

BIOLOGICAL MANUFACTURING

CHOZN[®] EXPRESSION PLATFORM

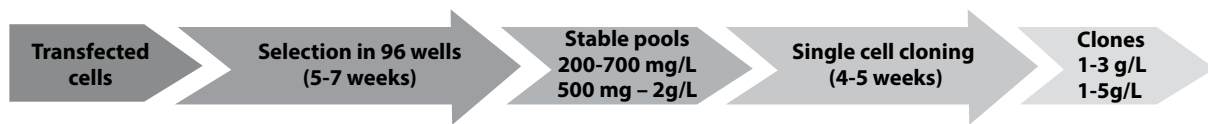
WORKFLOW PRODUCTS AND SERVICES FOR
BIOLOGIC MANUFACTURING

CHOZN[®] Platform

Complete Cell Line Solution that Accelerates Development Timelines

- **Time:** Save up to eight weeks in cell line development timelines (no MSX, no amplification, high rate of clone recovery, fewer clones screened)
- **Adaptability:** Media/feed were optimized for use with the CHOZN GS^{-/-} cell line. If preferred, cells can easily be adapted to a customer's formulation
- **Stability:** >70% of clones maintain >90% titer over 60 generations
- **Ease of Use:** Comprehensive user protocols guide customers from transfection through small scale bioreactors; complete CD process allows for seamless scale up

CHOZN GS Clone Development Timeline



CHOZN[®] GS^{-/-} and DHFR^{-/-} ZFN-modified CHO Cell Lines for Bioproduction

Robust Cell Lines that Maintain Favorable Growth and Productivity Characteristics

Streamline Workflows with More Efficient Methodologies

- Screen fewer clones to find robust, high producers
- Reduce development timelines by using a completely animal component free process

Operate with the Security of Robust and Regulatory Compliant Cell Lines and Media

- Scale up easily with suspension adapted cell lines
- Use cGMP manufactured cell lines that are fully characterized and safety tested
- Ensure regulatory compliance with our chemically defined, animal component free media

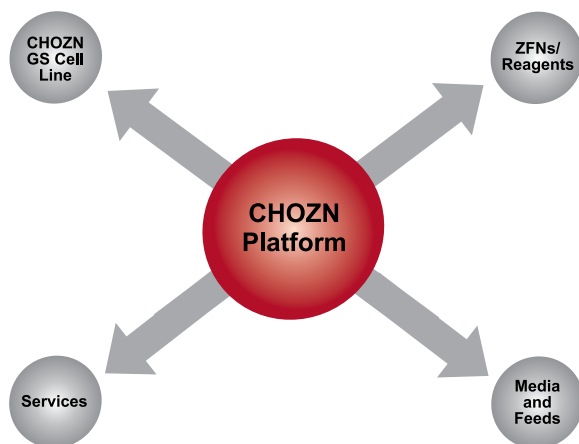
Enhance Your Biopharmaceutical Development

- Accelerate upstream process development
- Rapidly develop recombinant cell lines through strong metabolic selection
- Avoid introducing MSX to your system

Apply Simple, Reliable Protocols and Count on SAFC Technical Support

- Consistently arrive at production clones using detailed protocols and selection strategies
- Easily overcome technical challenges with the support of our expert teams

CHOZN® – PROVIDING SOLUTIONS TO MEET YOUR EXPANDING PROCESS DEVELOPMENT NEEDS



- **CHOZN Platform:** Off-the-shelf cell line platform containing the CHOZN GS cell line, media and feed for use in fed batch cultures and complete user protocols
- **CHOZN GS Cell Line:** cGMP manufactured, full quality documentation to support your filing needs
- **ZFNs:** Improve performance of your existing cell line by implementing gene knockout
- **Services:** Cell line engineering via Cell Design Studio (CDS), Media Development and Optimization
- **Media and Feeds:** Catalog and custom media capabilities support you from research through process development

CompoZr® Zinc Finger Nucleases (ZFNs)

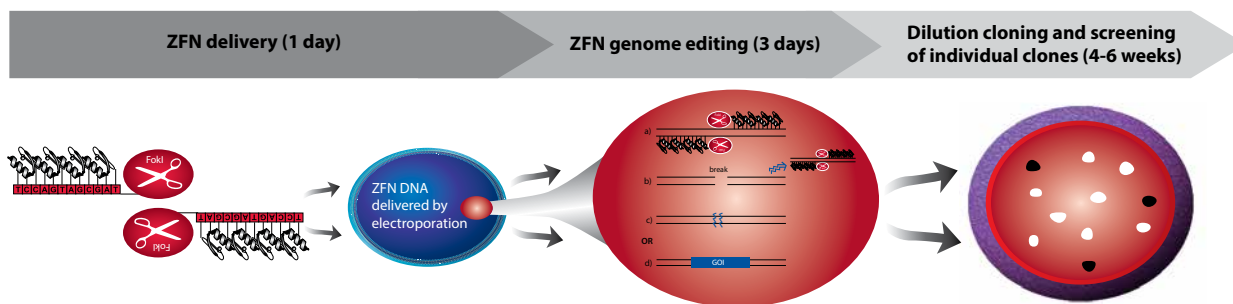
Easy Creation of Novel CHO Cell Lines with Precise and Heritable Gene Additions, Deletions or Modifications

