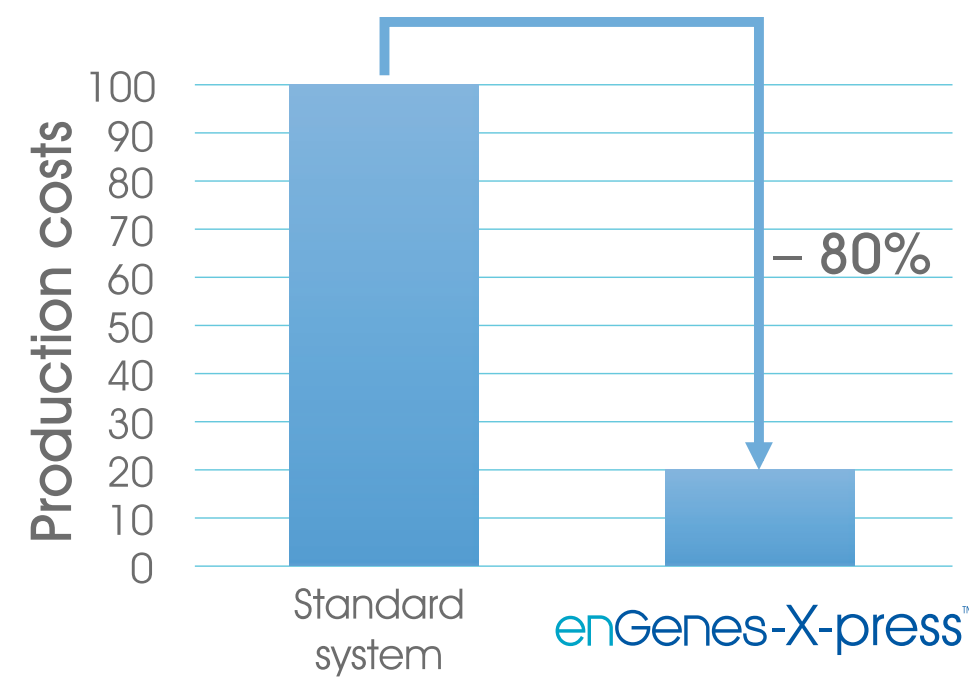
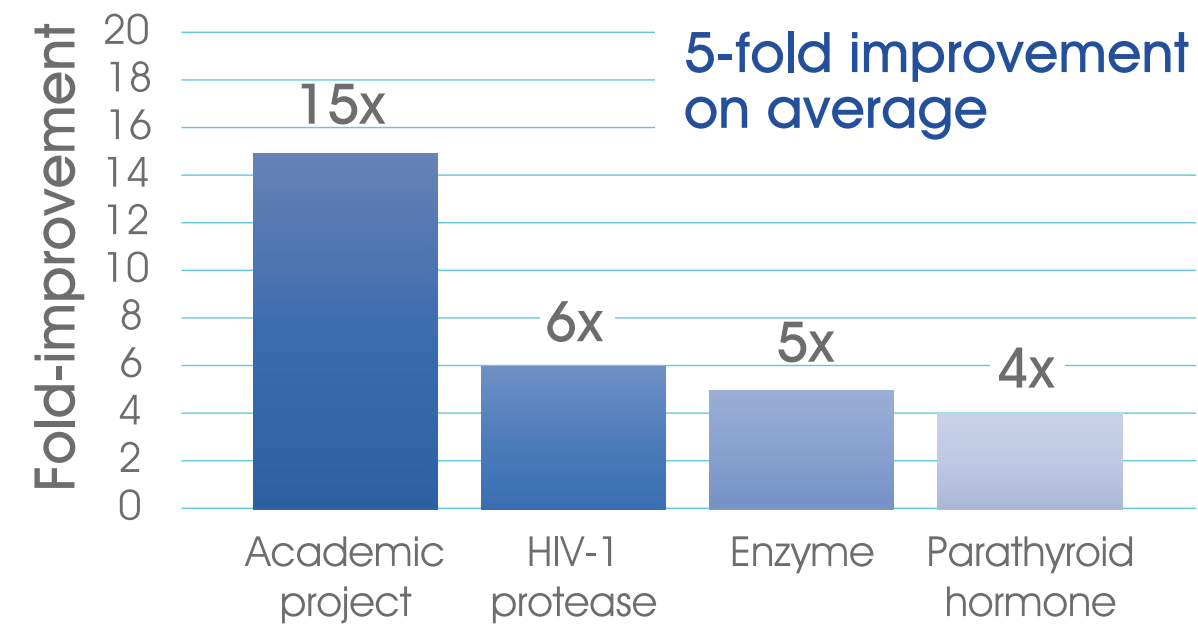


