curia

End-to-end solutions for mRNA vaccines and therapeutics

With our scale and experience in both chemistry and biologics, Curia is uniquely positioned to provide mRNA drug development solutions.

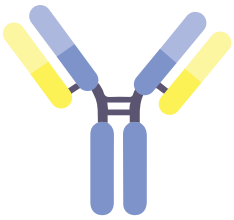
Our expertise spans discovery and engineering, mRNA drug substance, formulation and fill-finish, and manufacturing of lipids and nucleosides/nucleotides.

Curia has successfully produced high quality mRNAs up to 16 kb.

We have extensive assay and analytical capabilities in-house for in-process testing and batch release of mRNA drug substance and drug product.

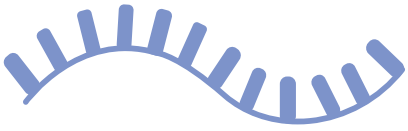
Integrated solutions for biologics

CURIA OFFERS SOLUTIONS THAT SPAN DISCOVERY, ENGINEERING, DEVELOPMENT AND CLINICAL MANUFACTURING



ANTIBODIES

PROTEINS



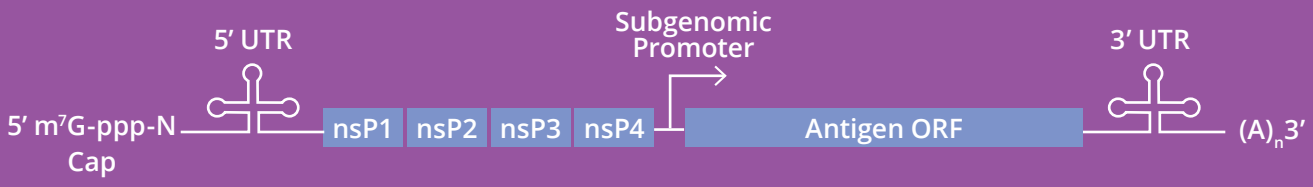
mRNA

DISCOVERY	ENGINEERING	DEVELOPMENT	MANUFACTURING
• Multiple antibody platforms • IgG, scFv, Fab, VHH, etc. • Screening • Characterization	• Construct design • Molecular cloning • Biologics production for preclinical studies (varying scales) • Characterization	• Cell line development • Upstream PD • Downstream PD • Formulation • Engineering runs • Analytical development	• Drug substance • Drug product • Phase I & II • Release testing

