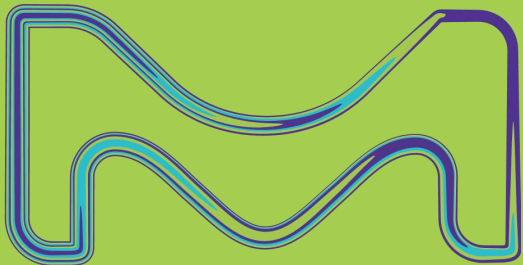


# WHO mRNA Technology Transfer Programme

**Merck Solutions at every level**

Andrew Clutterbuck, Sven Verguts  
Cape Town – 18/04/2023



**MERCK**

# Agenda

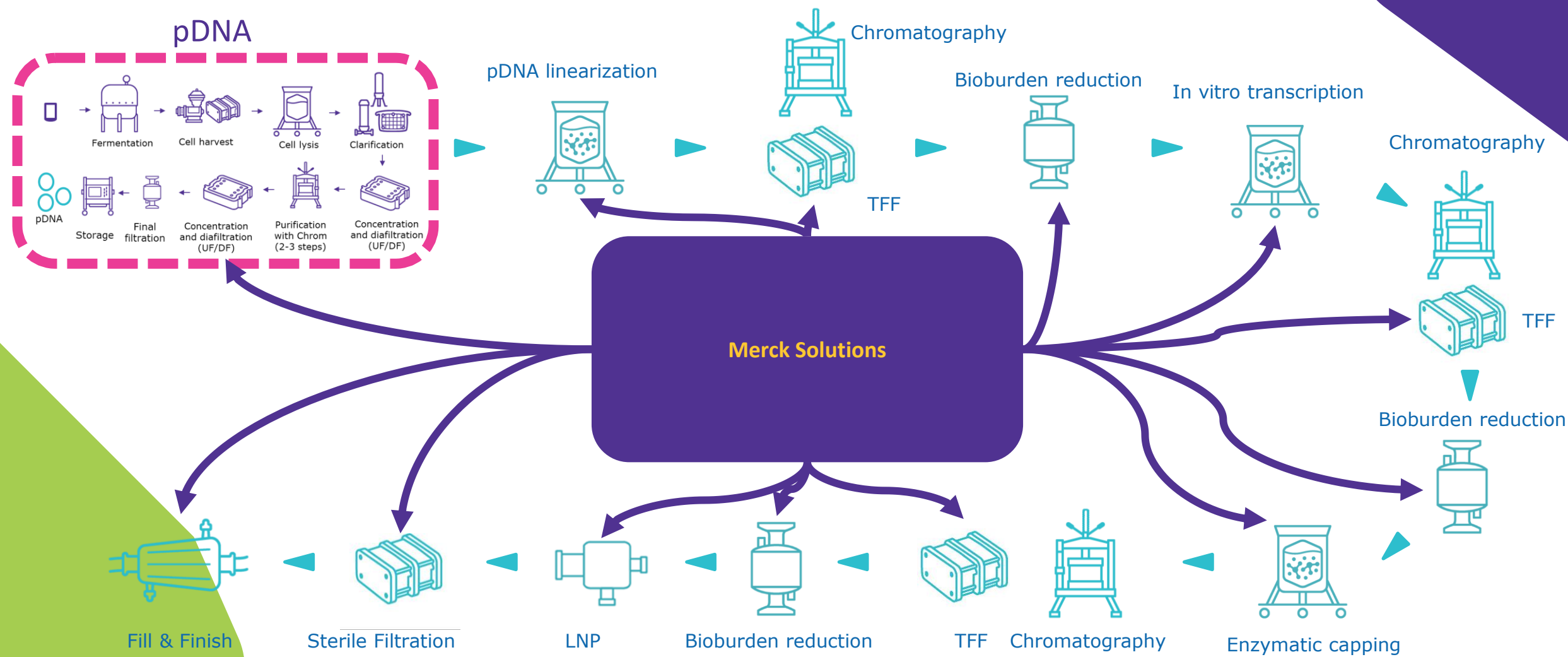
<b>1</b>	<b>mRNA Process Overview</b>	<b>3</b>
<b>2</b>	<b>Merck Solutions</b>	<b>5</b>
	<b>2.1 Technical Solutions for mRNA</b>	<b>7</b>
	<b>2.2 Merck Support</b>	<b>12</b>