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IMPRESSIVE EXPRESSIONS

enGenes Biotech provides research, development and production services for pharmaceutical companies, industrial enzyme suppliers and CMOs to substantially improve product yields & quality and to reduce manufacturing costs

enGenes-X-press™



MORE WITH LESS

GROWTH-DECOUPLED PROTEIN PRODUCTION

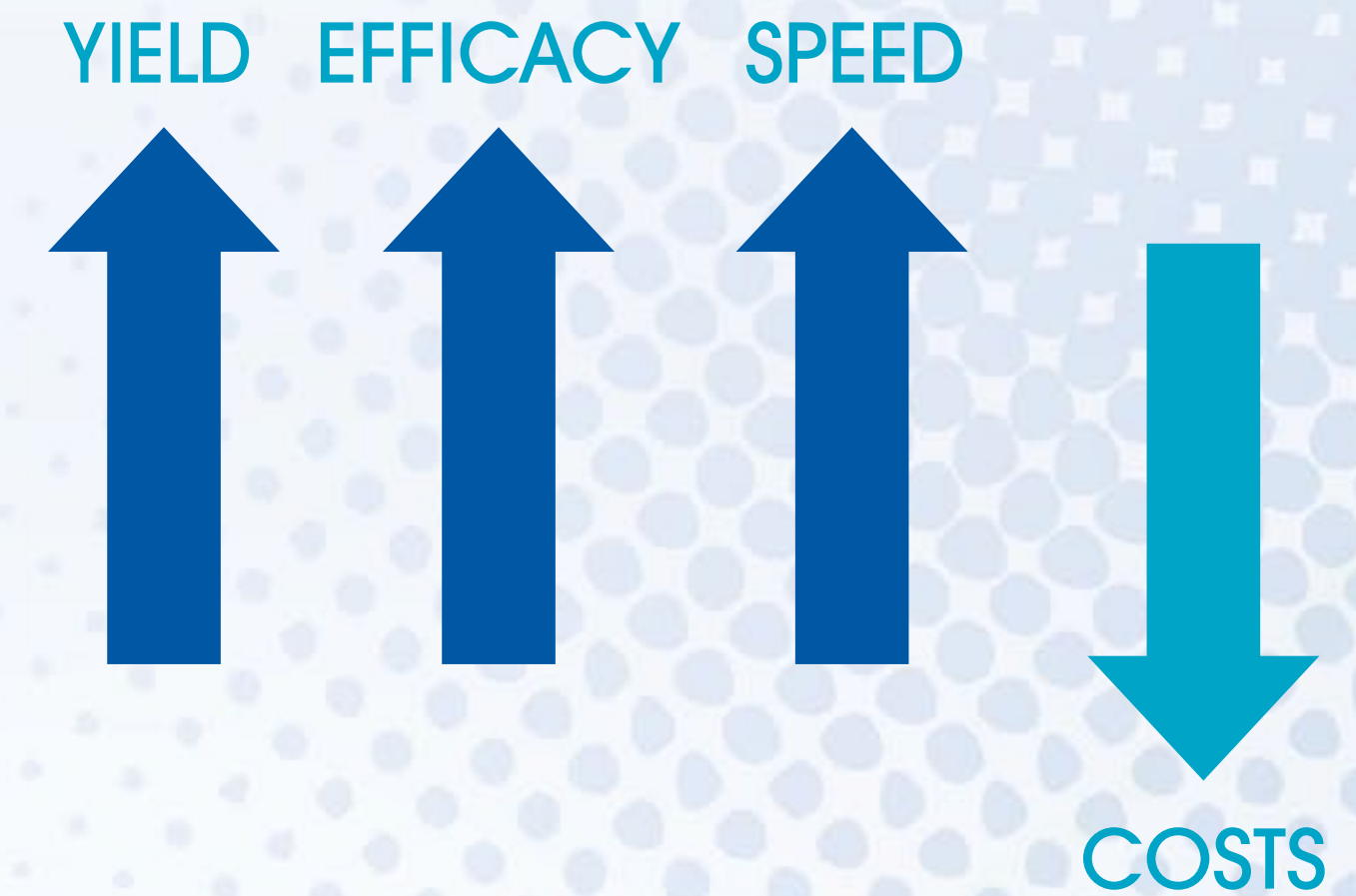
- ✓ Unique, proprietary platform technology
- ✓ Very high specific & volumetric product yields
- ✓ Enabling technology for the production of difficult-to-express proteins
- ✓ More recombinant protein with less biomass
- ✓ Generic, fully scalable and cost-effective manufacturing process
- ✓ Outperforming, established industry standards

OUR MISSION

Providing **cost effective** and **scalable production** of recombinant proteins **at a fraction of their current cost**

OUR VISION

Developing a **world-class portfolio** of **cutting-edge protein production technologies** committed to **reducing costs & time to market periods** and to out-license them across a broad spectrum of application fields



