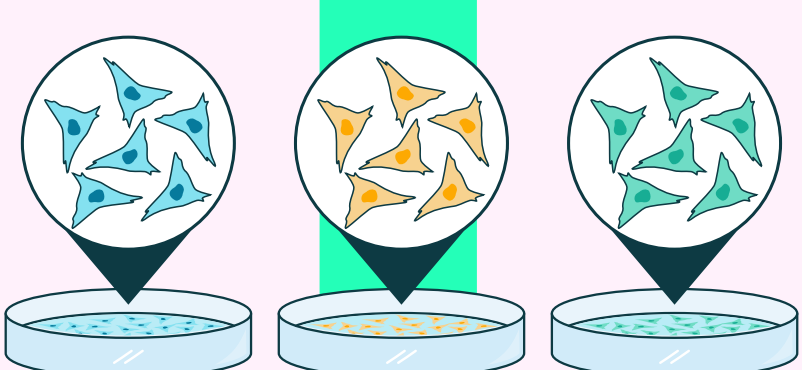
Navigating the smarter path to stable cell lines in cell line development

Stable, robust cell lines are the engines driving biologics production and biomedical research, but developing them involves a series of careful steps. Along the way, researchers face challenges that can slow progress or affect clone quality — but with the right tools and strategies, they can fast-track development and build cell lines that move science forward.



Host cell line selection

The process begins with selecting a host cell line that's biologically relevant, genetically stable, contaminant-free, and suited to the experimental goals.

Challenge:

Selection bias — clones chosen based on early traits that may not predict long-term performance

Strategy:

Include a mix of high- and medium-producing clones to ensure a fair chance to identify those that maintain stability, quality, and growth over time

Plasmid design and construction

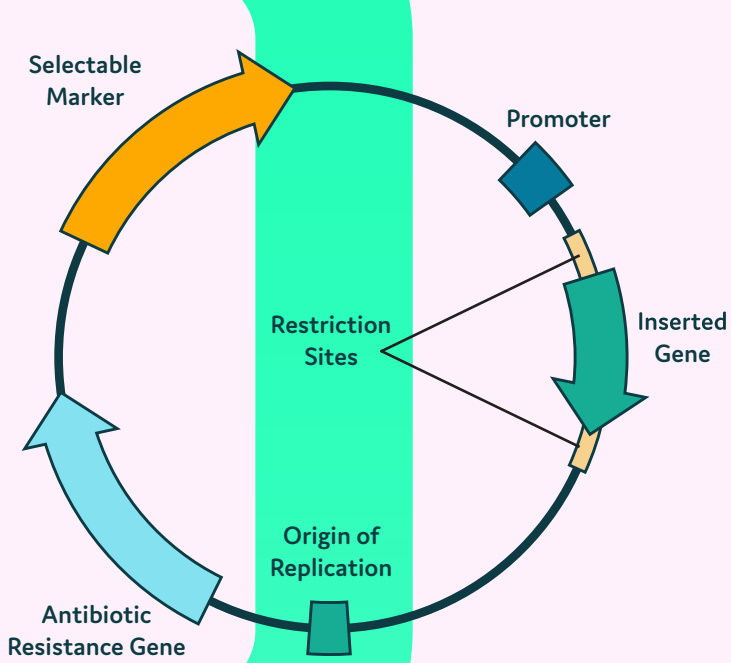
Researchers design and assemble a plasmid vector carrying the gene of interest (GOI) along with essential regulatory elements, creating a construct ready for delivery into the host cells.

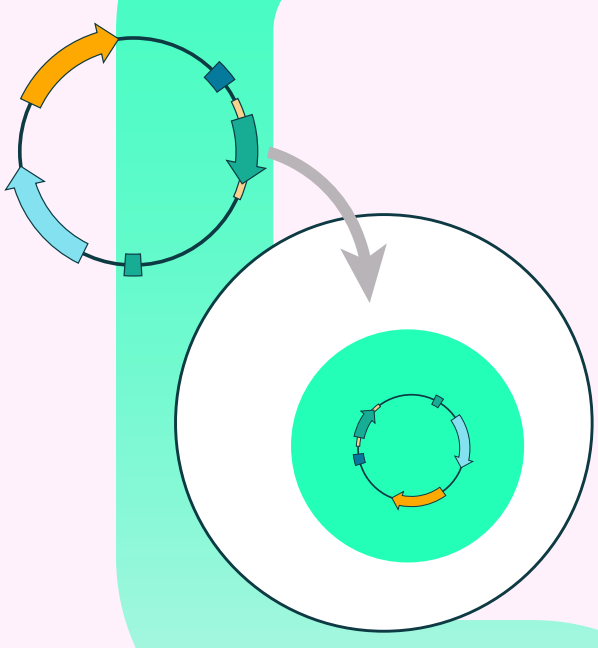
Challenge:

Achieving efficient, stable, and high-level GOI expression

Strategy:

Design expression vectors with synthetic promoters, robust selection markers, and selection marker attenuation to enhance yields of high-producing clones





Transfection

Researchers introduce the plasmid construct into host cells using transfection methods such as electroporation or lipofection, so that host cells take up the foreign DNA and begin expressing the target protein.

