

# NOT SURE WHETHER YOU NEED **RESEARCH- GRADE (RUO)** OR **GMP-GRADE** PRODUCTS?

		<b>RUO</b>	<b>GMP*</b>
<b>PRODUCT CUSTOMIZATION</b> 	Examples include but are not limited to: High-concentration enzymes, formulation, packaging and fill size	 Contact our Customized Solutions Team to discuss	 Contact our Customized Solutions Team to discuss
<b>INFRASTRUCTURE</b> 	Animal-free facility		
	Validation programs in place based on risk assessments		
	Expanded validation requirements for facility/utilities/process equipment for GMP-grade		
	ISO 8 Clean Rooms ISO 5 Filling Hoods		
<b>MANUFACTURING PROCESSES</b> 	Multiple production sites for business continuity		
	Ampicillin-free processes	Contact our Customized Solutions Team to discuss	
	Animal-free processes and final formulation	Contact our Customized Solutions Team to discuss	
<b>PRODUCT ATTRIBUTES/ TESTING</b> 	Characterized master cell banks		
	Comprehensive panel of product contamination assays performed		
	Validated assays with quantitative results		
	Compendial assays applied to all products, including bioburden and endotoxin levels		
	TSE/BSE statements		
<b>QA &amp; REGULATORY</b> 	Animal-free raw materials, processes and formulation	Contact our Customized Solutions Team to discuss	
	ISO 9001 and ISO 13485 certified		
	Batch history files/batch history records		
	Consolidated batch history file/batch records and defined critical quality attributes and critical process parameters and QA reviews		
	Change management and lot disposition by Quality Unit		
	Regulatory support package including but not limited to the following risk statements – melamine, antibiotic, mutagenic and elemental impurities, nitrosamine and residual solvents		
	Validated shipping configurations		
<b>SUPPORTED APPLICATIONS</b> 		Research use or preclinical applications	For further processing in clinical or commercial cGMP applications

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## GMP-GRADE PRODUCTS

FOR NUCLEIC ACID THERAPEUTIC MANUFACTURING



be INSPIRED  
 drive DISCOVERY  
 stay GENUINE

For nearly 50 years, NEB® has been a world leader in the discovery and production of reagents for the life science industry. When it is time to scale up and optimize reaction components, our standalone reagents are readily available in formats matching our GMP-grade\* offering, enabling a seamless transition to large-scale therapeutic manufacturing.

To better serve the needs of customers in regulated markets, in 2018 NEB opened a state-of-the-art, 43,000 sq. ft. production facility in Rowley, MA for the manufacture of GMP-grade products – approximately 15 minutes from our main campus in Ipswich, MA, USA. This purpose-built facility includes Quality Control and Production functions ranging from a shipping/receiving area and dedicated warehouse, to separate inoculation preparation, fermentation, purification and filling suites.



## ENABLING SMALL-TO-LARGE-SCALE PRODUCTION BATCHES

NEB manufactures and inventories the following enzyme specificities at GMP-grade, to support the production of commercially-approved mRNA and DNA product(s), meeting customer needs with short lead times:

- Vaccinia Capping Enzyme
- RNase Inhibitor, Murine
- T7 RNA Polymerase
- Pyrophosphatase, Inorganic (*E. coli*)
- mRNA Cap 2'-O-Methyltransferase
- DNase I (RNase-free)
- BspQI
- Faustovirus Capping Enzyme (coming soon)

\*GMP-grade\* is a branding term NEB uses to describe reagents manufactured at NEB's Rowley facility. The Rowley facility was designed to manufacture reagents under more rigorous infrastructure and process controls to achieve more stringent product specifications and customer requirements. Reagents manufactured at NEB's Rowley facility are manufactured in compliance with ISO 9001 and ISO 13485 quality management system standards. However, at this time, NEB does not manufacture or sell products known as Active Pharmaceutical Ingredients (APIs), nor does NEB manufacture its products in compliance with all of the Current Good Manufacturing Practice regulations.

## BENEFITS OF GMP-GRADE PRODUCT MANUFACTURING AT NEB

NEB's expertise in enzyme manufacturing positions us to best anticipate your needs and minimize the risk of transferring manufacture of your materials to our GMP-grade production facility. Examples of customer requirements that are achieved by our GMP-grade products include:

- Bioburden and/or endotoxin specifications on reagents
- Certified animal-free origin and manufacturing process
- Qualified equipment, utilities, QC test methods and instrumentation to deliver the highest levels of lot-to-lot consistency

### Infrastructure & Approach

- Purpose-built for GMP-grade manufacturing
- Increased manufacturing output
- ISO 8 clean rooms, ISO 5 filling hoods
- Environmental monitoring of the facility
- Animal-free facility