CELL DIVISION IS COSTLY



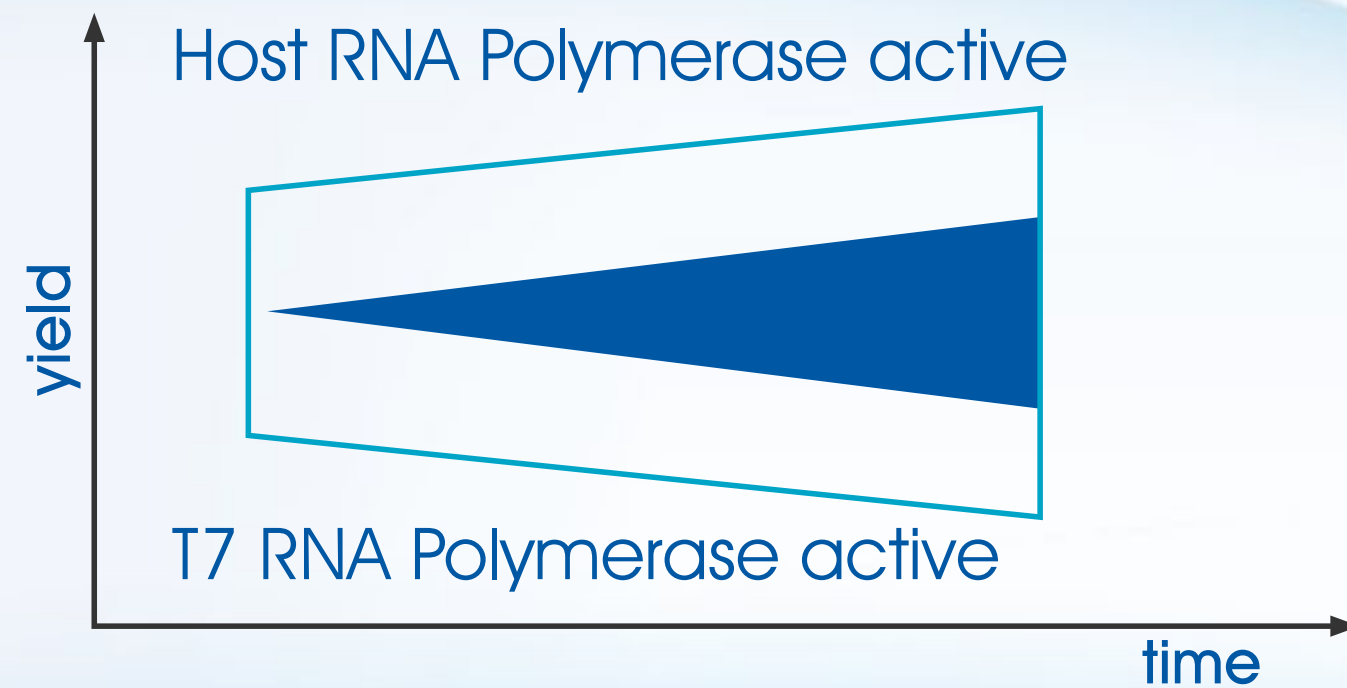
- ✓ **Efficient, cost-effective protein production is essential** to the economic viability of recombinant protein-based products
- ✓ Bacterial cells have evolved to generate progeny as fast as possible
- ✓ Unfortunately, **cell division and biomass generation is a rather costly process** that consumes a lot of metabolic resources
- ✓ It costs **20 billion** precious **ATP molecules to build one E. coli cell**
- ✓ Metabolic resources that **can be otherwise used to generate more efficient, high-titer production process**
- ✓ With that in mind **we have invented enGenes-X-press – a game changing technology –** that allows **decoupling of recombinant protein synthesis from cell growth**
- ✓ Thereby, allowing **significant cost savings** during manufacturing