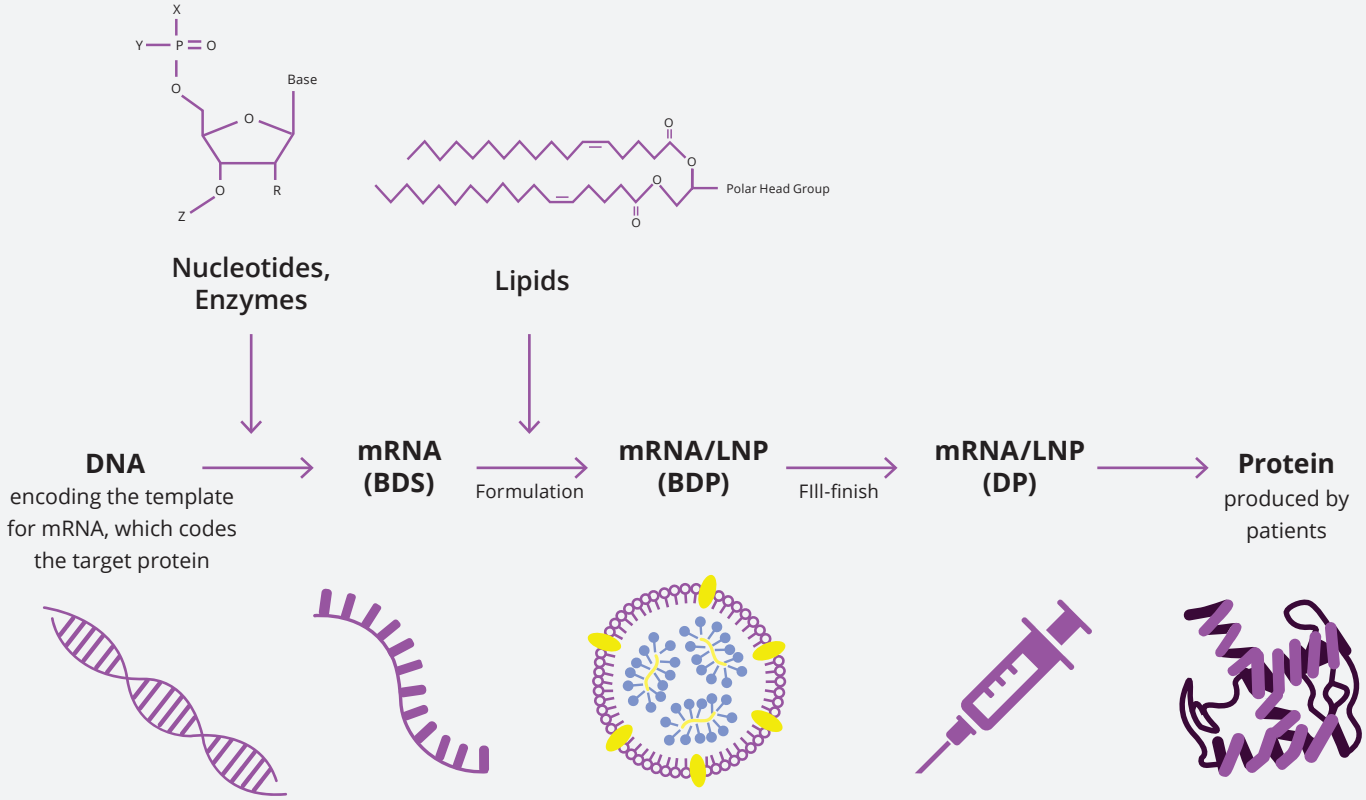
Structures of conventional and self-amplifying mRNA

