



# Vaccine

**Creating Efficiency & Maintaining Quality  
to Accelerate Your Vaccine Manufacturing**



# Introduction

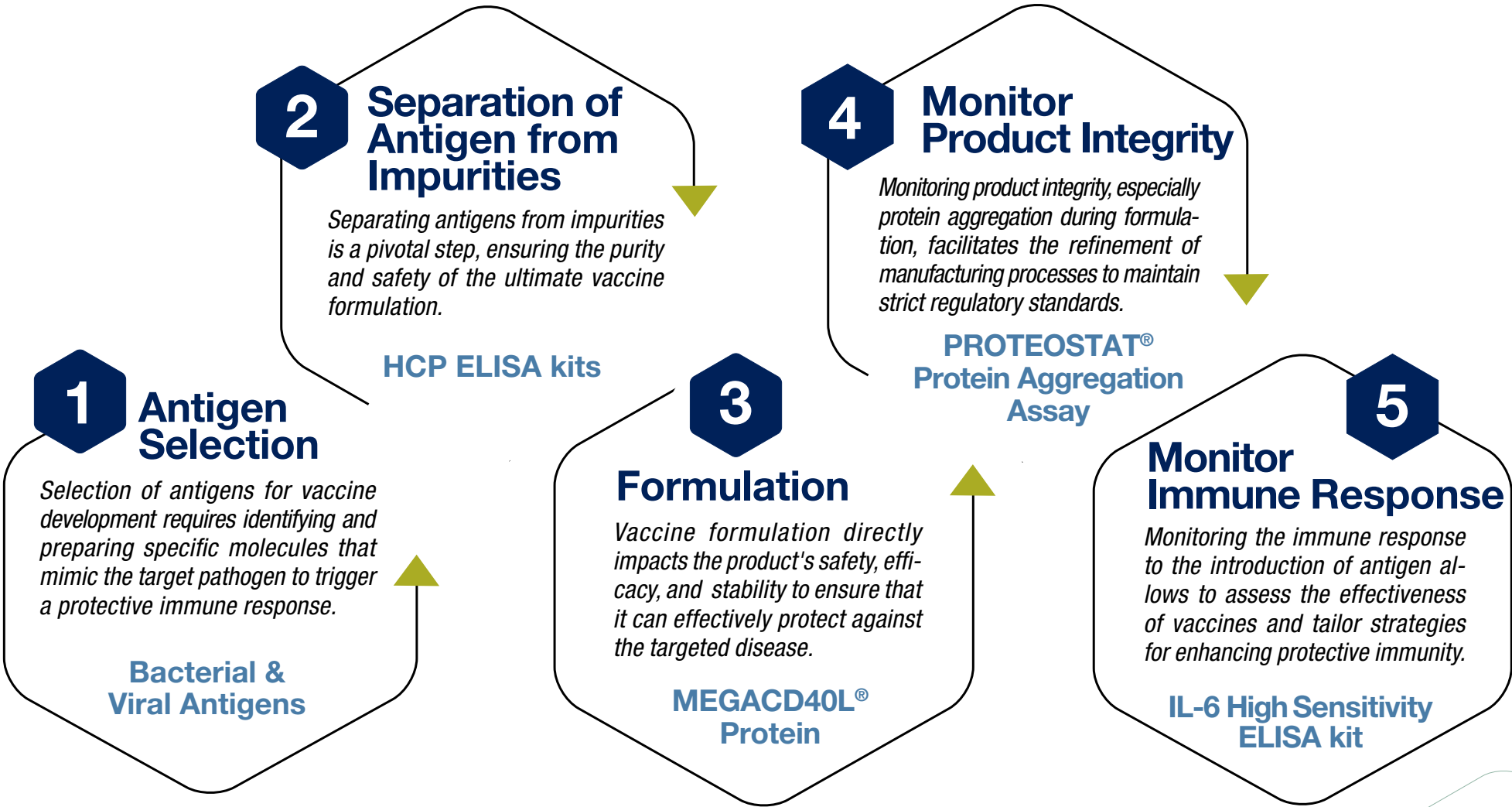
Vaccine-driven immunity is a multifaceted puzzle. The focus on designing antigens stems from our evolving comprehension of how they trigger diverse immune responses. Moreover, the rapid rise of messenger RNA (mRNA) vaccines, built on groundbreaking mRNA technology, has ushered in new possibilities for treating conditions like cancer and infectious diseases.

