Streamline your synthetic biology workflow with solutions from Beckman Coulter Life Sciences and Molecular Devices

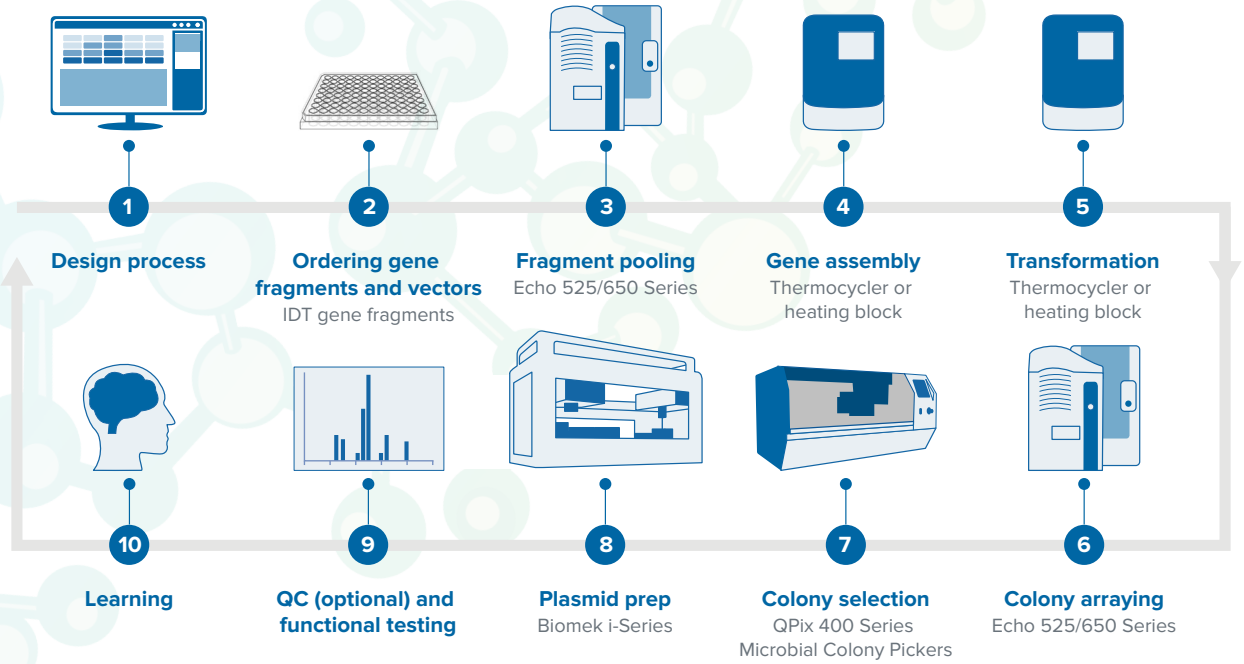
Synthetic biology is an interdisciplinary science with the potential to impact academic and industrial applications including the creation of novel therapeutics and vaccines, plant science and biofuels. The focus is often on generating, characterizing, and isolating parts of natural biological systems before using them as components of an engineered biological pathway. A trademark of synthetic biology is the application of rational principles to the design and assembly of these biological components. Even with rational design, the impact of introducing foreign DNA into a cell can be difficult to predict. This creates the need to test multiple permutations to obtain the desired outcome. An emphasis on the modular design of DNA parts enables the assembly of a greater variety of potential constructs by interchanging the individual components. Automation of the assembly process reduces the time, labor, and cost of generating multiple constructs to allow for an increase of throughput with an overall shortened development cycle.

Double-stranded DNA fragments are designed for easy gene construction. The assembled constructs are typically cloned into an expression vector and verified with colony qPCR or Next-Generation Sequencing (NGS). However, in some high-throughput workflows this verification step can be optional. The synthetic constructs are then analyzed in variety of functional assays. After learning from the assay results, the constructs can then be modified or refined. This design, build, test, learn cycle is repeated until a DNA construct is obtained that produces the desired function.

Key benefits

- The solutions offered by Beckman Coulter Life Sciences and Molecular Devices, both part of Danaher Corporation, are essential in automating the main steps of these high-throughput synthetic biology workflows.
- Reduced reaction volumes offer significant reagent cost and time-savings while improving reaction efficiency.

Gene assembly workflow



1 Design process

The *in-silico* tools to design the high-throughput gene assembly experiments.

2 Ordering gene fragments and vectors

Gene fragments and vectors from a variety of vendors, such as Integrated DNA Technologies (IDT), can be directly ordered in Echo source plates at the ready-to-use concentrations.

3 Fragment pooling

Echo acoustic liquid handling technology enables highly accurate, fully automated, non-contact dispensing of fluids in nL to µL volumes. By reducing reaction volumes the Echo offers significant reagent cost and time savings while improving reaction efficiency.

4 Gene assembly

A thermocycler or heating block for heating of the reaction mixtures and formation of the assemblies.

5 Transformation

The assembled genes are transformed into competent cells.

6 Colony arraying

Echo acoustic liquid handling technology enables high-density and high-throughput fully automated colony arraying onto media/agar plates. Hundreds of Petri dishes can be replaced with one densely spotted plate (up to 1536 spots).

7 Colony selection

Automated colony picking allows scientists to focus on discovery, instead of performing repetitive tasks. The QPix microbial picker uses precision robotics to quickly and accurately pick 3,000 colonies per hour.