CONVENTIONAL NON-AMPLIFYING mRNA

SELF-AMPLIFYING MRNA: >9KB

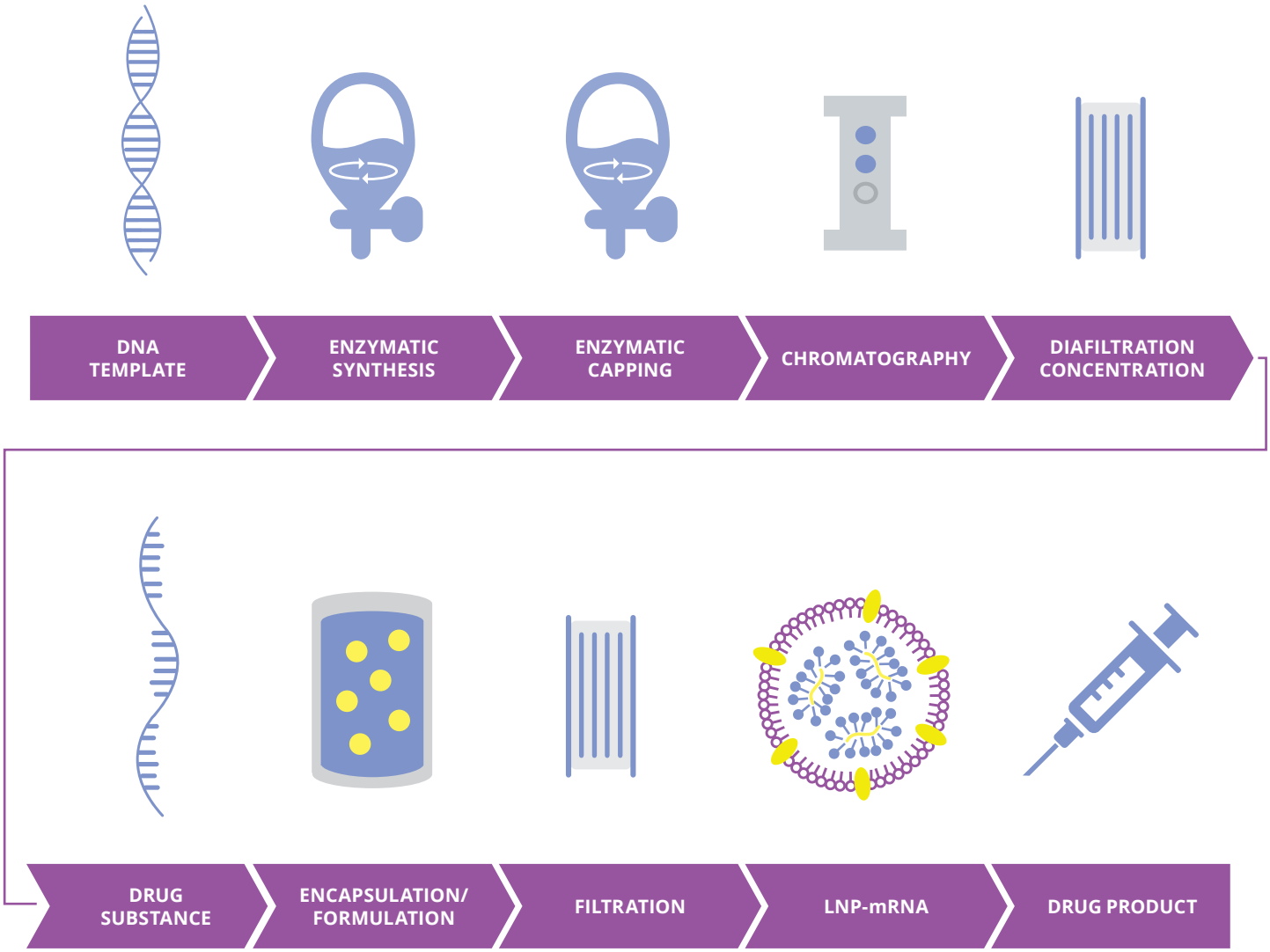


Major steps in making mRNA therapeutics



Manufacturing mRNA-based vaccines and therapeutics

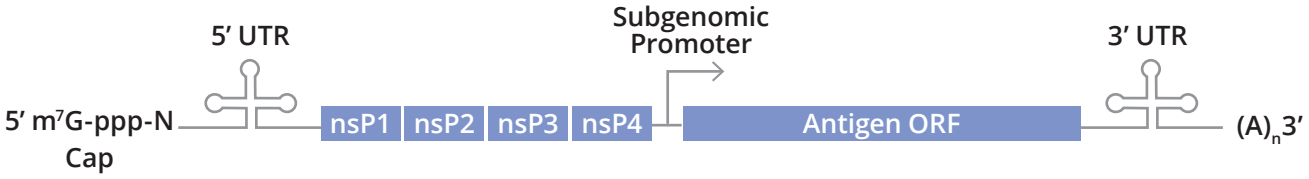
DOES NOT REQUIRE COMPLEX CELL CULTURE, COMPLEX PURIFICATION, OR NOVEL EQUIPMENT



- Well-defined composition and high-purity RNA
- Manufacturing of drug substance can be completed in 1-2 days using single-use consumables
- Yields of 4-5 grams/liter, translating to 40,000-50,000 doses for saRNA and 4,000-5,000 for traditional RNA

Features of Curia's mRNA development and manufacturing services

- DNA template engineering
- Cell-free, enzymatic synthesis
- Free of animal-derived raw materials
- Short and long RNAs
  - » Self-amplifying RNA (saRNA): typically 9-16 kb
  - » Non-amplifying RNA: typically 1-6 kb
- Manufacturing to support clinical development
- 0.1 to 8 L scale (current)
- Expanding capacity to 50 L
- Full assays and analytics on-site for in-process testing and batch release



Bulk drug substance mRNA manufacturing capabilities

- GMP-compliant, single-use equipment
- Cell-free mRNA manufacturing
- Up to 8L scale
- ISO7 suite
- Expertise in self-amplifying mRNA production
- Onsite analytics for in-process testing and batch release

