Assembly® HiFi™ Cloning Kit, electrocompetent cells	10 reactions	A46626
GeneArt™ Gibson Assembly® HiFi™ Master Mix	50 reactions	A46628
pENTR™/D-TOPO™ Cloning Kit, with One Shot™ TOP10 Chemically Competent <i>E. coli</i> Cells	20 reactions	K240020
Gateway™ LR Clonase™ II Enzyme Mix	20 reactions	11791020
Gateway™ BP Clonase™ II Enzyme Mix	20 reactions	11789020
Gateway™ LR Clonase™ II Plus Enzyme Mix	20 reactions	12538120
One Shot BL21 (DE3) Chemically Competent <i>E. coli</i> Cells	21 x 50 µL/tube	C600003
One Shot™ BL21 Star™ (DE3) Chemically Competent <i>E. coli</i> Cells	21 x 50 µL/tube	C601003
BL21 Star™ (DE3)pLysS One Shot™ Chemically Competent <i>E. coli</i> Cells	21 x 50 µL/tube	C602003
BL21-AI One Shot Chemically Competent <i>E. coli</i> Cells	21 x 50 µL/tube	C607003
MultiShot™ StripWell BL21 Star™ (DE3) Competent Cells	1 x 96 tube rack (50 µL/tube)	C609601
Explore our comprehensive range of cloning products at thermofisher.com/cloning		
Gibco™ expression products		
Expi293 Expression System Kit	1 kit	A14635
Expi293™ Expression Medium	1,000 mL	A1435101
ExpiFectamine™ 293 Transfection Kit	1 kit	A14524
Expi293™ GnTI- Expression System Kit	1 kit	A39250
Expi293™ Inducible Expression System Kit	1 kit	A39251
Expi293™ Inducible GnTI- Expression System Kit	1 kit	A39252
ExpiCHO Expression System Kit	1 kit	A29133
ExpiCHO™ Expression Medium	1,000 mL	A2910001
ExpiFectamine™ CHO Transfection Kit	1 kit	A29129
ExpiSf Expression System Starter Kit	1 kit	A38841
ExpiSf™ CD Medium	500 mL	A3767801
ExpiFectamine™ Sf Transfection Reagent	1 mL	A38915
Thermo Scientific™ purification and analytics products		
M-PER™ Mammalian Protein Extraction Reagent	250 mL	78501
I-PER™ Insect Cell Protein Extraction Reagent	250 mL	89802
B-PER™ Bacterial Protein Extraction Reagent	250 mL	90084
Halt™ Protease Inhibitor Cocktail (100X)	24 x 100 µL	78430
Invitrogen™ purification and analytics products		
Bolt™ Mini Bis-Tris Welcome Pack for Protein Expression (4–12%, 12 well)	1 kit	NW0412PEX
NuPAGE™ Midi Bis-Tris Welcome Pack for Protein Expression (4–12%, 20 well)	1 kit	STM4001PEX
iBlot 2 Starter Kit	1 kit	IB21001S
iBright™ FL1500 Imaging System	1 instrument	A44241
iBright™ CL1500 Imaging System	1 instrument	A44240
iBright™ CL750 Imaging System	1 instrument	A44116

 Find out more at thermofisher.com/proteinexpression