# Supporting the Vaccine Product Lifecycle through Standards

Kevin Carrick, PhD | Global Biologics | Oct 17, 2024

# United States Pharmacopeia Biologics Supporting Vaccines

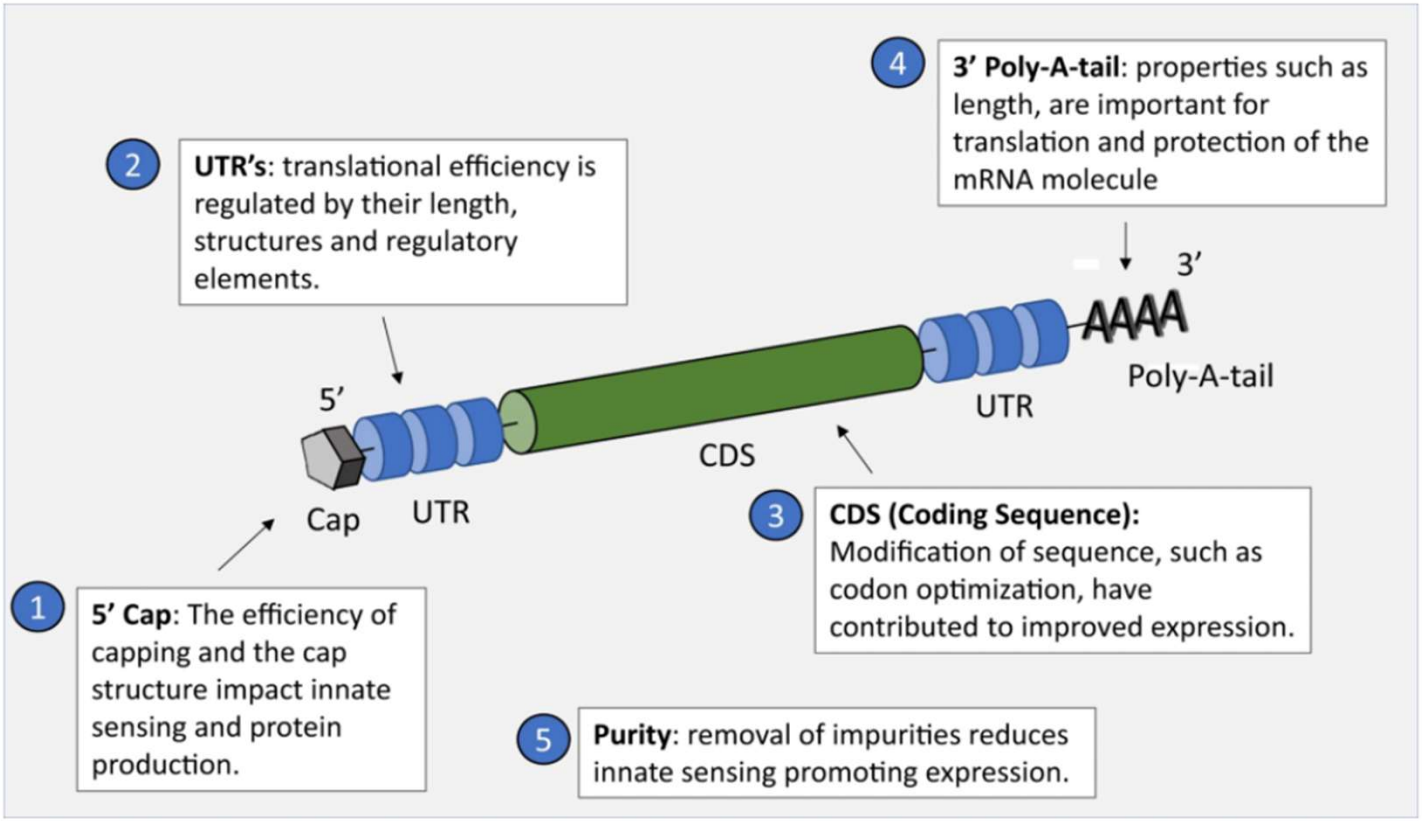
USP Independent Scientific Standard Setting for over 200 years

Support development, manufacturing, regulation and distribution of vaccines globally

1. **Developing** standards, publications, and other guidance supporting potential vaccines and treatments
2. **Expanding** collaborations to provide these tools and facilitate global access to quality vaccines
3. **Supporting** analytical and regulatory systems and workforce capabilities of our partners

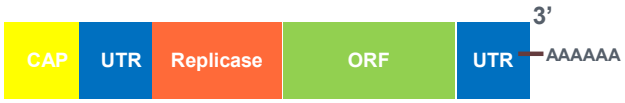
- Collaborate with stakeholders to build awareness and consensus on quality
- Utilize innovative approaches to gather feedback, methods and materials
- Leverage science and global reach to maximize impact
- Partner to enhance use of international best practices for informed decision making