RCB GENERATION, DNA PRODUCTION AND LINEARIZATION

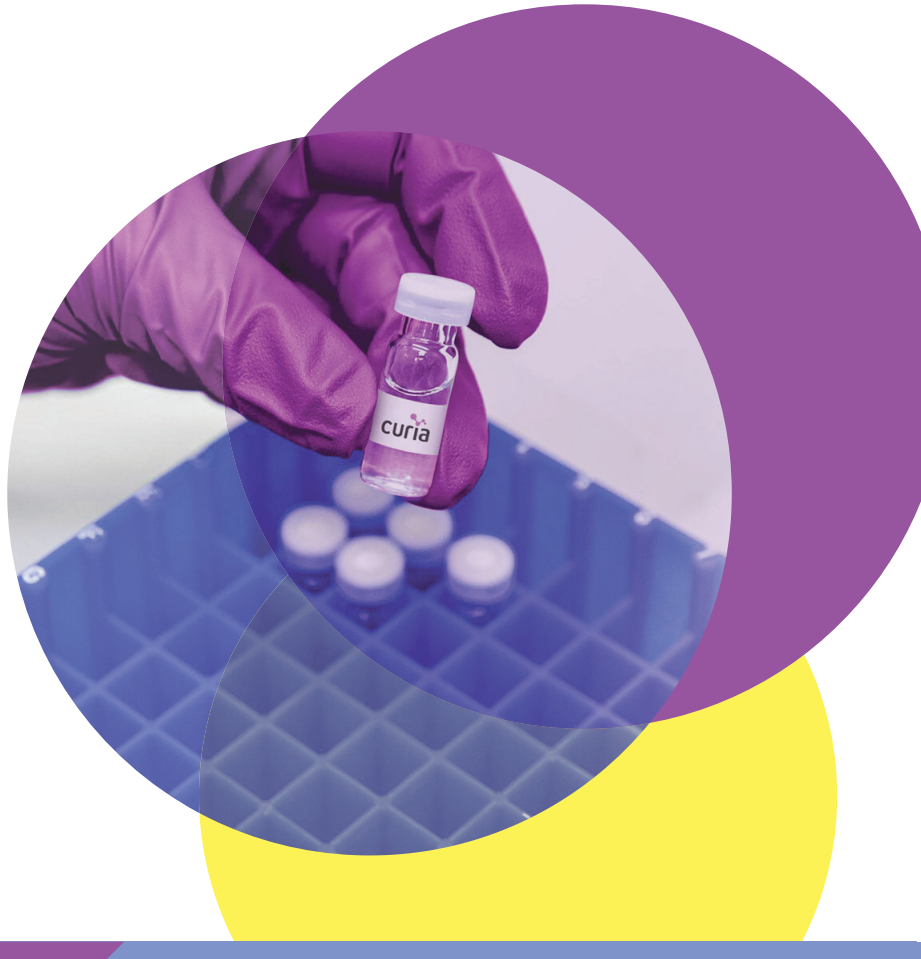
mRNA IVT SCOUTING	PILOT PROGRAM PRODUCTION	PROCESS DEVELOPMENT	PRODUCTION RUN
8-10 weeks	**1-2 weeks**	**1-2 weeks**	**2-4 weeks**	**1-2 weeks**
Plasmid DNA template	Small scale optimization and production level proof-of-concept	Target small scale deliverable / purification optimization	Target client specific quantity for GMP run Scale-up process for analysis and downstream development GMP compliant batch record creation	Repeat of engineering run conditions in GMP suite Execution of process as developed in engineering run and deliverable of GMP grade bulk material

mRNA assays and analytics at Curia

Test	Purpose	Assay
Appearance	Safety, quality	Visual Inspection
Bacterial Endotoxin	Safety, quality	Chromogenic LAL
Sterility (w/BnF)	Safety, quality	1 mL x 2 Direct Inoculation
pH	Safety, quality	pH
Osmolality	Safety, quality	Osmolality
RNA Concentration	Strength	UV A260
RNA Identity	Identity	CE-Based
Identity (as RNA)	Identity	Enzyme Degradation and CE
Residual Protein	Purity	BCA Protein Assay
Residual DNA	Purity	qPCR
Residual DS RNA	Quality	Dot Blot
RNA Integrity	Strength	Capillary Electrophoresis
% Cap	Strength	LC-MS
Functional Assay	Strength	Optional

