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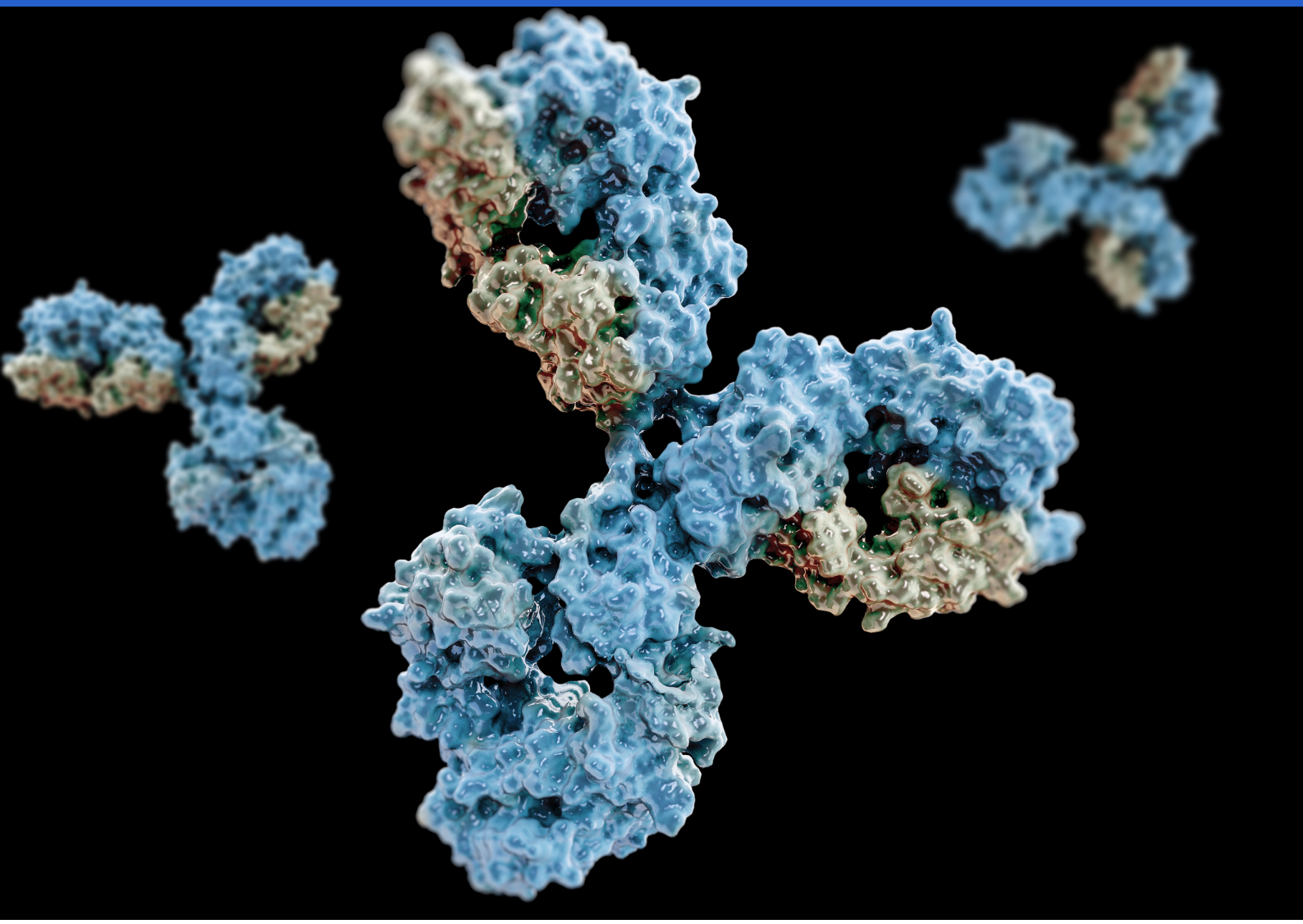
BDG LIFESCIENCES



DESIGN OF PROTEIN & MRNA BASED VACCINES

15 DAY TRAINING

EVERY DAY 90 MIN LIVE SESSION

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INTRODUCTION

Vaccines are among the most powerful tools in modern medicine. But how are new vaccines designed — especially those like mRNA vaccines that changed the course of the COVID-19 pandemic?

This 15-Day Program on Design of Protein and mRNA Vaccines introduces high school students to the computational science behind modern vaccine development. Students will explore how scientists use bioinformatics and immunoinformatics tools to identify antigens, predict immune responses, design vaccine candidates, and evaluate safety — all before laboratory testing begins.