THE TECHNOLOGY



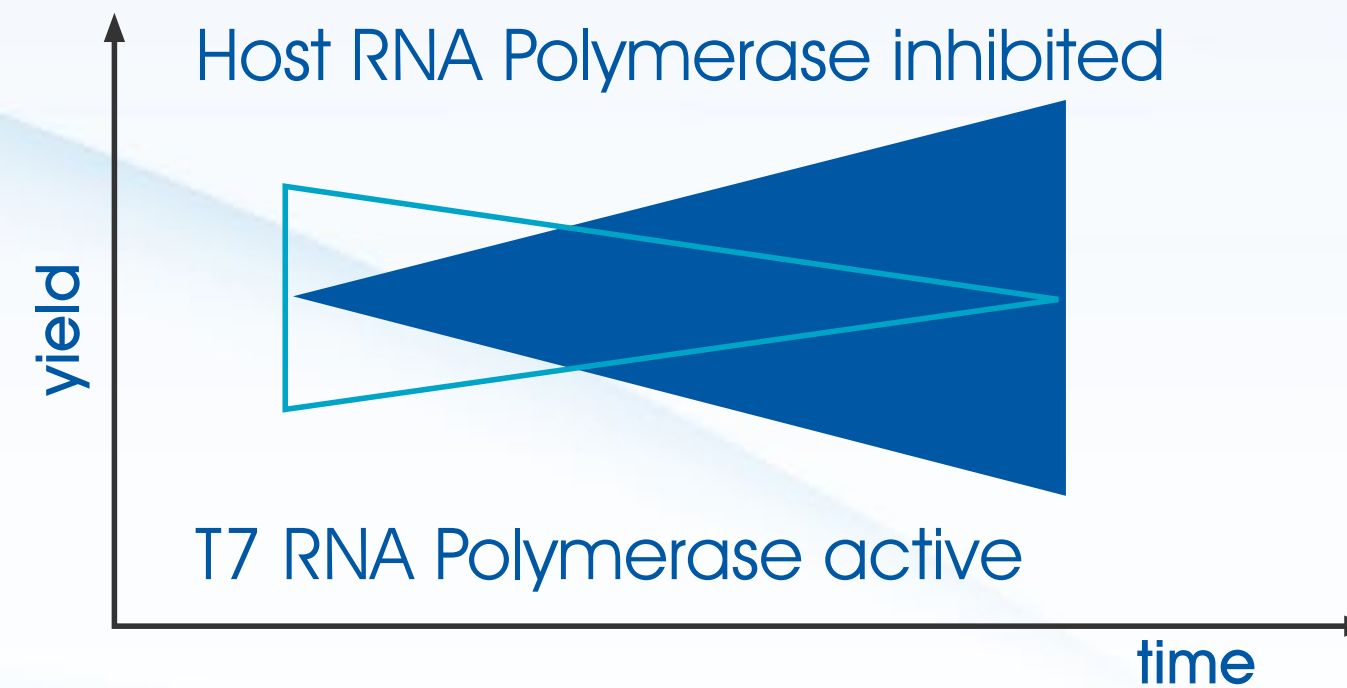
enGenes Biotech has developed a T7-based protein expression system for *Escherichia coli* where **protein production is no longer growth associated**. Cells can be reversibly shifted into a stationary phase-like state whereby **synthesis of cellular proteins is turned off** and the remaining **metabolic resources** can be exclusively **utilized for synthesis of the recombinant protein of interest**