# mRNA Process Overview

1

# mRNA Process Overview

## Merck offers process wide solutions



# Merck Solutions

2

# Merck Solutions

## Merck assures in depth support

### Technical Solution



Pellicon® Capsules

- Plug and play
- Gamma sterilized
- Easily scalable

### Optimisation



Expert support

- On site Process Development scientists
- M Lab™ Collaboration centres

### Implementation



Training & troubleshooting

- Virtual & classroom training
  - Troubleshooting

# Technical Solutions for mRNA

## 2.1

# Technical solutions for mRNA

## Solutions at every level

### Make

### Purify

### Formulate

### Assure

#### mRNA transcription



Oligos  
Reagents  
**Mixers**  
Sampling solutions  
Product characterization  
Validation services

#### Plasmid DNA removal



Buffers  
Benzonase®  
endonuclease  
Depth filters  
Pleated filters  
**Single-use systems**  
Validation services

#### Chromatography



Clean-in-place  
solutions  
**Solvents &  
Buffers**  
Ion exchange  
chromatography  
resins  
Membrane-based  
chromatography  
Single-use systems  
& multi-use skids  
Mixers  
Storage assemblies  
Validation services

#### Tangential flow Filtration



Clean-in-place  
solutions  
Buffers  
**TFF cassettes  
and capsules**  
Single-use  
systems &  
multi-use skids  
Mixers  
Storage  
assemblies  
Validation  
services

#### Encapsulation & Formulation



Excipients  
**Lipids**  
Buffers  
Mixers  
Storage  
assemblies  
Sampling  
solutions  
Validation  
services

#### Sterile or bioburden Filtration



Sterilizing filters  
Housings  
Integrity testers  
Storage  
assemblies  
Sterile  
connectors  
Sampling  
solutions  
Validation  
services

#### Final Fill



Single-use final  
fill assemblies  
Storage  
assemblies  
Biosafety  
testing  
Lot release  
testing  
**Validation  
services**

- Millipore® Products
- SAFC® Products
- BioReliance® Services



# Technical solutions for mRNA

## Emprove® Suite

### Material Qualification Dossier

- General information
- Manufacturing flow chart
- Product characterization and qualification
- Specification, release criteria a
- Materials of construction
- Extractables summary
- Residual solvents statement
- Elem. Impurities statement
- Regulatory statements (AO, Allergens...)

**Information to start a material qualification**

### Quality Management Dossier

- Quality Self Assessment
- Supplier and CMO management
- Shelf life testing and results
- Packaging and Sterility Validation

**Answers questions during risk assessment**

### Operational Excellence Dossier

- Full Extractables profile
- Elemental Impurity (ICH Q3D)
- Analytical procedure

