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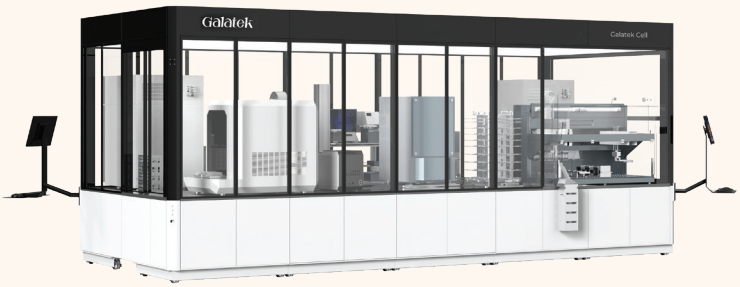
Automating Synthetic Biology Workflows



PORTFOLIO INTRODUCTION

Synthetic biology research demands precise, repeatable workflows across gene assembly, molecular cloning, colony picking, strain screening, and expression detection. Traditional manual methods limit throughput, introduce variability, and make traceability difficult — slowing the Design-Build-Test-Analyze (DBTA) cycle that drives biological discovery.

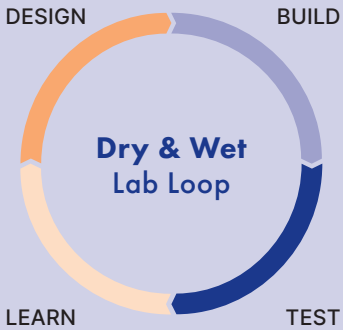
Galatek's automated synthetic biology platforms integrate robotics, intelligent software, and AI-assisted analytics to automate each stage of the DBTA cycle - from DNA assembly and plasmid construction through colony selection and verification, strain screening, and expression detection - and moving the emphasis of the last stage from "Analyze" to "Learn." A tiered platform portfolio allows laboratories to select the configuration that fits their throughput requirements, with a clear path to scale.

The advanced platforms integrate with Galatek's onboard software for intelligent scheduling, automated data management, AI-assisted colony identification, and traceability across every run — providing the high-quality, structured data assets required to train and advance AI models.

Automated Design-Build-Test-Learn (DBTL) Workflow

Design
- Plasmid sequence design
- Bioinformatics pathway analysis
- Media & process design
- Sequence optimization

Learn
- AI-assisted model refinement
- Multidimensional data analysis
- Knowledge base updates
- Reinforcement learning



Build
- Gene assembly & cloning (PCA, Golden Gate)
- Plasmid construction
- Transformation
- Colony plating

Test
- Colony picking & clone selection
- Strain screening & culture
- Emzyme activity detection
- Expression & yield quantification

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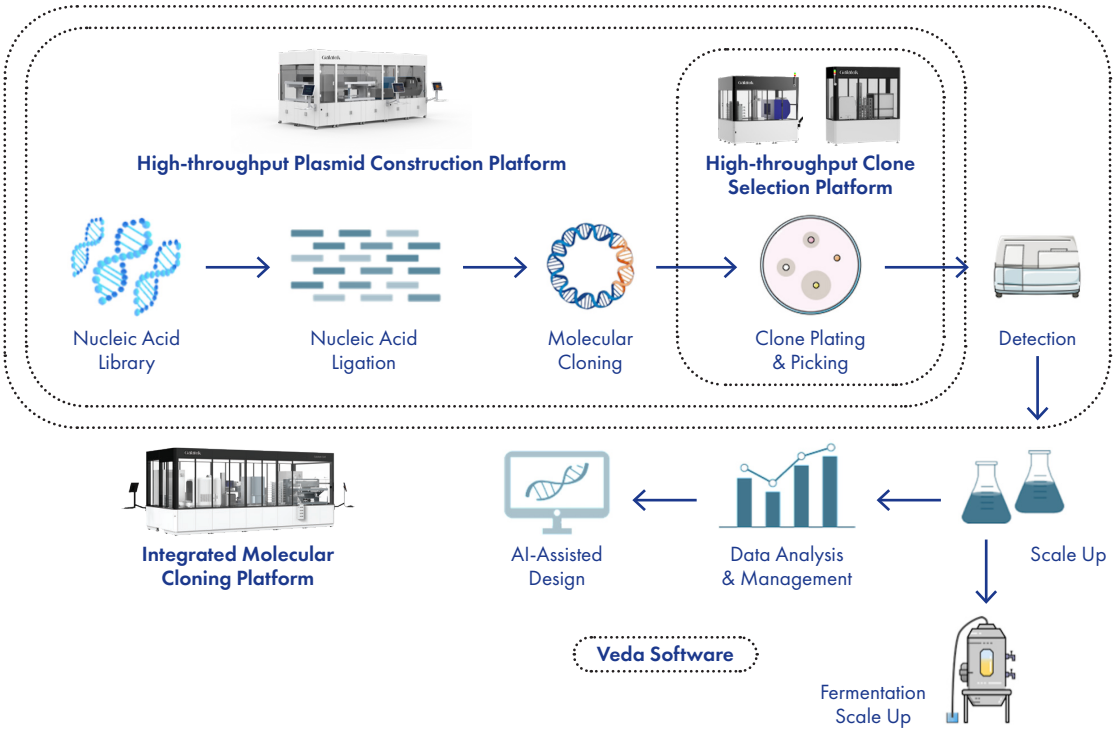
SYSTEMS OFFERED

Galatek's synthetic biology portfolio includes four automated platforms covering each stage of the DBTL cycle — from DNA assembly and plasmid construction through molecular cloning, colony selection, and strain screening. Platforms can be deployed individually or combined into a fully integrated workflow.