# Quality Attributes for mRNA Drug Substance




**Non-replicating mRNA (NRM)**

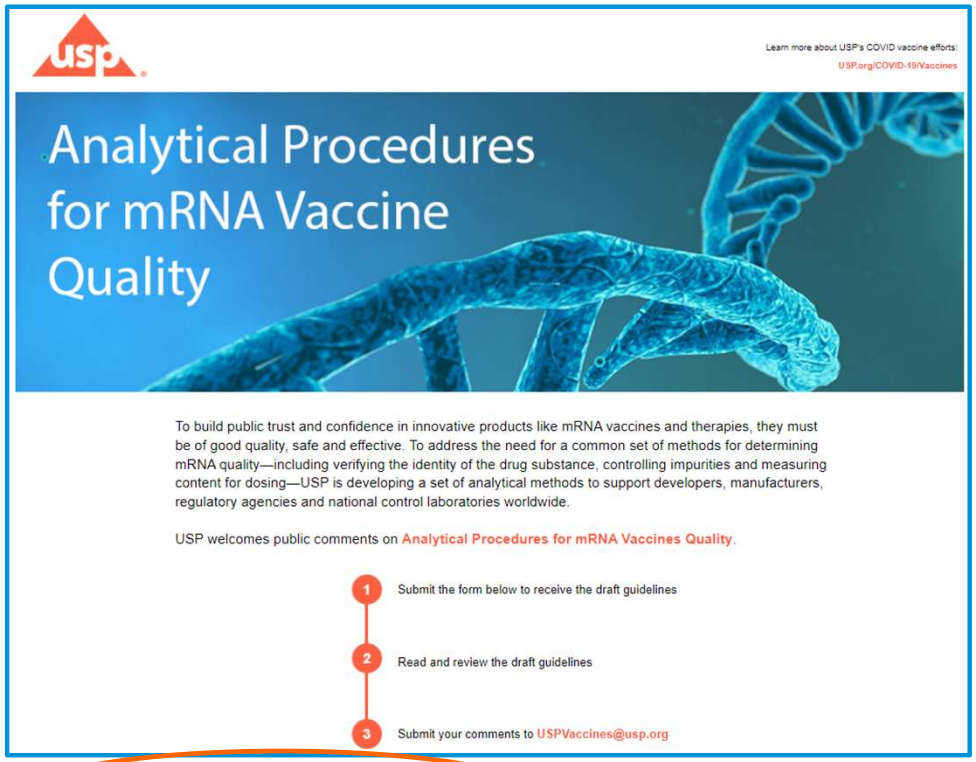

**Self-amplifying mRNA (SAM)**




Source: npj Vaccines 5, 11 (2020). https://doi.org/10.1038/s41541-020-0159-8

# USP Identified Analytical Quality Attributes for mRNA Drug Substance and mRNA Vaccine – Draft guidelines

Includes multiple method options for the same attribute




Available Online at: www.usp.org/mrna-quality

**Table 2. Characterization and release testing for mRNA Drug Substance**

| Quality | Attribute | Method |
|---|---|---|
| Identity | mRNA sequence identity confirmation | *High throughput sequencing (HTS) |
| | | Sanger sequencing |
| | | Reverse Transcriptase – PCR (RT-PCR) [V] |
| Content | RNA concentration | Quantitative PCR (qPCR) |
| | | digital RT-PCR (RT–dPCR) |
| | | Ultraviolet Spectroscopy (UV) |
| Integrity | mRNA integrity | Fragment Analyzer [D] |
| | | Capillary gel electrophoresis (CGE) [DV] |
| | | Agarose gel electrophoresis |
| Purity | 5′ capping efficiency | Liquid chromatography mass spectroscopy (LC-MS) [D] |
| | | *Reverse-phase liquid chromatography mass spectroscopy (RP–LC-MS/MS) [D] |
| | | *Ion pair reverse-phase high-performance liquid chromatography (IP-RP-HPLC) |
| | 3′ poly(A) tail length | *Ion pair reverse-phase high-performance liquid chromatography (IP-RP-HPLC) |
| | | Liquid chromatography - mass spectroscopy (LC-MS) [DV] |
| | mRNA purity | Ion pair reverse-phase high-performance liquid chromatography (IP-RP-HPLC) [DV] |
| | Product related impurities - dsRNA | *Immunoblot [DV] |
| | | *Enzyme-linked immunosorbent assay (ELISA) |
| | Product related impurities - percentage of fragment mRNA | *Size exclusion-high-performance liquid chromatography (SEC-HPLC) [D] |
| | | *Reverse-phase HPLC (RP-HPLC) [D] |
| | Process related impurities - residual DNA template | quantitative PCR (qPCR) |
| | **Process related impurities – quantitation of free/non-incorporated nucleosides | Anion-exchange chromatography (AEX-HPLC) [DV] |
| | | *Reverse-phase liquid chromatography mass spectroscopy (RP–LC-MS/MS) [D] |
| | Residual proteins | Enzyme-linked immunosorbent assay (ELISA) |
| Safety | Endotoxin | USP <85> |
| | Bioburden | USP <61>, <62>, <1115> |
| Other | Appearance | USP <790> |
| | pH | USP <791> |

# Amplify your impact as a USP Expert Volunteer

Share your expertise, knowledge, and experience with others from around the world.

Learn more and find out how to apply

**Bit.ly/USPExpertVolunteer**