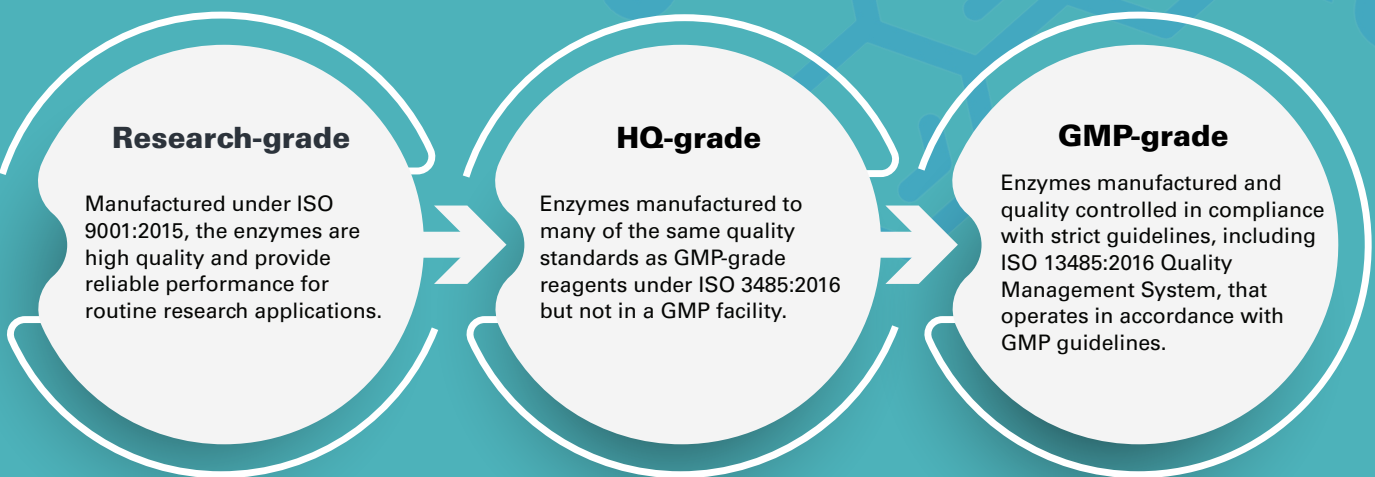


SEAMLESS RNA PRODUCTION—FROM DISCOVERY TO DELIVERY—WITH HIGH-QUALITY (HQ) ENZYMES

Adopt HQ-grade enzymes early during preclinical studies and process development to transition seamlessly to large-scale mRNA manufacturing with GMP-grade enzymes.

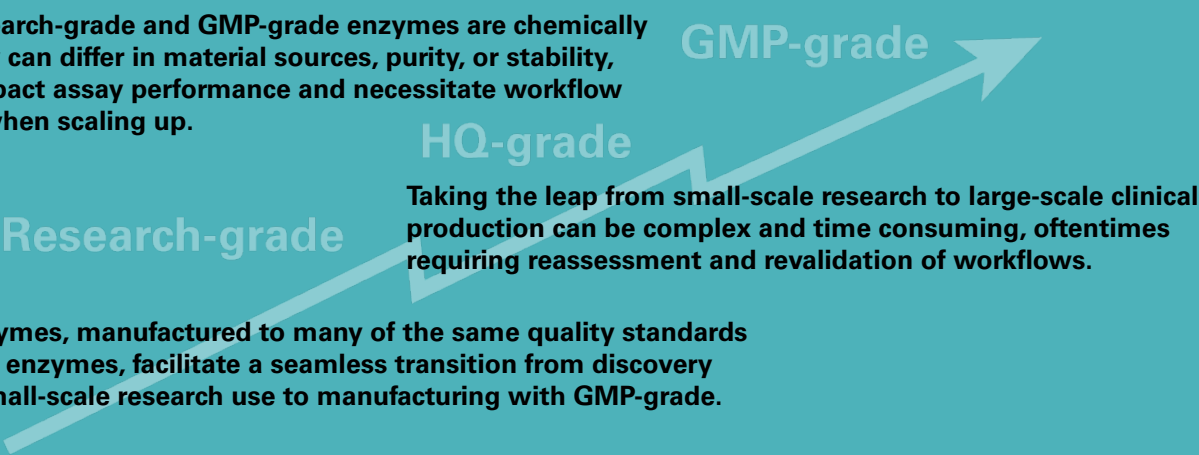
Using the appropriate grade of enzyme for each stage of development helps you scale up faster and within budget



Drawbacks of scaling up mRNA production with research-grade enzymes

- Small package sizes are not ideal for large-scale reaction workflows
- Lot-to-lot variability in production can impact reproducibility
- Inconsistency with GMP-level quality assurance may slow down your scale-up process

Although research-grade and GMP-grade enzymes are chemically identical, they can differ in material sources, purity, or stability, which can impact assay performance and necessitate workflow revalidation when scaling up.



Compare the three grades of enzymes		How HQ-grade enzymes help
Purity	Research-grade + HQ-grade ++ GMP-grade +++	✓ Documented purity and rigorous testing to support preclinical studies
Size	Research-grade <1 ml HQ-grade ≥1 ml GMP-grade 1 ml ~100 ml	✓ Streamlined scale up and lot testing with larger package sizes
Cost	Research-grade \$ HQ-grade \$\$ GMP-grade \$\$\$	✓ Compliance with many GMP-grade quality standards while maintaining a lower cost

HQ-grade enzymes are the perfect solution for scaling up to therapeutic development stages—whether preclinical testing or process development—when GMP-grade reagents aren’t required

		Therapeutic development stage		
		Research	Development	Manufacturing
Quality feature	Evaluation stage	Research-grade	HQ-grade	GMP-grade
Exonuclease and endonuclease free	Final formulation	✓	✓	✓
Purity testing <ul style="list-style-type: none">• Endotoxin, bioburden• Host cell-derived DNA/ RNA contamination	Final formulation	-	✓	✓
AOF: animal- and human-origin free	Final formulation	-	✓	✓
	Raw materials	-	-	✓
β-lactam free	Final formulation	-	✓	✓
	Raw materials	-	-	✓



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