**Supports process optimization**



# Technical solutions for mRNA

## Lipid nanoparticle formulations



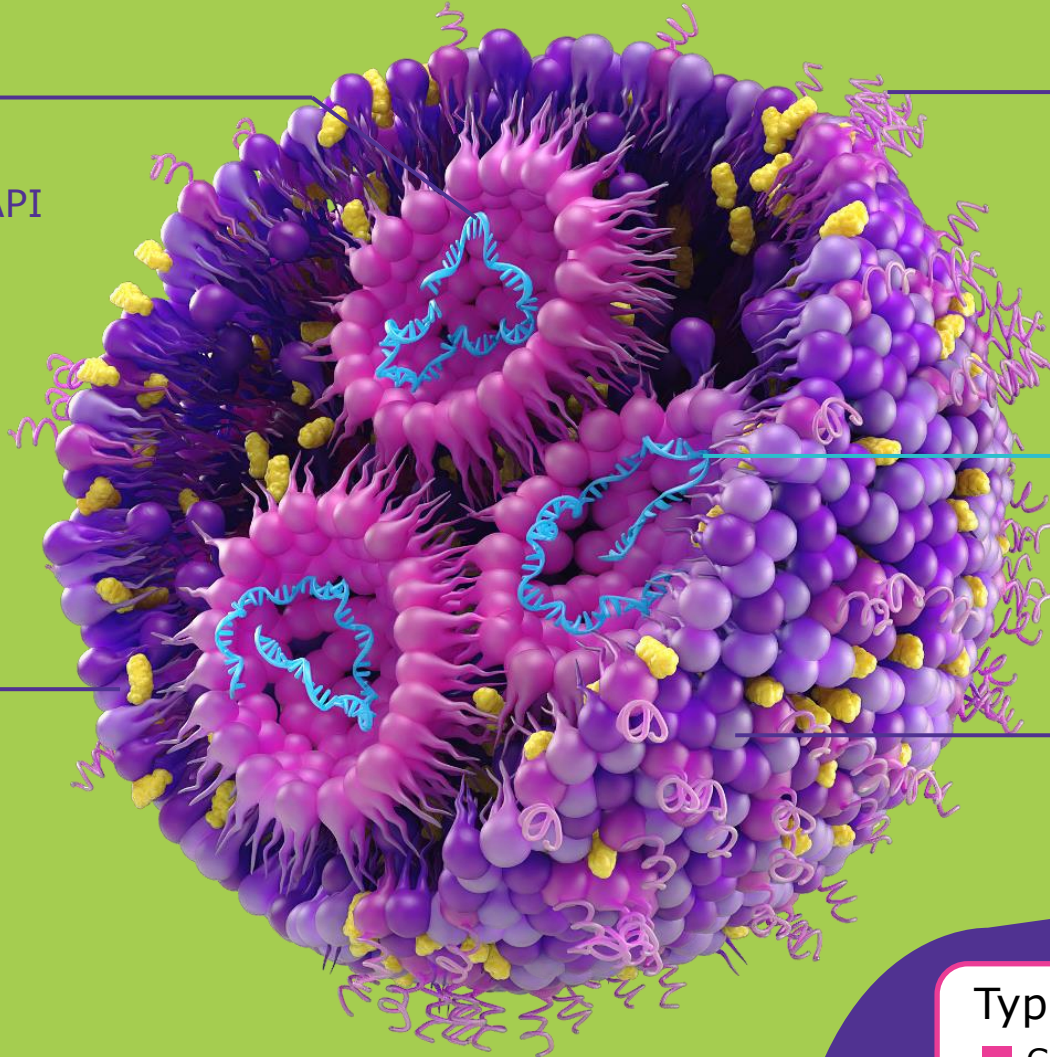
### Cationic/ Ionizable lipids

- Encapsulation of API
- Release in cell



### Cholesterol

- Structural support
- Rigidity



### PEG lipids



- Higher stability
- Longer circulation

### mRNA





### Helper lipids



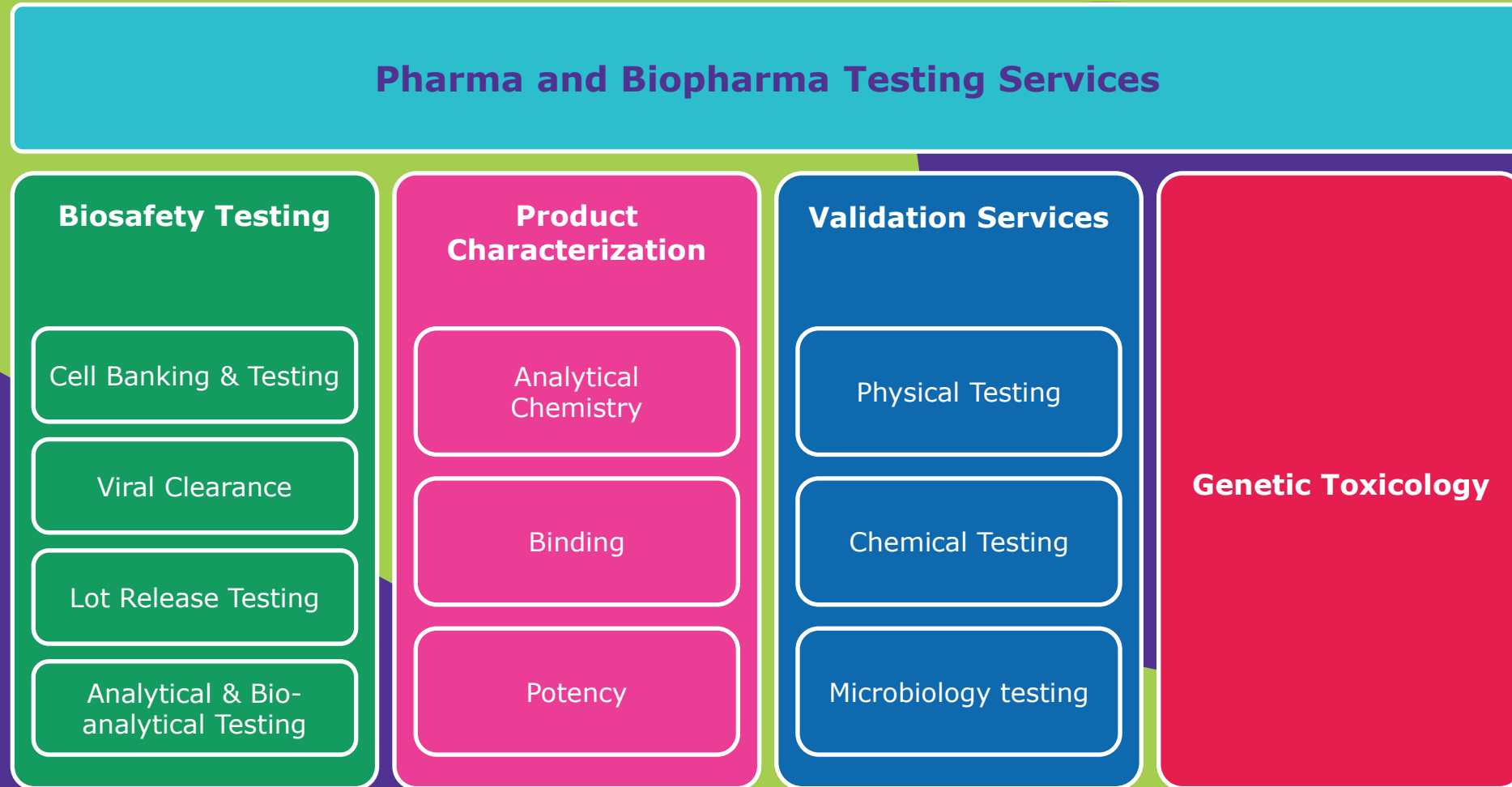
- Structural support
- Several in portfolio