CONVENTIONAL MICROBIAL EXPRESSION SYSTEM



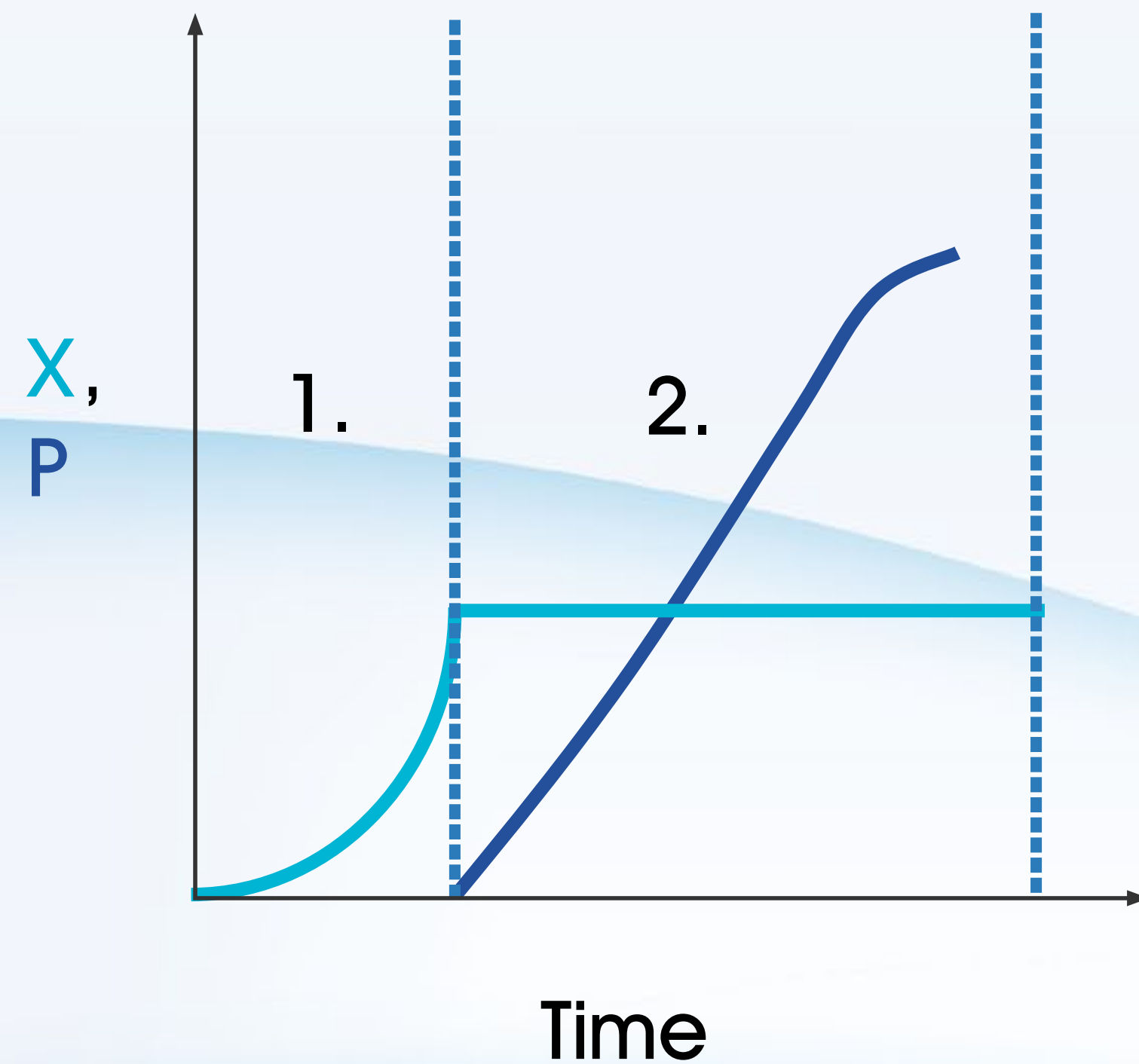
enGenes-X-press™

KEY ADVANTAGE – HIGH SPECIFIC AND TOTAL PROTEIN YIELD



■ Recombinant Protein □ Host Cell Protein

- Enables production of toxic proteins
- Plasmid instability not an issue
- Low level of Host cell Proteins
- Easy Down-stream Processing



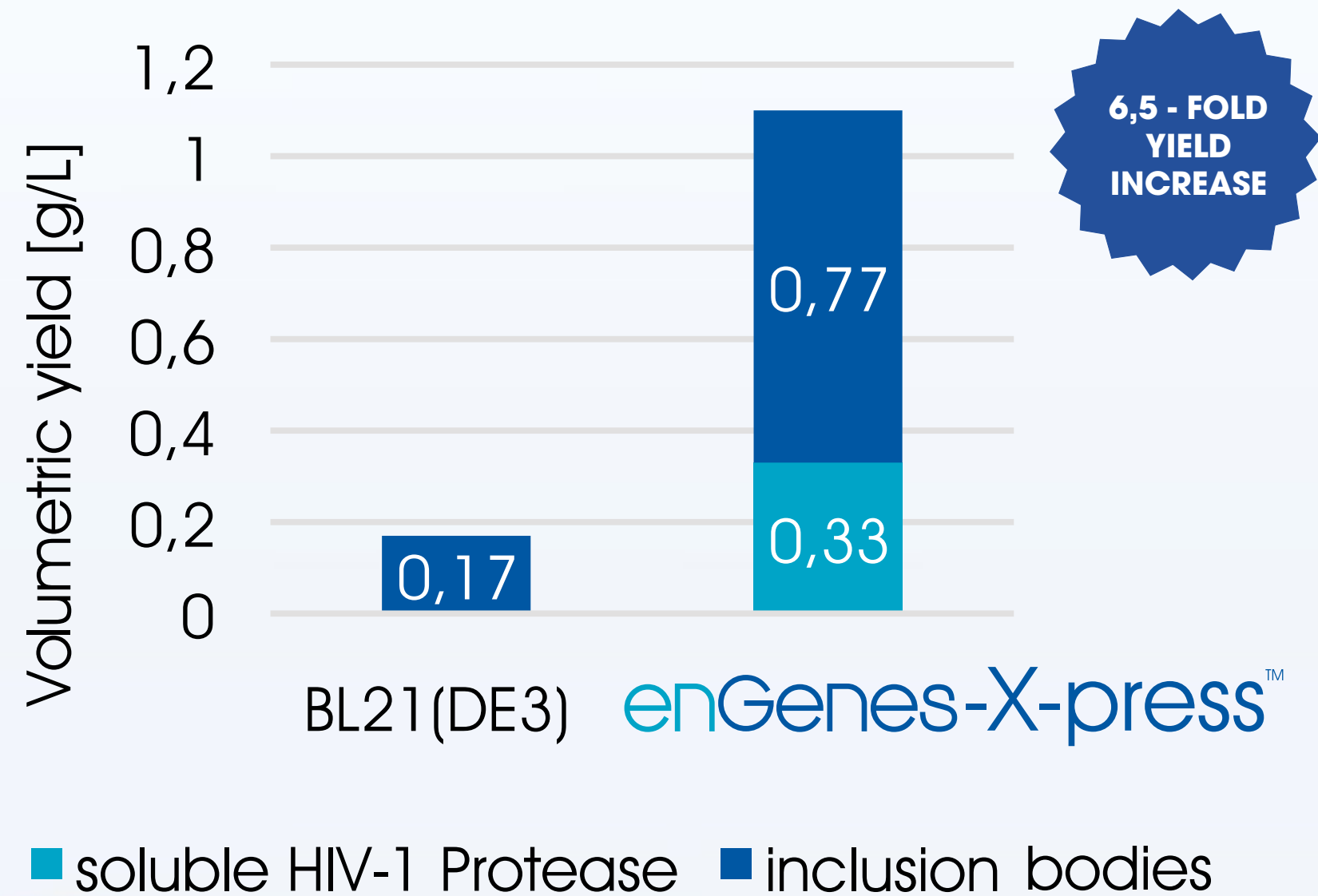
1. Phase: Production of Biomass (X)