Vaccines encompass diverse modalities, incorporating live attenuated or inactivated organisms, as well as formulations derived from partially purified components. The forefront of vaccine innovation now involves the development of RNA and DNA vaccines, representing the latest strides in harnessing genetic material to induce targeted immune responses.

Whether your vaccine development journey involves bacterial, viral, or nucleic acid molecules, we provide the tools to help improve yields, lower costs, ensure quality, and cut down your manufacturing process.

High-quality vaccine research and manufacturing products that consistently yield reproducible results, ensuring efficiency in time, effort, and cost reduction in every lot.

# Creating Efficiency and Maintaining Quality to Accelerate Vaccine Manufacturing



# Antigen Selection

## OPTIMIZED EXPRESSION SYSTEMS DELIVER SUPERIOR ANTIGENICITY

Generating and validating antigens for vaccine development requires selecting and preparing specific molecules that mimic the target pathogen to trigger a protective immune response.

Enzo offers various native-state bacterial and viral antigens for vaccine research. These are native or recombinant proteins produced in the latest expression systems to ensure high-level expression, maintenance of their native-folded state, and retention of all relevant post-translational modifications (PTM).

### Native Bacterial and Viral Antigens

- Higher specificity and sensitivity
- Reproducible scale-up and lot-to-lot consistency
- Lyophilized format for extended shelf-life

## Structure of Pertussis Toxin



Pertussis toxin is a protein-based exotoxin that causes whooping cough, produced by the bacteria *Bordetella pertussis*.

## Ordering Information

<b><i>C. trachomatis</i> native antigen</b>	<b>ALX-630-124</b>
<b>Adenovirus type 5 hexon protein</b>	<b>ALX-630-120</b>
<b>Adenovirus type 40 antigen</b>	<b>ALX-630-121</b>
<b>Pertussis toxin (<i>Bordetella pertussis</i>)</b>	<b>BML-G100</b>
<b><i>C. difficile</i> toxin A</b>	<b>BML-G140</b>
<b><i>C. difficile</i> toxin B</b>	<b>BML-G150</b>
<b><i>C. difficile</i> toxoid A</b>	<b>BML-G145</b>
<b><i>C. difficile</i> toxoid B</b>	<b>BML-G155</b>
<b>Cytomegalovirus (CMV) native antigen</b>	<b>ALX-630-125</b>
<b>Cholera toxin (<i>Vibrio cholerae</i>), (azide free)</b>	<b>BML-G117</b>
<b>Cholera toxin B subunit (<i>Vibrio cholerae</i>)</b>	<b>BML-G125</b>