8 Plasmid prep

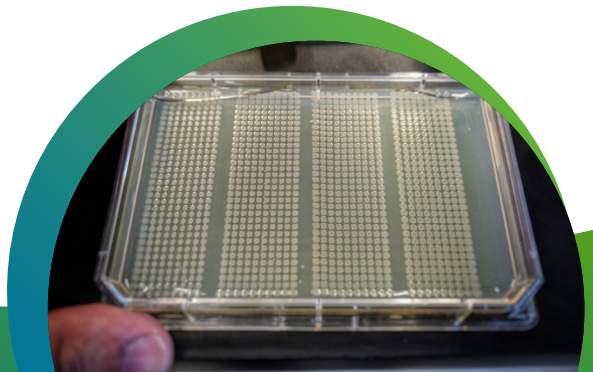
Automated plasmid prep on Biomek workstations reduces hands-on time and pipetting errors associated with manual processing. Ready-to-implement demonstrated methods provide quick implementation.

9 QC (optional) and functional testing

An Echo or Biomek i-Series can be used for setting up an optional QC step to select for successful gene assemblies. A variety of methods, such as NGS or colony qPCR can be used for the QC step; or instead a functional assay will be immediately pursued to select for the successful clones.

10 Learning

The learning from the round of experiments will be applied to the future *in-silico* design steps.



A 1536 pattern of bacterial colonies being arrayed by the Echo 525.
Image credit: George McArthur, Ansa Biotechnologies

BECKMAN COULTER Life Sciences

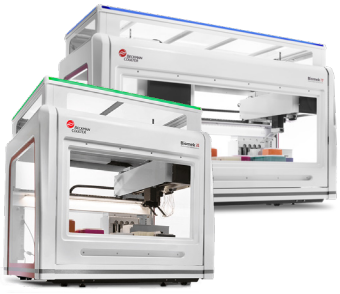
Echo 525/650 Series Liquid Handlers

- Up to ~75% faster gene assemblies and up to ~85% more efficient assemblies at reduced volumes, to reduce assembly cost by up to ~98
- Reduced cost of QC (up to 90%) using colony qPCR/NGS due to accurate and precise low-volume reaction setup
- Up to 97% faster normalization and pooling of NGS libraries
- Automated system for high-throughput and high-density colony arraying (up to 1536 colonies per plate)
- Consistent cell transfer

MOLECULAR DEVICES

QPix™ Microbial Colony Picking Series

- Fully automate synthetic biology workflows for DNA assembly, antibody discovery and protein engineering with library management
- Streamline your workflow with scalable automation – pick up to 30,000 colonies per day
- Automate several sample prep and plate handling processes such as transfer of bacterial liquid culture and plating on agar
- Electronic data tracking for well-documented data control



BECKMAN COULTER Life Sciences

Biomek i-Series Automated Workstations

- 0.5 µL – 5 mL pipetting capability to automate a wide range of workflows including extraction, plasmid-prep, NGS library prep, cell culture and functional assays
- On-deck devices (e.g. orbital shakers, peltiers) and integrated devices (e.g. plate washers, incubators) to control sample processing and minimize hands-on time
- Track sample and plate data with DART (Data Acquisition and Reporting Tool)
- Mid-throughput (i5) and high-throughput (i7) workstations to suit your workflow needs

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BECKMAN COULTER Life Sciences

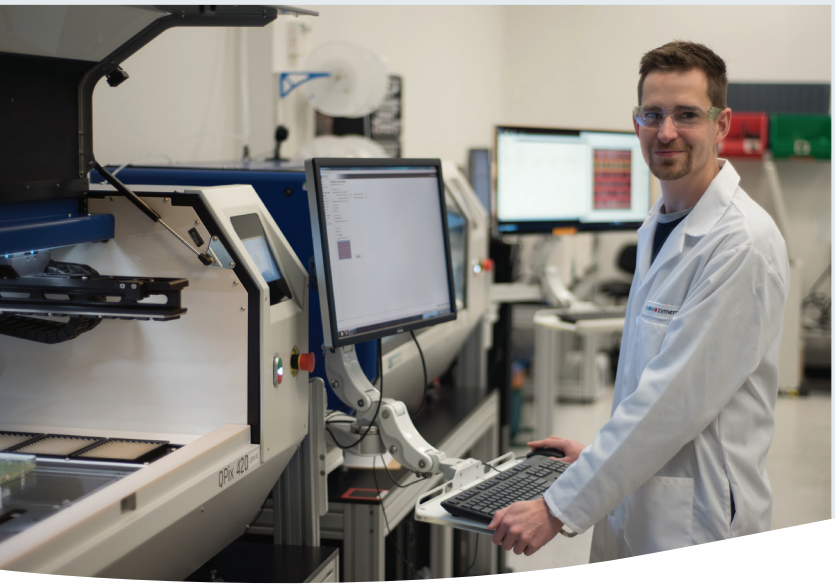
CosMCPrep Plasmid Purification Kit

- SPRI paramagnetic bead-based purification system to purify a variety of high and low copy number template types

Beckman Coulter Life Sciences Customer Breakthrough

"The Echo 525 automates complex liquid aliquot rearray at high speeds and at miniaturized scales, saving significant time and money. It has proven to be extremely versatile and robust; my teams have used it to set up PCRs, cell-free protein synthesis reactions and biochemical assays, and even to array colonies of transformed bacteria on solid media. At Ansa, the Echo 525 is the workhorse for our automated DNA assembly platform."

—George McArthur, PhD, Head of Product, Ansa Biotechnologies



Molecular Devices Customer Breakthrough

Zymergen uses the QPix colony pickers to make better microbes in industrial fermentation.

Zymergen's growing fleet of Molecular Devices QPix™ 420 Systems allows them to identify and pick large numbers of colonies quickly, accurately, and reliably. The QPix units are a critical link in their microbe engineering pipeline, integrating seamlessly with their state-of-the-art laboratory information management system (LIMS).

To find out more about the systems, contact your Beckman Coulter Life Sciences, IDT or Molecular Devices sales team or use the contact information below.

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Email: info@moldev.com
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