Typically supported by

-  Custom manufacturing
-  Portfolio

# Technical solutions for mRNA

## BioReliance® pharma and biopharma testing services



Merck Support

2.2

# Merck Support

## Merck assures in depth support

### Technical Solution



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### Implementation



Training & troubleshooting

- Virtual & classroom training
- Off site troubleshooting

# Merck Support M Lab™ Collaboration centres



**Molsheim,**  
France

**Songdo IBC,**  
Incheon, S. Korea

**Tokyo,**  
Japan

**Mumbai,**  
India

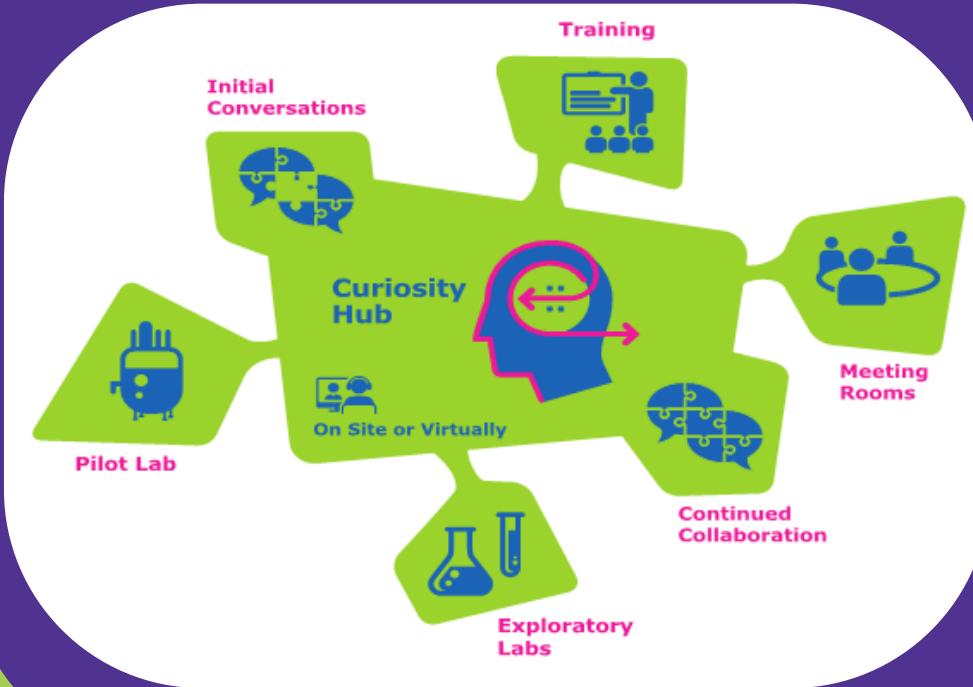
**Shanghai,**  
China

**Bangalore,**  
India

**Singapore**

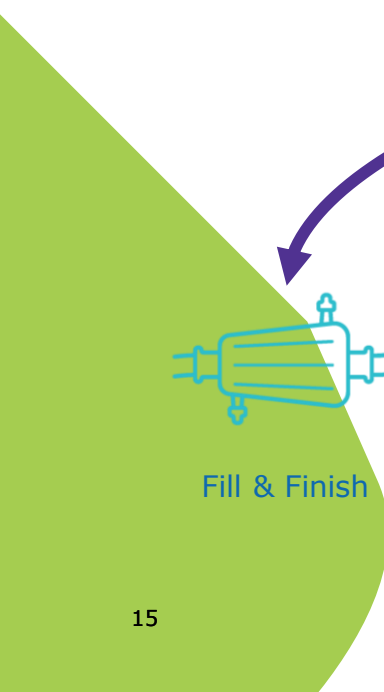
**Sao Paulo,**  
Brazil

**Burlington,**  
USA





## Merck offers process wide solutions



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