**More antigens at [enzolifesciences.com/antigens](https://enzolifesciences.com/antigens)**




# Separation of Antigen from Impurities

## CONTAMINATION MONITORING

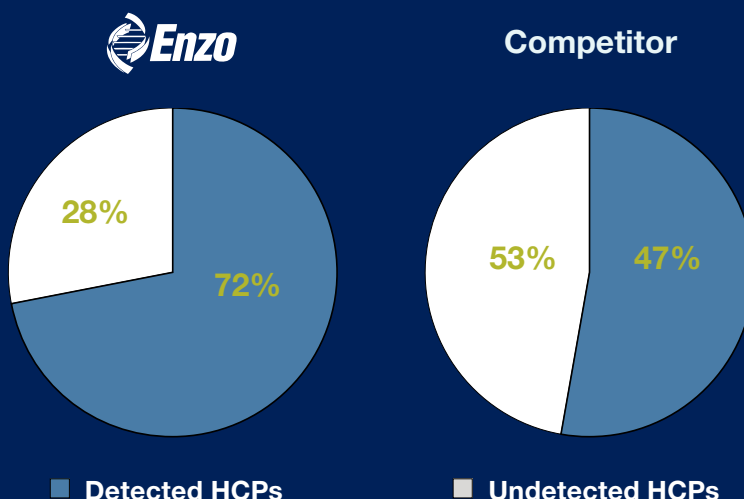
A challenge in vaccine manufacturing lies in effectively monitoring and managing contamination. Separating antigens from impurities is a pivotal step, ensuring the purity and safety of the ultimate vaccine formulation.

Enzo offers Host Cell Protein (HCP) ELISA kits and reagents for contamination monitoring that are ideal for impurity analysis.

## HCP ELISA Kits

-  Sensitive measurement of host cell protein, detecting as little as 10 ng/ml
-  More than 70% protein coverage to reduce the risk of missing potential contaminants
-  High-throughput format with results in as little as 3 hours.

## Monitor CHO HCP Residuals with Confidence



CHO Host Cell Protein ELISA Kit (ENZ-KIT128) was compared to the leading competitor's kit. Results indicate that Enzo's ELISA kit has 25% more coverage than the leading competitor's kit.

## Ordering Information

CHO Host Cell Protein ELISA Kit	ENZ-KIT128
<i>E.coli</i> Host Cell Protein ELISA Kit	ENZ-KIT127
HEK293T Host Cell Protein ELISA Kit	ENZ-KIT162

## Related Products

CHO HCP Standards	ENZ-PRT122
CHO HCP polyclonal antibody	ENZ-ABS260
CHO HCP polyclonal antibody (biotin conj)	ENZ-ABS261
<i>E.coli</i> HCP Standards	ENZ-PRT121
<i>E.coli</i> HCP polyclonal antibody	ENZ-ABS262
<i>E.coli</i> HCP polyclonal antibody (biotin conj)	ENZ-ABS263
HEK293T Host Cell Protein Standard	ENZ-PRT311

# Formulation

## IMMUNOSTIMULANTS TO MAXIMIZE RESPONSE

A robust and targeted immune response is essential for the vaccine to provide protection against the targeted disease.

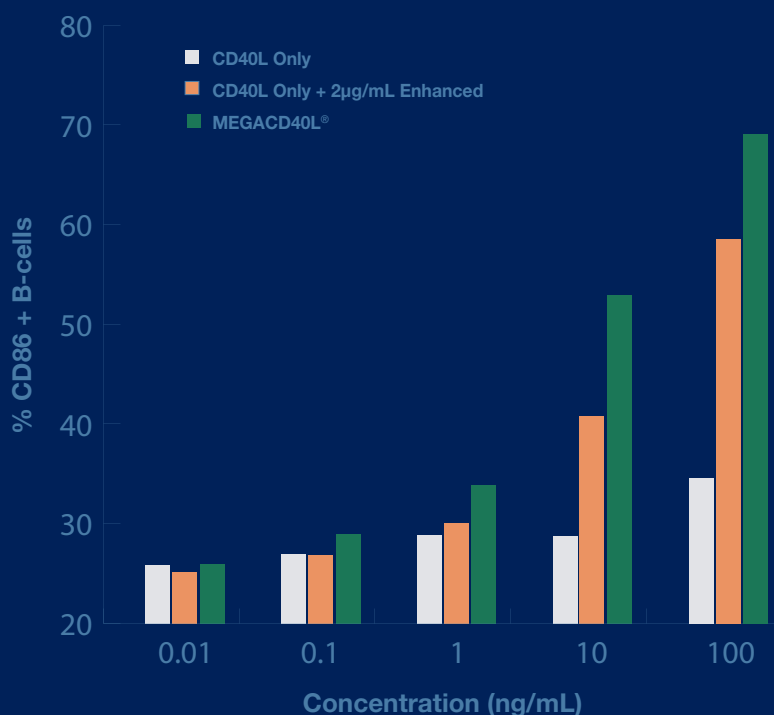
We offer a comprehensive portfolio of products that enhance the magnitude and durability of the vaccine immune response, including MEGACD40L<sup>®</sup> Protein. CD40 ligand (CD40L) plays a central role in co-stimulation and regulation of the immune response.