2. Phase: Production of recombinant protein (P)

Advantages:

- Improved scalability and controllability
- Increased process robustness
- No need for laborious optimization of process parameters
- Shorter process development cycles

TECHNOLOGY SHOWCASE – BIOPHARMACEUTICALS

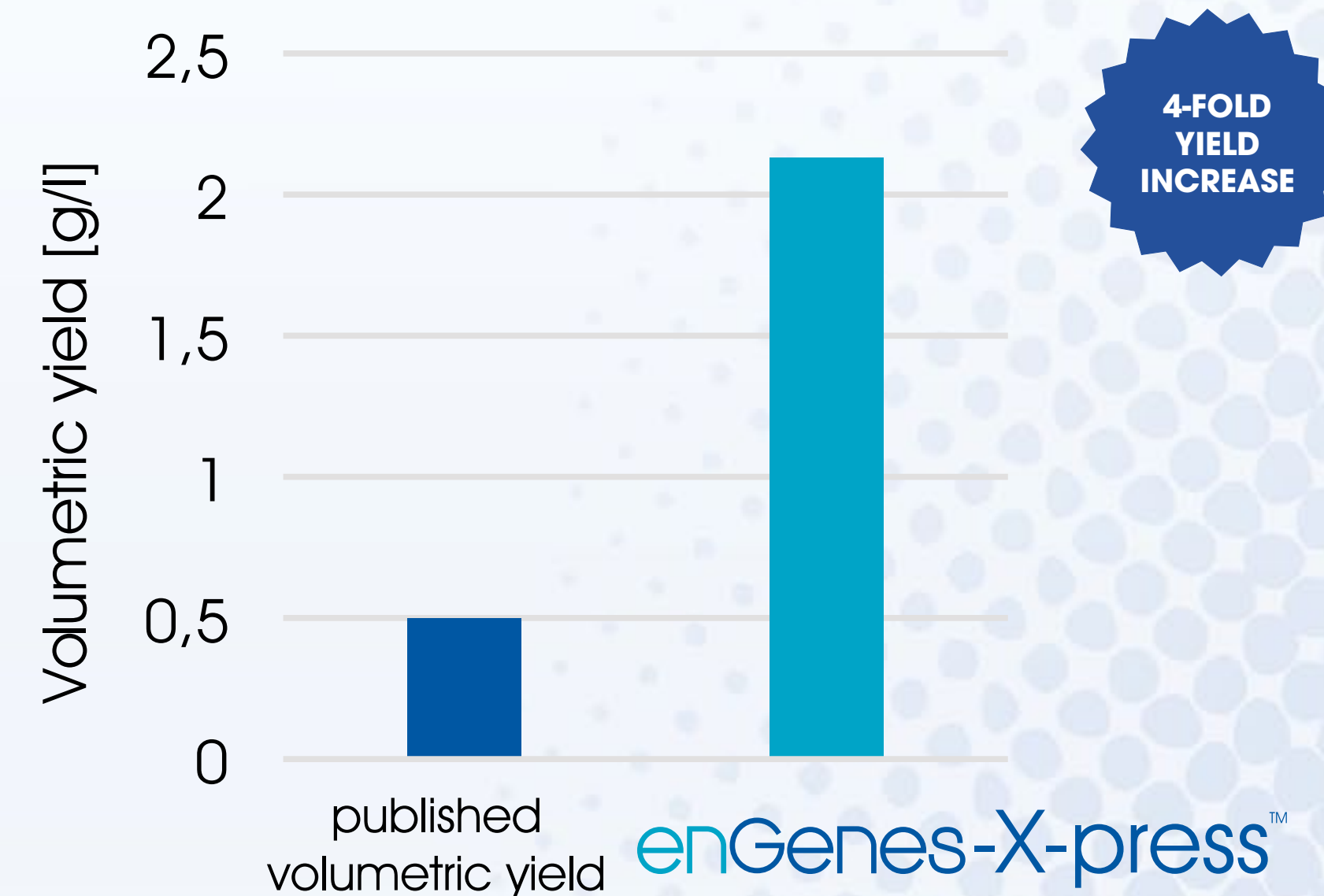


SOLUBLE EXPRESSION OF A „TOXIC“ PROTEIN POSSIBLE 6,5 FOLD INCREASE IN VOLUMETRIC YIELD

HIV-1 Protease

Retroviral aspartic protease

Very low published yields (~1mg/L, see Volonté *et al.*, 2011)