- Catalog ZFNs available for GS and DHFR
- Custom ZFNs available for any other gene target in CHO or other bioproduction cell line

Applications to CHO Cell Engineering

- **Improve Cell Culture Performance:** Titer, growth, longevity
- **Enhance Product Quality and Efficacy:** By modification of glycosylation
- **Remove Interfering Host Cell Proteins:** Endogenous CHO cell molecules that co-purify or otherwise interfere with product yield
- **Metabolic Selection Markers:** Bi-allelic knockouts of GS or DHFR

ZFN-Mediated Genome Editing Process



CHOZN[®] Custom Engineering Solutions

Optimize Your Platform Quickly with Proven Customization Services

- **CHOZN Cell Design Studio:** Create a custom cell line in your host or ours, to meet your specific design requirements
- **Media Development and Optimization:** Custom development of your media and/or feed for optimal performance with your host cell line

EX-CELL[®] Advanced[™]

Next Generation Chemically-Defined Products

Developed from a leading scientific team supporting industrial biopharmaceutical applications for more than two decades:

- Elimination of all non-essential components
- Improved inter and intra lot to lot consistency
- Road-tested to ensure scalable bioreactor performance

Robust and Sustainable Supply Chain

Lower risk profile for improved business continuity:

- Single Global Supplier Quality Management program
- Well Characterized Critical Raw Materials
- Raw material transparency, traceability, and documentation

Proven Manufacturability and Consistency

World-class supplier of cell culture media for clinical and commercial bio-manufactured products:

- Scalable GMP-ready product
- Stable dry and liquid media formats
- Multi-site manufacturing redundancy

Best in Class Performance

- 3-5 fold improvement in titer and growth over initial formulation
- Single feed stable at room temperature for >30 days
- Outperforms competitors in media to media comparison

CHOZN GS

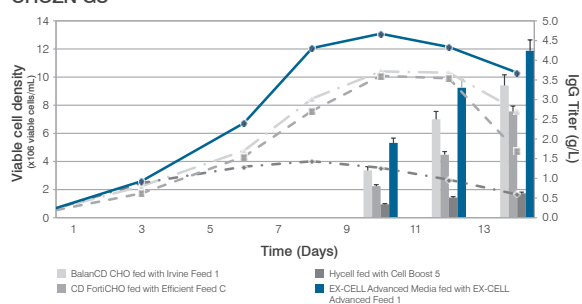


Figure 3: Viable cell density and productivity comparative at TPP tube scale

CHOZN GS Scale-up

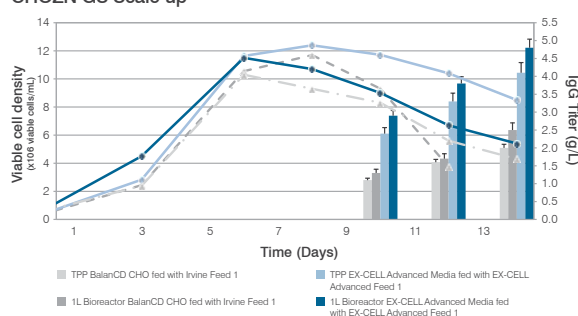


Figure 4: Demonstrates the scalability in the performance of the EX-CELL Advanced CHO Fed-batch System. Study comparison between SAFC's small scale model (TPP tubes) and 1 L benchtop bioreactor (BioStat Q+) using the top competitor media and feed products in the CHOZN cell line. Parameters were as follows: pH 6.9, DO 40%, and temperature 37 °C.

Accelerate Your Development Timelines

With Solutions for Simplified Manufacturing Clone Selection

Chinese Hamster Ovary (CHO) cell lines continue to be the predominant cell line of choice for biopharmaceutical manufacturers.

SAFC's CHOZN® products and services were created utilizing zinc finger nuclease (ZFN) technology to engineer CHO cell lines with characteristics that are important to biopharmaceutical developers and manufacturers, such as growth, productivity and stability.

CHOZN Products and Services

- CHOZN Platform (CHOZN GS cell line + CD media and feed, protocols for fed batch)
- CHOZN ZFN-modified CHO Cell Lines for Bioproduction
- ZFN Reagents (catalog and custom)
- Custom Engineering Options
- EX-CELL® Advanced™ CHO Fed-batch System



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