MEGACD40L<sup>®</sup> Protein is a highly active and pure CD40L recombinant protein that can enhance an immune response without additional enhancers.

### MEGACD40L<sup>®</sup> Protein (ALX-522-110)

- Optimized formulation for improved stability and enhanced activity
- Superior purity and low endotoxin levels eliminate experimental artifacts
- Reliable and consistent lot-to-lot performance

## Improved Stability and Enhanced Activity Compared to CD40L and CD40L with enhancers.



B cell lymphocyte activation by various CD40L constructs. PB-MCs were treated for 48 hours in media containing serially diluted CD40L, CD40L + 2 µg/mL Enhancer, or MEGACD40L<sup>®</sup> Protein. Cells were dual-stained with anti-human CD19-PE and anti-human CD86-APC and analyzed by flow cytometry. The data is presented as the percentage of CD86<sup>+</sup> cells per CD19<sup>+</sup> B cells at each concentration.

## Ordering Information

Monophosphoryl Lipid A (synthetic)

MALP-2

Polyinosinic-polycytidylic acid . potassium salt (TLRGRADE<sup>®</sup>) (synthetic)

Paclitaxel

R-848

ODN 2006 (TLRGRADE<sup>®</sup>) (synthetic)

ODN 1826 (TLRGRADE<sup>®</sup>) (synthetic)

ALX-581-205

ALX-162-027

ALX-746-021

BML-T104

ALX-420-038

ALX-746-006

ALX-746-002

# Monitor Product Integrity

## MAINTAIN PRODUCT INTEGRITY

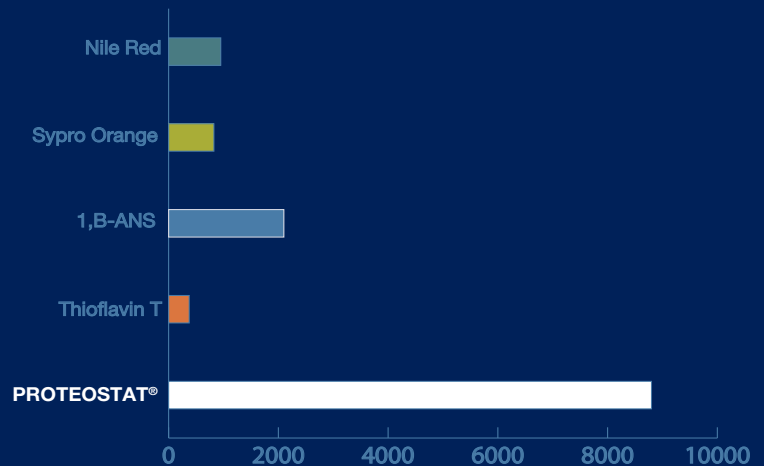
Aggregation poses a substantial challenge in vaccine manufacturing. It can impact product quality, safety, and efficacy. Ensuring structural integrity, preventing safety concerns, and optimizing production processes are critical to meeting regulatory standards and ensuring vaccine stability and efficacy.

Product stability can be assessed by monitoring protein aggregation with PROTEOSTAT® Protein Aggregation Assay, allowing the optimization of formulations and manufacturing processes.

## PROTEOSTAT® Protein Aggregation Assay (ENZ-51023)

- Monitor bulk freezing and freeze/thaw cycle-induced aggregation and define post-purification storage conditions
- Identify inhibitors of protein aggregation
- Rank effectiveness of buffers and excipients in protein formulations

## PROTEOSTAT® Dye Yields Much Brighter Signal



Signal intensity of PROTEOSTAT® aggregate sensing dye compared to other dyes.