APPLICATION AREAS

Recombinant Protein Expression

Encode, select, and validate high-producing microbial strains for therapeutic or industrial protein manufacturing.

Directed Evolution

Generate and screen large variant libraries to identify sequences with optimized enzyme activity, binding affinity, or stability.

CRISPR-Based Genome Editing

Assemble guide RNA and donor constructs, then isolate correctly edited clones from heterogeneous post-transformation populations.

Metabolic Pathway Engineering

Build and screen multi-gene assemblies that redirect cellular metabolism toward target small molecules or chemical intermediates.

Synthetic Gene Circuit Construction

Construct and verify multi-part regulatory circuits — promoters, repressors, reporters — at the clone level before scale-up.

Biosensor Development

Engineer and screen strain libraries to optimize signal sensitivity, dynamic range, and specificity for target molecule detection.

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SYSTEM PARAMETERS

	High-Throughput Clone Selection Platform	High-Throughput Clone Selection Platform (Enhanced)	High-Throughput Plasmid Construction Platform	Integrated Molecular Cloning Platform
Dimensions (mm)	2,500 × 1,900 × 2,400	2,350 × 1,000 × 2,400	4,800 × 2,500 × 2,400	5,600 × 2,500 × 2,400
Throughput	600–3,000 colonies/hr	600–3,000 colonies/hr; ~1 min/plate for plating	~200 gene constructions/day; or 1,600 strain plating & screening/day	384–576 plasmid constructions or 480–960 strain screenings/batch
Sample Types	Bacterial colonies	Bacterial colonies	Nucleic acid library	E. coli, yeast, etc.
Environmental Control	—	—	—	HEPA filter
Picking & Plating	Disposable or steel pins; AI-assisted colony picking	Disposable or steel pins; multiple microorganism plating modes	Colony picking module; bacteria coating instrument	Full-process automation: colony picking, induction, detection
Gene Assembly & Cloning	—	PCR amplification, ligation, transformation end-to-end	PCA & Golden Gate assembly; targeted mutation support	Automated plasmid construction; plasmid validation
Detection & Analysis	AI colony imaging: size, color, morphology, count	ELISA data auto-matched to sample information	Microplate reader; AI-assisted identification	OD detection with decision/loop judgment; ELISA; fragment analysis
Cell & Strain Handling	Bacterial solution plating; monoclonal picking	Square-well culture plate; automated plating	Monoclonal culture; scale-up shake flask seeding	Overnight strain passaging; automated density thresholding
Data & Software	Scheduling & data management	Visual management; experimental data tracking	AI-assisted identification; visual management	High-quality data; growth curves; increased data volume
Best Suited for	High-volume monoclonal selection in compact configuration	Full-workflow DNA assembly with enhanced plating & ELISA integration	High-throughput plasmid construction and strain plating	Complex multi-step molecular cloning with plasmid construction and strain culture

SYSTEM COMPONENTS

Base Systems

The **High Throughput Clone Selection Platforms** automate monoclonal colony identification and isolation from transformed cell populations. Imaging analysis, supported by AI-enabled capabilities, helps assess colony size, color, and morphology to support robotic picking, while automated consumable handling reduces manual touchpoints throughout the run. The **Enhanced** configuration adds an on-board Colony Coating Instrument for a more comprehensive end-to-end workflow within the same footprint.

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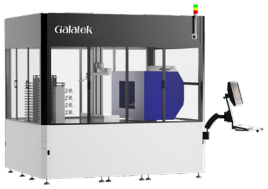
	High Throughput Clone Selection Platform	High Throughput Clone Selection Platform (Enhanced)
		
Robotic Arm and Scanner	✓	✓
Colony Picking Instrument	✓	✓
Consumables Stack	✓	✓
Automated Plate Lid Remover	✓	✓
Environmental Control Module	✓	✓
Colony Coating Instrument		✓

Additional devices can be integrated with the base systems to build out the **Plasmid Construction** and the **Integrated Molecular Cloning Platforms**. Examples of add-ons include:

- Centrifuge
- Film peeler
- Film sealer
- Fragment analyzer
- Freezer
- Liquid handling workstation
- Microplate reader
- Microfuge tube decapper
- Nucleic acid and plasmid purification instrument
- PCR instrument
- Plate hotel
- Thermal shaker

Whether supporting early-stage gene assembly, directed evolution, or large-scale strain screening campaigns, Galatek's synthetic biology platforms are designed to adapt as research programs scale. Each system is backed by Galatek's application expertise and integration support, ensuring that automation delivers not just throughput — but reproducible, high-quality data from day one.

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