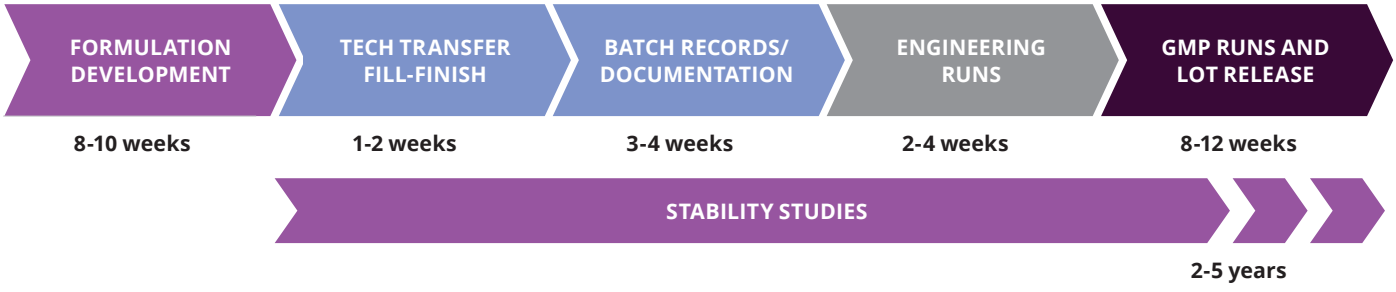
Drug product

- Formulation, fill-finish, lyophilization process development (disposable product contact manufacturing train available)
- mRNA-LNP formulation development expected in 4Q 2022
- Manufacturing for Phase I & II clinical trials
- Tech transfer
- Engineering runs
- Validation
- Novel processes



DRUG PRODUCT FORMULATION DEVELOPMENT AND MANUFACTURING

- EU Grade A environment
- Vial size: 2-30cc
- Fill volume: 0.2-32 mL
- Max batch size:
  - » Liquid: 20,000 units
  - » Lyophilized: 1200- 5,000 (2 cc to 20 cc)
- Onsite analytics for in-process testing and batch release



Lipid manufacturing

DEVELOPMENT

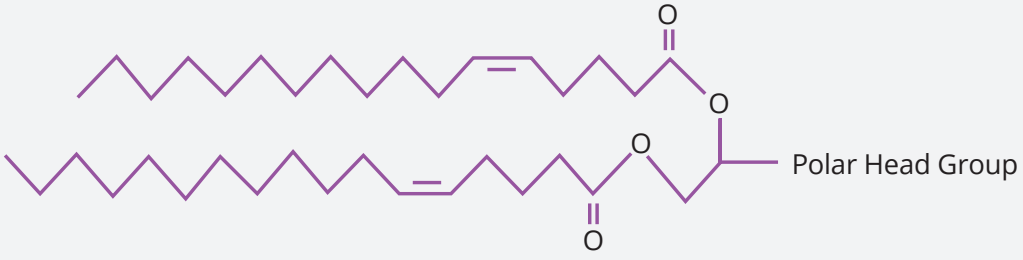
- International plants focused on process development and analytical services
- Scale-up to 10 kg (non-GMP and GMP)
- MF-UF-NF, chromatography development (1-500L)
- Focus on custom ionizable, PEG and phospholipids
- Extensive analytical capabilities

COMMERCIAL MANUFACTURING

- Multiple lines for manufacturing
- Multiple chromatographic columns in various sizes – semi-automated – 14 L to 500 L each for normal phase, reverse phase, and ionic bed
- Cold storage for lipids and packaging configurations to accommodate various volume split needs