## Ordering Information

PROTEOSTAT® Protein Aggregation Assay

ENZ-51023

PROTEOSTAT® Protein Aggregation Standards

ENZ-51039

PROTEOSTAT® Protein Refolding and Aggregation Sensing Kit

ENZ-51040

## Related Products

PROTEOSTAT® Thermal Shift Stability Assay Kit

ENZ-51027

PROTEOSTAT® Aggresome Assay

ENZ-51035



# Monitor Immune Response

## DETECT ANALYTES ACCURATELY WITH HIGH-SENSITIVITY ELISAS

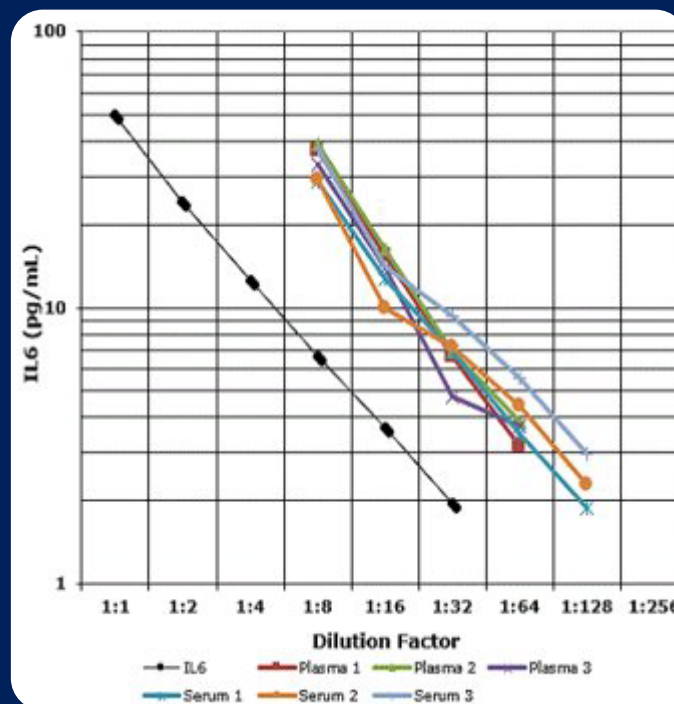
Assessing the vaccine's effectiveness by monitoring the immune response when the antigen is introduced is crucial to tailor strategies to enhance protective immunity.

Measuring IL-6 levels in response to vaccination can provide insights into the vaccine's immunostimulatory effects. Enzo offers one of the most sensitive IL-6 ELISA Kits on the market.

### IL-6 (Human), High Sensitivity ELISA Kit (ENZ-KIT178)

- High sensitivity (0.057 pg/mL) colorimetric immunoassay kit available able to detect very low concentrations of IL-6
- Highly specific, showing minimal cross-reactivity to IL-1, IL-1 $\beta$ , IL-2, IL-3, IL-4, IL-7, IL-8, TNF- $\alpha$ , and TNF- $\beta$
- Validated with several sample types: plasma, serum, culture supernatants, and urine

## Detect IL-6 in Several Sample Types



Graphical representation demonstrates the parallel relationship between the standard and sample curves during assay validation.