4-FOLD INCREASE FOR A BIOSIMILAR

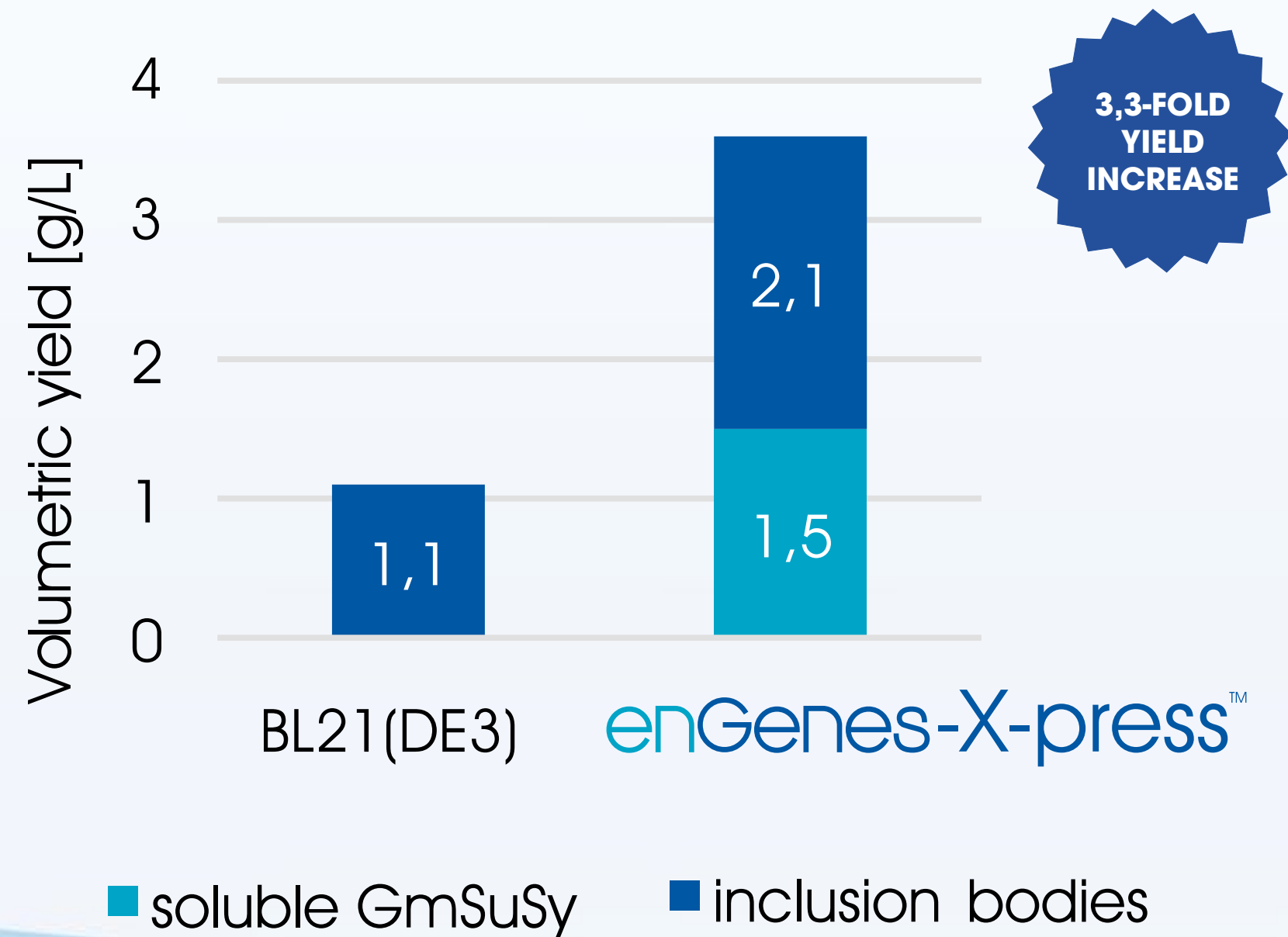
Human parathyroid hormone (PTH)