This program is ideal for students interested in:

- Immunology and infectious diseases
- Medicine and public health
- Biotechnology and vaccine research
- Science fair research projects
- Computational biology and biomedical innovation

Rather than just learning theory, students will follow structured case studies and simulate real vaccine design workflows used in modern research.

TRAINERS

The training programs at BDG Lifesciences are conducted by highly experienced resource persons with strong academic and research backgrounds in bioinformatics, computational biology, drug discovery, molecular modeling, genomics, and artificial intelligence applications in life sciences. Our trainers include research professionals and subject-matter experts who have worked on real-world research projects, guided students for science fairs and publications, and delivered advanced workshops internationally. With over a decade of experience mentoring students—from high school to postgraduate levels—our team focuses on building strong conceptual foundations while providing hands-on exposure to industry-standard tools and research methodologies. The teaching approach emphasizes clarity, structured progression, practical application, and personalized guidance to ensure students not only understand the concepts but also gain confidence in applying them independently.

OVERVIEW

This 15-day structured program walks students through the complete computational pipeline of vaccine design — from antigen identification to structural validation.

DAYS 1–7: DESIGNING A PROTEIN-BASED VACCINE (CASE STUDY 1)

Students begin with foundational concepts:

- Introduction to vaccines and the immune system
- Conventional vs computational vaccinology
- Reverse vaccinology and immunoinformatics

They then move into hands-on computational design:

- Retrieval of pathogen protein sequences
- Antigenicity prediction
- Allergenicity prediction
- Toxicity prediction

Students perform advanced immune analysis including:

- B Cell epitope prediction (linear & conformational)
- T Cell epitope prediction
- MHC Class I & II peptide prediction
- Population coverage analysis
- Epitope conservancy and clustering

They then design a novel vaccine sequence and evaluate:

- Primary and secondary protein structure
- Functional domain prediction
- Homology modeling (3D structure prediction)
- Antibody structure prediction
- Docking and structure visualization
- IEDB database analysis

This phase introduces the complete computational protein vaccine workflow.

DAYS 8–14: DESIGNING AN MRNA VACCINE (CASE STUDY 2)

Students are introduced to:

- DNA, mRNA, replication, transcription
- Applications of mRNA vaccines

They then follow a second case study involving:

- Retrieval of protein sequences of a disease-causing microbe
- Antigenicity and allergenicity prediction
- B Cell and T Cell epitope prediction
- MHC Class I & II epitope prediction
- Population coverage analysis

Students design novel mRNA vaccine candidates and perform:

- Codon optimization
- Antigenicity, allergenicity, and toxicity evaluation
- Primary, secondary, and tertiary structure prediction
- Structure analysis
- Antibody retrieval and docking with structure visualization

DAY 15: REVISION & CONCEPT INTEGRATION

A final interactive session consolidates learning, clarifies doubts, and reinforces the complete vaccine design workflow.

FEE- $ 254 US

For this small amount, students gain hands-on exposure to cutting-edge immunoinformatics and vaccine design techniques, including the development of protein and mRNA-based vaccines used in modern biomedical research. Considering the advanced scientific concepts, practical skills, and strong research foundation it builds, this investment is minimal compared to the long-term academic and career advantages for students interested in biotechnology, immunology, and medical research.

NOTE-

- All live sessions will be conducted via Zoom.
- A concise summary of each session will be provided to participants for revision and reinforcement.
- The recording of each session will be shared for future reference and review.
- A Certificate of Completion will be awarded by BDG Lifesciences upon successful completion of the program.

BENEFITS OF THIS COURSE

EXPOSURE TO CUTTING-EDGE VACCINE SCIENCE

Students gain insight into how modern vaccines — including mRNA vaccines — are computationally designed before laboratory testing.

REAL RESEARCH WORKFLOW EXPERIENCE

Students perform:

- Epitope prediction
- Antigen screening
- Structural modeling
- Docking simulations
- Safety analysis

These are university-level research techniques introduced early.

STRONG SCIENCE FAIR POTENTIAL

Students can apply these computational methods to:

- Infectious disease-focused projects
- Immunology research studies
- Computational vaccine modeling investigations

COLLEGE APPLICATION DIFFERENTIATION

Participation demonstrates:

- Interest in advanced biomedical innovation
- Exposure to immunoinformatics and reverse vaccinology
- Initiative beyond standard high school curriculum

FOUNDATION FOR FUTURE BIOMEDICAL CAREERS

This program builds early readiness for:

- Medicine
- Biotechnology
- Immunology research
- Pharmaceutical sciences
- Computational biology

Students develop both conceptual understanding and practical skills that form a strong foundation for advanced research pathways.