## Ordering Information

IFN- $\gamma$  (human), ELISA Kit  
IL-8 (human), ELISA Kit  
IL-1 $\beta$  (human), ELISA Kit  
TNF- $\alpha$  (human), ELISA Kit  
IL-10 (human), ELISA Kit  
cAMP complete ELISA Kit  
PGE2 high sensitivity ELISA Kit

ADI-900-136  
ADI-900-156  
ADI-900-130A  
ADI-900-099  
ADI-900-036  
ADI-900-163A  
ADI-930-001

# Monitor Immune Response

## ANTIBODIES

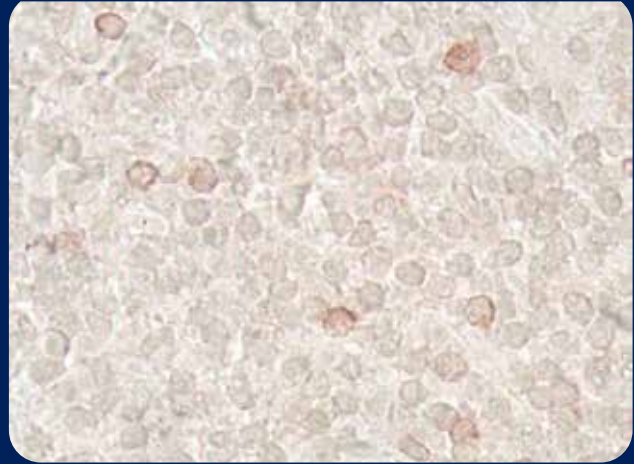
Antibodies are indispensable tools in vaccine research, from initial antigen discovery to vaccine design, efficacy testing, manufacturing, and quality control. They are fundamental in understanding and harnessing the immune response to develop safe and effective vaccines.

### LAG-3 (human) recombinant monoclonal antibody (L4-PL33) (ENZ-ABS677)

LAG-3 is used as a marker in immune monitoring and assessment of vaccine-induced immune responses. Measuring LAG-3 expression on T cells provides insights into the immune system's status and its potential to respond to vaccination.

- ⬡ A broad range of antibodies for use in all areas of vaccine research.
- ⬡ Validated for use in key applications such as flow cytometry, immunohistochemistry, immunoprecipitation, and Western blotting
- ⬡ Backed by our *Worry-free Antibody Trial Program*

## Detection of LAG-3 in Human Tonsil Tissue



60X image of LAG-3 (dark brown) detected in human tonsil tissue with LAG-3 (human) recombinant mAb (L4-PL33) (ENZ-ABS677).

## Ordering Information

**CD3 (human) monoclonal antibody**

**ALX-804-822**

**CD4 (human) monoclonal antibody**

**ALX-805-053**

**CD8 monoclonal antibody**

**ENZ-ABS456**

**CD40 (human) monoclonal antibody**

**ENZ-ABS148**

**CD20 (human) clonal antibody**

**ALX-810-209**

**CD19 monoclonal antibody (4G7)**

**ENZ-ABS416**

**MHC Class I monoclonal antibody**

**ALX-805-711**

**More antibodies at [enzlifesciences.com/antibodies](https://enzlifesciences.com/antibodies)**



# Enabling Vaccine Research & Manufacturing

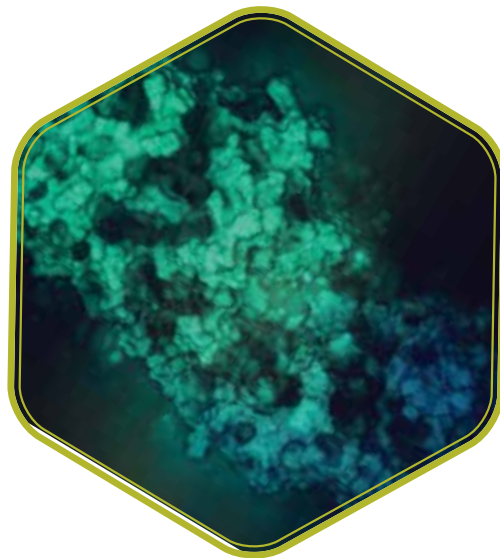
Leverage over 45 years of innovation and technical expertise, supporting drug discovery, development, research, and diagnostics through our core technology platforms. With GMP and ISO certifications, and over 160,000 citations, our highly sensitive, quality products consistently deliver trusted results. We maintain product integrity and reliability with our in-house U.S. manufacturing facility. We deploy our bench of expert PhD scientists to provide technical, tailored, support for our customers and their projects.