Treatment of postmenopausal osteoporosis

Periplasmatic expression

Biosimilar / Originator = Preos / Preotact®

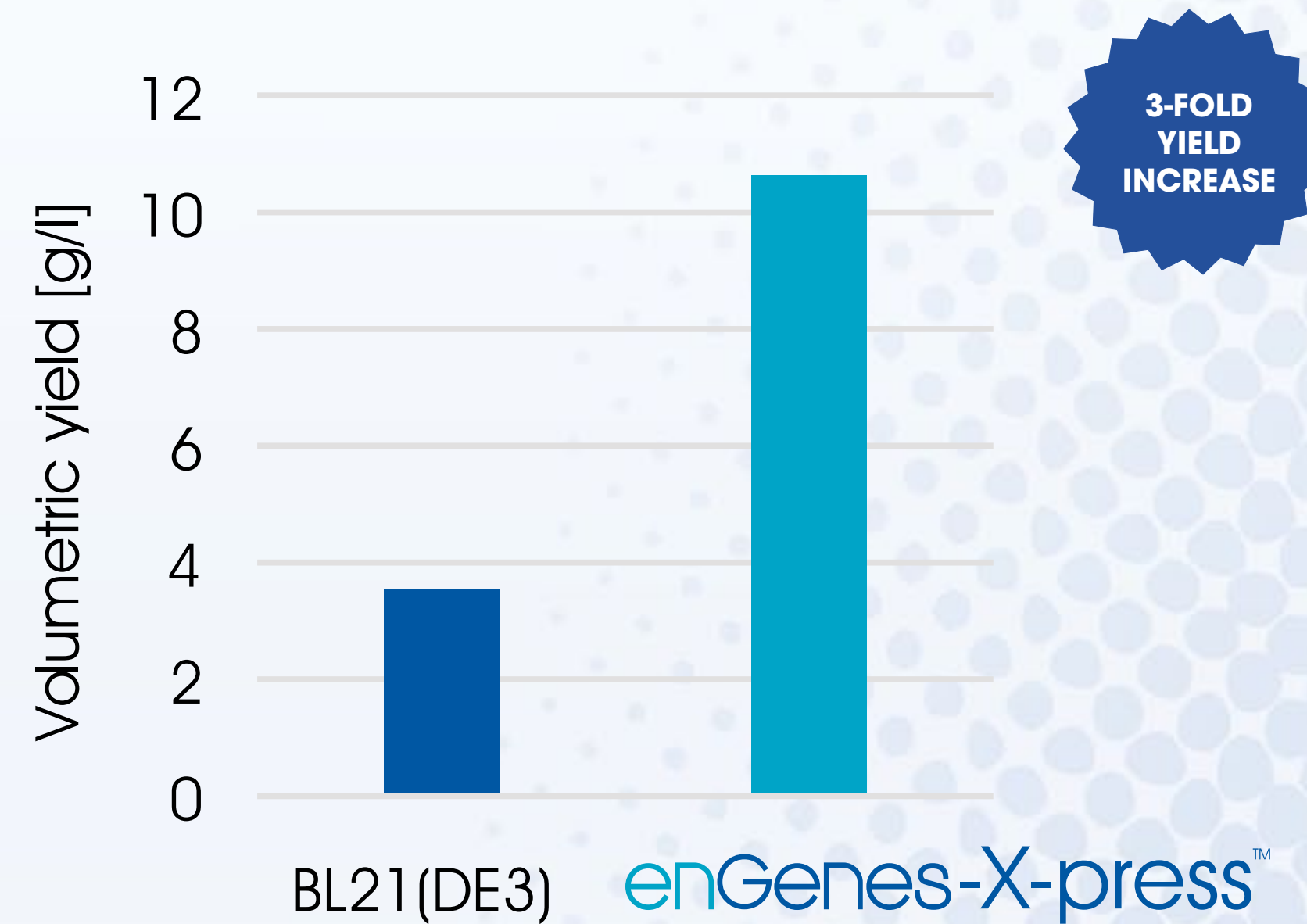
TECHNOLOGY SHOWCASE – ENZYMES



SOLUBLE EXPRESSION OF A POORLY SOLUBLE ENZYME POSSIBLE
3,3-FOLD INCREASE IN VOLUMETRIC YIELD

Sucrose Synthase (GmSuSy)

Carbohydrate-modifying enzyme



3-FOLD INCREASE FOR AN „EASY TO PRODUCE“ SOLUBLE ENZYME

enGenes SERVICES



ENGENES BIOTECH OFFERS A BROAD VARIETY OF INTEGRATED SERVICES INCLUDING INNOVATIVE EXPRESSION SYSTEMS, PROCESS DEVELOPMENT, SCALE-UP AND PRODUCTION OF RECOMBINANT PROTEINS

- ✓ Host cell/vector design & engineering
- ✓ Feasibility studies
- ✓ Process development (USP/DSP)
- ✓ Non-GMP protein production (mg-g)
- ✓ Pilot-scale production (g-kg)
- ✓ Process-transfer to CMO
- ✓ Consulting





PLEASE CONTACT US IF YOU WANT TO
SIGNIFICANTLY REDUCE MANUFACTURING COSTS
OF YOUR RECOMBINANT PRODUCT



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