FLEXIBLE OPTIONS

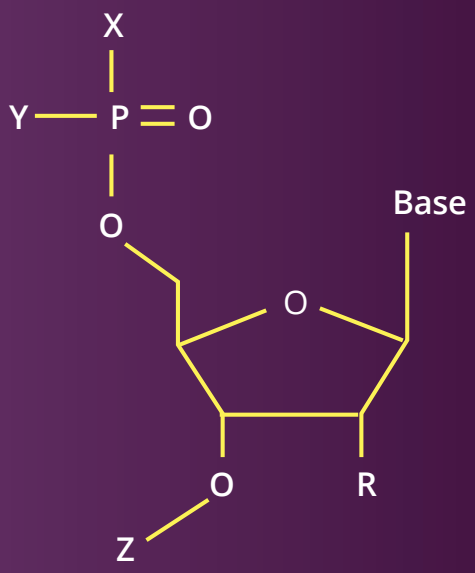
- Site selection based on the unique process, analytical, and chromatographic needs of each program
- Multiple teams and parallel activities are planned to compress timelines when appropriate
- Expedition of any regulatory needs
- Established RM supply chain

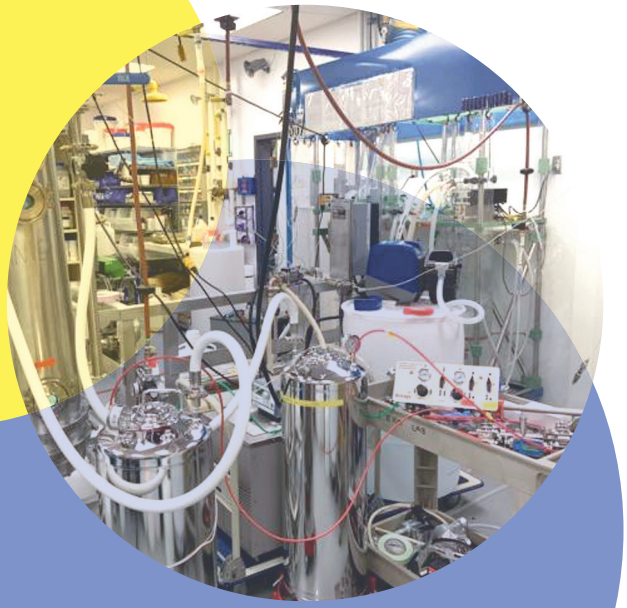


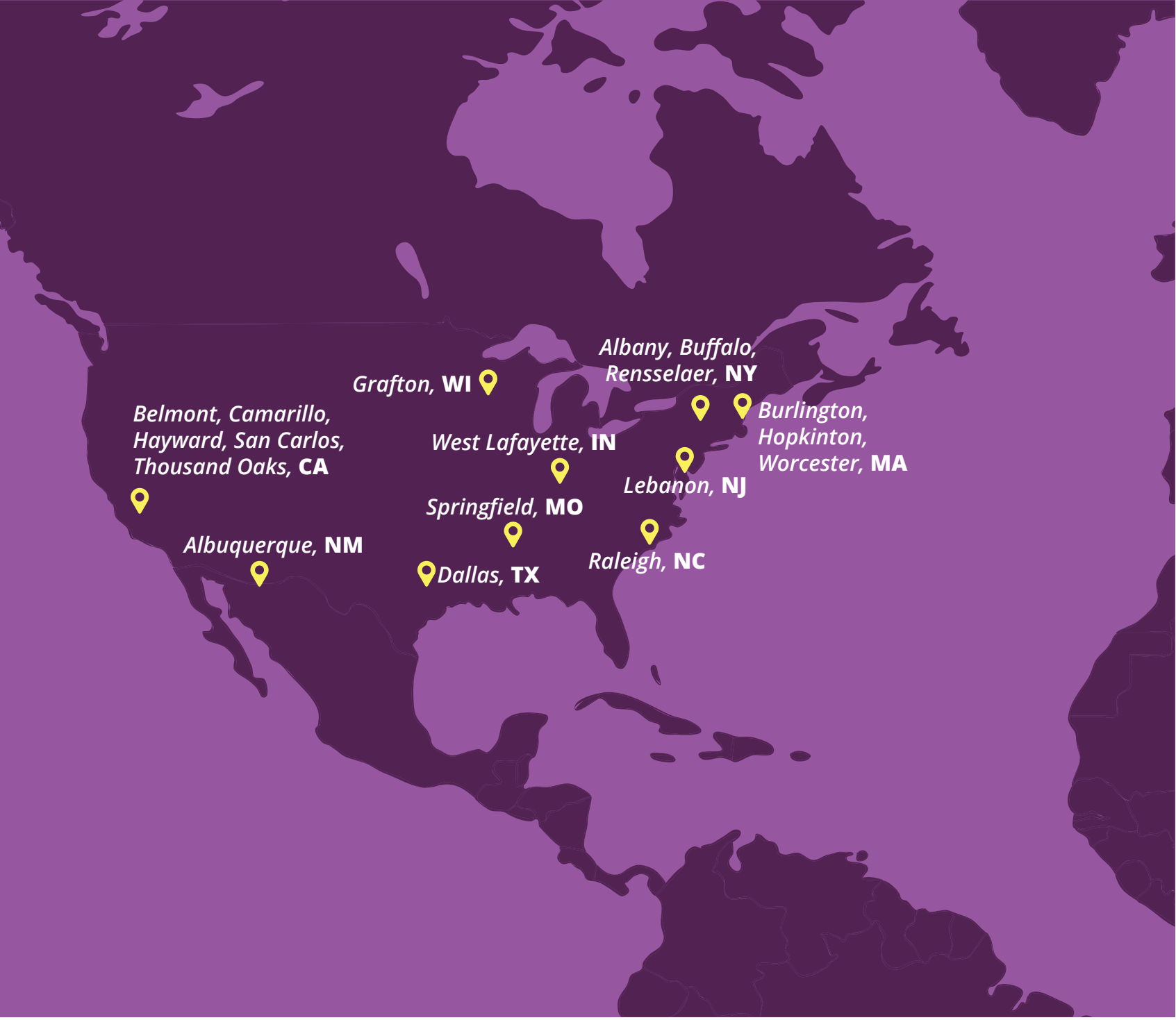
Ionizable Cationic PEG-conjugates Phospholipids Steroid analogs

Nucleoside/nucleotides chemistry and manufacturing capabilities

- Monomer and oligomer manufacturing
- Kilogram scale with ion exchange chromatography and TFF purification
- cGMP manufacturing
- Expertise in development and manufacturing of modified nucleosides
- Guanosine caps
- Novel nucleotides







DISCOVERY

Albany, NY
Buffalo, NY
Hyderabad, India
San Carlos, CA
Belmont, CA
Worcester, MA

DEVELOPMENT

Albany, NY
Hopkinton, MA
Worcester, MA
Grafton, WI
Frankfurt, Germany
San Cristóbal, Spain
Belmont, CA
Hayward, CA
San Carlos, CA
Hyderabad, India

LAB TESTING SERVICES

Albany, NY
West Lafayette, IN
Lebanon, NJ
San Carlos, CA
Hayward, CA
Valladolid, Spain
Hyderabad, India

API MANUFACTURING

Springfield, MO
Grafton, WI
Rensselaer, NY
Bon-Encontre, France
Tonneins, France
Frankfurt, Germany
Aurangabad, India
Origgio, Italy
Rozzano, Italy
Valladolid, Spain

DRUG PRODUCT

Camarillo, CA
Thousand Oaks, CA
Burlington, MA
Albuquerque, NM
Glasgow, UK

29 global locations

>3,700 employees

COMMITMENT TO SCIENCE

+600 chemists
+230 biologists
+285 senior scientists
+435 quality & regulatory specialists

ABOUT CURIA

Curia is a Contract Development and Manufacturing Organization with over 30 years of experience, an integrated network of 29 global sites and over 3,500 employees partnering with customers to make treatments broadly accessible to patients. Our biologics and small molecule offering spans discovery through commercialization, with integrated regulatory and analytical capabilities. Our scientific and process experts and state-of-the-art facilities deliver best-in-class experience across drug substance and drug product manufacturing. From curiosity to cure, we deliver every step to accelerate and sustain life-changing therapeutics. ***Learn more at curiaglobal.com***

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CONTACT US

www.curiaglobal.com