Rely on Enzo's extensive experience in innovation, technology development, and manufacturing to support your vaccine research and development. Our comprehensive Life Sciences Contract Services support the development of customizable, unique, and efficient solutions for all your research needs.



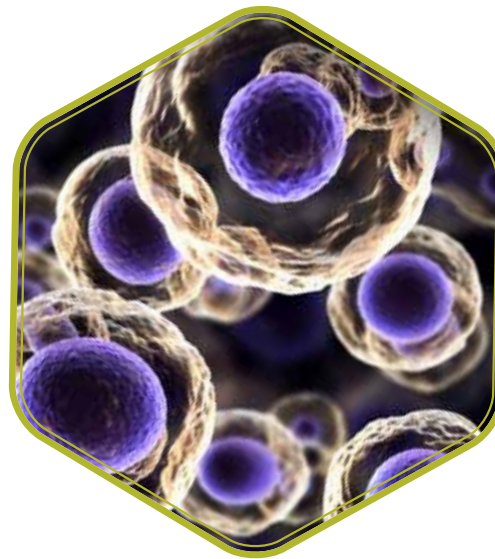
## GENOMIC ANALYSIS

Nucleic Acid Extraction, PCR, qPCR, and NGS



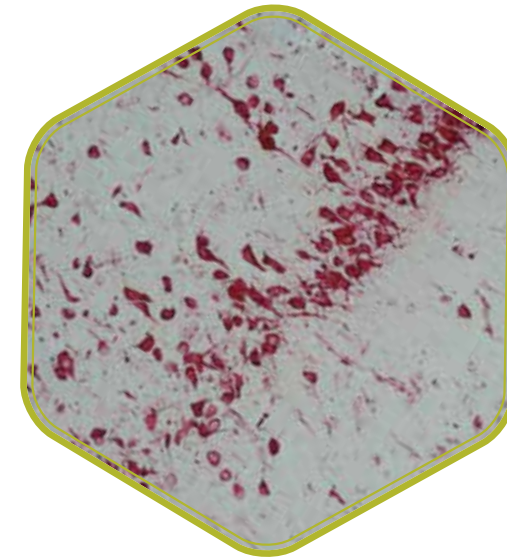
## PROTEIN ANALYSIS

ELISA, Western Blot, Proteins, Peptides, and Enzymatic Assays



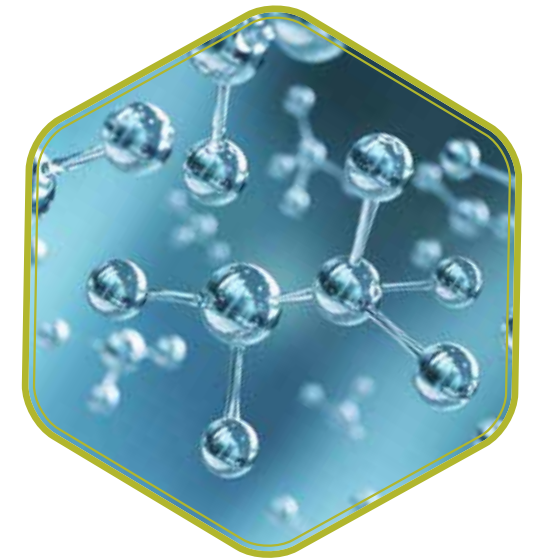
## CELLULAR ANALYSIS

Cell-based Assays, Fluorescent Dyes, and Antibodies



## TISSUE ANALYSIS

IHC, ISH, and FISH



## SMALL MOLECULE CHEMISTRY

Small Molecules and Compound Libraries

# Our Depth of Technology Enables Efficiency for our Customers.

Learn More at [enzolifesciences.com/vaccine](https://enzolifesciences.com/vaccine)

**SCIENTISTS ENABLING HEALTHCARE™**



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