Challenge:

Random GOI integration into the genome, resulting in inconsistent and unpredictable protein expression

Strategy:

Incorporate site-specific integration techniques like genome editing tools to ensure precise gene insertion and reduce clonal variation

Cell cloning and selection

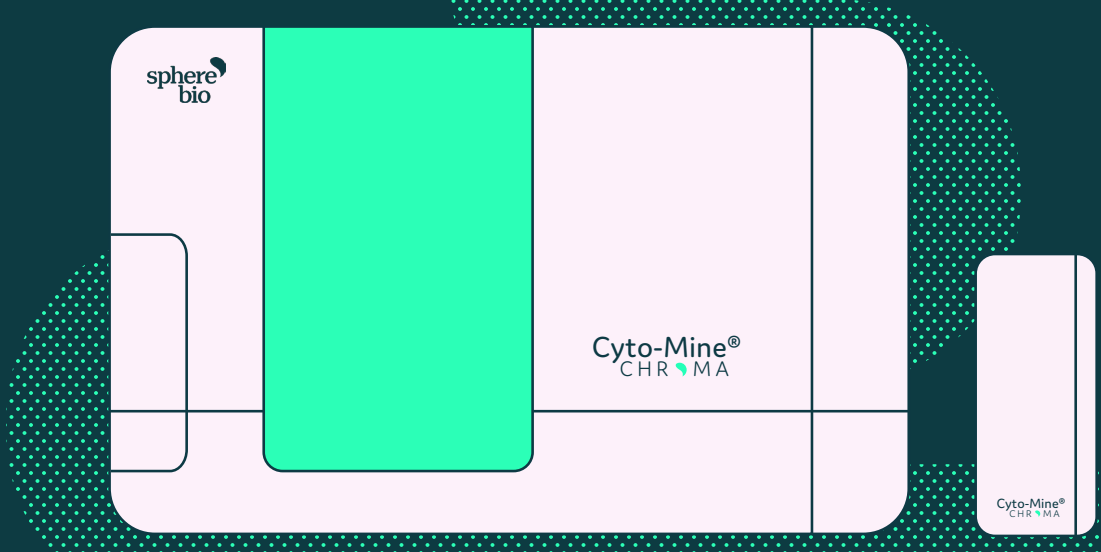
After transfection, researchers screen the cell population, identify the ones that successfully express the target protein, and clone these cells individually to establish monoclonal populations.

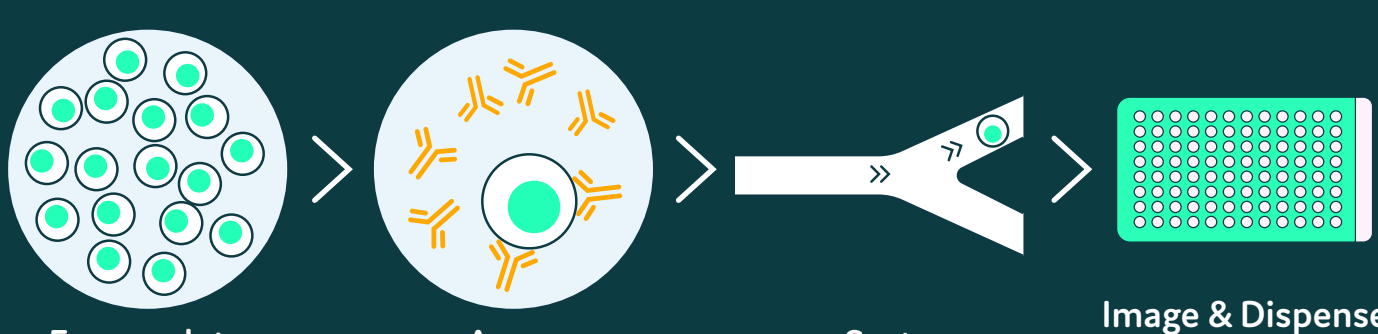
Challenge:

Low efficiency and high variability in traditional methods, which often rely on manual handling and extensive screening

Strategy:

Use automated techniques like Cyto-Mine® Single Cell Analysis Platform to screen, sort, and isolate top clones in one workflow





Encapsulate
Isolate up to 400,000 single cells in picodroplets

Assay
Screen each cell for antibody secretion

Sort
Select top performers based on fluorescence

Image & Dispense
Capture images for monoclonality assurance and dispense selected cells into 96- or 384- well plates

Automated Workflow (4-8 Hours)

Built on picodroplet technology, Cyto-Mine encapsulates individual cells in tiny droplets, each acting as a mini bioreactor. It then rapidly screens millions of cells for target protein expression, sorts high-performing cells, and precisely dispenses single cells into wells, eliminating hands-on time and reducing contamination.



Clone expansion

After identifying top clones, researchers expand these cells under controlled conditions, monitoring their stability, productivity, and quality over time.

Challenge:

Clones may lose performance during scale-up due to changes in culture conditions

Strategy:

Apply stepwise expansion and early analytics, such as Cyto-Mine, to track performance and identify optimal growth conditions

Paving the way for scalable, reproducible research

Optimizing each step of the cell line development process allows scientists to generate high-performing cell lines that support efficient and reliable research. With advanced automated solutions like Cyto-Mine, researchers can scale discoveries and drive reproducible results from early-stage research through therapeutic development.



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