### Manufacturing Processes

- Lateral transfer from Ipswich to Rowley
- Characterized master cell banks
- Ampicillin-free processes
- Dedicated chromatography resins
- 0.22 micron-filtered final product

### Product Attributes/Testing

- TSE/BSE statements – animal-free raw materials, processes and formulation
- Bioburden and endotoxin included for all products, with numerical values provided
- Appearance, protein concentration, gDNA contamination and other current QCs qualified
- Stability testing program
- Contamination and other current QCs qualified

### QA & Regulatory

- ISO 9001 and ISO 13485 certification
- Batch history files/batch records
- Defined CQAs and CPPs
- Enhanced change management and lot disposition processes
- Customer support for regulatory submissions



## GMP-GRADE PRODUCTS FOR NUCLEIC ACID THERAPEUTICS MANUFACTURING AT THE SCALE (µL to L) YOU NEED

	GMP-GRADE PRODUCT NAME	GMP-GRADE PRODUCT DESCRIPTION
<p><b>AMPLIFICATION</b></p>	Q5® Hot Start DNA Polymerase <b>COMING SOON</b>	Composed of a novel polymerase fused to the processivity enhancing Sso7d DNA binding domain, improving speed, fidelity and ultra-low error rates.
	phi29 DNA Polymerase <b>COMING SOON</b>	Replicative polymerase from the <i>Bacillus subtilis</i> phage phi29 and has exceptional strand displacement and processive synthesis properties with inherent 3'→5' proofreading exonuclease activity
<p><b>mRNA SYNTHESIS</b></p>	T7 RNA Polymerase	RNA Polymerase used for <i>in vitro</i> mRNA synthesis, and is highly specific for the T7 phage promoter
	Inorganic Pyrophosphatase ( <i>E. coli</i> )	Catalyzes the hydrolysis of inorganic pyrophosphate to form orthophosphate
	RNase inhibitor (Murine)	Specifically inhibits RNases A, B and C
	DNase I (RNase-free)	DNA specific endonuclease used for removal of contaminating genomic DNA from RNA samples and degradation of DNA templates in transcription reactions
	Vaccinia Capping Enzyme	Adds the m7G-cap (Cap-0) to the 5' end of the triphosphorylated and dephosphorylated RNA
	Faustovirus Capping Enzyme <b>COMING SOON</b>	
	Cap 2'-O-Methyltransferase	Adds a methyl group at the 2'-O position of the first nucleotide adjacent to the cap structure at the 5' end of the RNA
	HiScribe® T7 RNA Polymerase Mix	Separate components available in GMP-grade format
	HiScribe 10X T7 Reaction Buffer	
	ATP	
CTP		
GTP		
UTP		
<p><b>NUCLEIC ACID THERAPEUTICS MANUFACTURING</b></p>	BsaI-HF®v2	Type IIS restriction enzyme optimized for protocols requiring DNA cutting by BsaI
	BspQI	Type IIS restriction enzyme and isoschizomer of LglI and SapI used to linearize plasmid DNA for mRNA therapeutics
	T4 DNA Ligase	Catalyzes the formation of a phosphodiester bond between juxtaposed 5' phosphate and 3' hydroxyl termini in duplex DNA or RNA. Joins blunt end and cohesive end termini as well as repair single stranded nicks in duplex DNA and some DNA/RNA hybrids
	T4 DNA Ligase Reaction Buffer	
	NEBuffer™ 4	
	T5 Exonuclease	Double-stranded DNA specific exonuclease and single-stranded DNA endonuclease, initiates at the 5' termini of linear or nicked double-stranded DNA
	TelN Protelomerase <b>COMING SOON</b>	Cuts dsDNA at a TelN recognition sequence and leaves covalently closed ends at the site of cleavage
	rCutSmart™ Buffer <b>COMING SOON</b>	
	NEBuffer® r3.1	

**Note:** Comparability report supporting migration from RUO to GMP-grade products for clinical production are available.

## From research to therapeutic production, NEB's GMP-grade portfolio will meet your needs.

NEB's portfolio of research-grade and GMP-grade reagents support microgram scale research production to gram scale therapeutic mRNA production. Our optimized HiScribe kits enable convenient *in vitro* transcription (IVT) workflows. When it is time to scale up and optimize reaction components, our standalone reagents are readily available in formats matching our GMP-grade offering, enabling a seamless transition to large-scale therapeutic manufacturing.



To inquire about custom formats or GMP-grade product manufacturing, contact us at

[www.neb.com/forms/contact-the-customized-solutions-team](http://www.neb.com/forms/contact-the-customized-solutions-team)

Learn more at

[www.neb.com/GMP](http://www.neb.com/GMP)