White Paper

Your Constructs, Your Timeline: Why It's Time to Own DNA Synthesis

Abstract

The biotechnology landscape is changing rapidly. As synthetic biology matures, research teams are increasingly expected to accelerate timelines without compromising fidelity, flexibility, or security. DNA synthesis - the foundational step of nearly every modern biology workflow - has not kept pace.

Service providers face growing backlogs, longer quote-to-delivery windows, and constrained capacity. Scientists are left navigating bottlenecks that stall discovery and development at a time when demand for custom DNA is surging across industries for applications ranging from therapeutic design and metabolic engineering to diagnostics and digital biology. The result? Missed deadlines, mounting costs, and an innovation cycle that's out of sync with what's technologically possible.

A growing number of labs are reclaiming control of their synthesis workflows.

The Gibson SOLA® Platform offers a game-changing solution that is fast and high-fidelity with in-house DNA synthesis that takes place overnight. Rather than outsourcing, teams can now autonomously build biology on-site with greater speed, visibility, and confidence.

Limitations of Traditional DNA Synthesis Methods

As demand for custom genetic constructs increases, the strain on traditional DNA synthesis pipelines has become more pronounced. Outsourcing to external providers, once seen as a standard practice, now presents significant logistical and scientific drawbacks that inhibit the pace and precision of modern research.

DNA synthesis through external providers often requires lead times of two to six weeks or longer. These delays span the entire order cycle, from initial quote requests to post-synthesis verification, and are exacerbated by bottlenecks in supply chains, production capacity, and global logistics. Labs operating on compressed timelines for grant deadlines, therapeutic development, or product launches are forced to wait while high-priority synthesis queues and batching policies push delivery dates further out. For too many teams, these delays create a recurring cycle of stalled experiments, resource reallocations, and planning strategies designed around uncertainty rather than innovation.

Lack of Control and Transparency

When synthesis is outsourced, visibility into the process disappears. Researchers are left without real-time updates, access to synthesis logs, or the ability to intervene when changes are needed. In urgent or time-sensitive scenarios, such as lead optimization or clinical candidate validation, the absence of actionable insight becomes a liability.

Modern synthetic biology is inherently iterative. Researchers often refine constructs based on screening data, experimental feedback, or new functional goals. Unfortunately, most outsourcing models are built for static, linear orders rather than flexible workflows. Adjusting a sequence after submission can require restarting the order entirely, adding new costs and further delays.

This rigidity makes traditional DNA synthesis misaligned with the fast-paced, data-driven experimentation seen in high-throughput environments, digital biology platforms, or AI-assisted design.

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Advantages of In-House DNA Synthesis

Shifting from outsourced synthesis to an in-house solution represents more than just a logistical improvement - it redefines how labs operate. The Gibson SOLA Platform delivers a new standard in autonomy and throughput by enabling rapid, high-fidelity DNA synthesis directly in your own lab. This transition empowers teams to operate on their own timelines, make real-time design decisions, and dramatically accelerate experimental workflows.

With Gibson SOLA, synthesis timelines shrink from weeks to a single day. Researchers can go from digital design to sequence-verified, transfection-ready DNA overnight. This speed closes the loop between design and experimentation, allowing for same-week iteration, rapid candidate screening, and real-time response to experimental data.

The ability to synthesize and test new constructs in a continuous cycle without waiting for third-party delivery enables faster project progression, shorter development timelines, and earlier decision-making.

Enhanced Confidentiality and IP Protection

When DNA constructs are outsourced, proprietary sequences must be shared with external vendors. This introduces security concerns, especially for commercial R&D teams working on competitive therapeutics, engineered strains, or synthetic circuits.

The Gibson SOLA Platform allows labs to maintain full ownership and privacy over their sequences. Sensitive data never leaves the organization, and synthesis takes place securely on-site, mitigating the risks associated with data transfer and third-party storage.

Precision and Quality Control at Every Step

With Gibson SOLA, researchers regain visibility into their synthesis workflows. The platform provides predictive success scores for each sequences with the ability to optimize with a click of a button (figure 1). Once DNA synthesis begins, the Platform provides real-time status updates, and sequence verification logs. This transparency gives teams confidence in the integrity of every run and allows them to troubleshoot or pivot faster than possible with a third-party vendor.

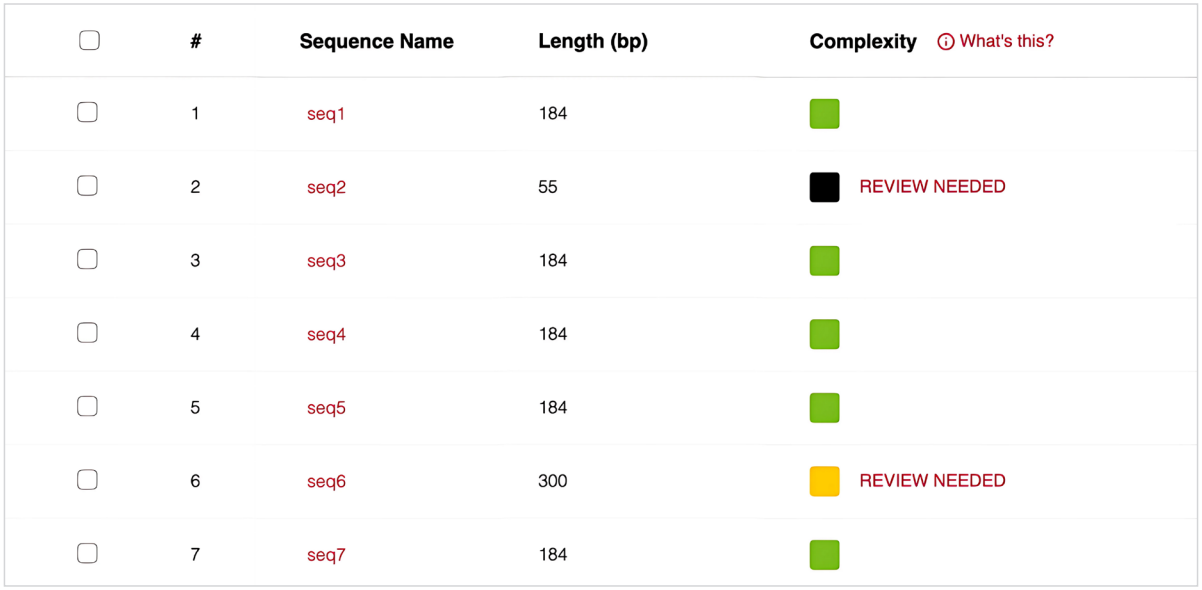


Figure 1: A predictive success score is provided for each sequence prior to initiation of DNA synthesis.

Introducing the Gibson SOLA Platform

The Gibson SOLA Platform is a next-generation DNA synthesis system that redefines how genetic material is optimized, built, and deployed in modern labs. Designed to operate within existing workflows, Gibson SOLA empowers researchers with overnight, high-fidelity DNA synthesis and full control over every step of the process.

By combining automated hardware, enzymatic chemistry, and proprietary assembly workflows, the platform eliminates longstanding bottlenecks in outsourced synthesis, enabling teams to build biology on demand, in-house, and at scale.

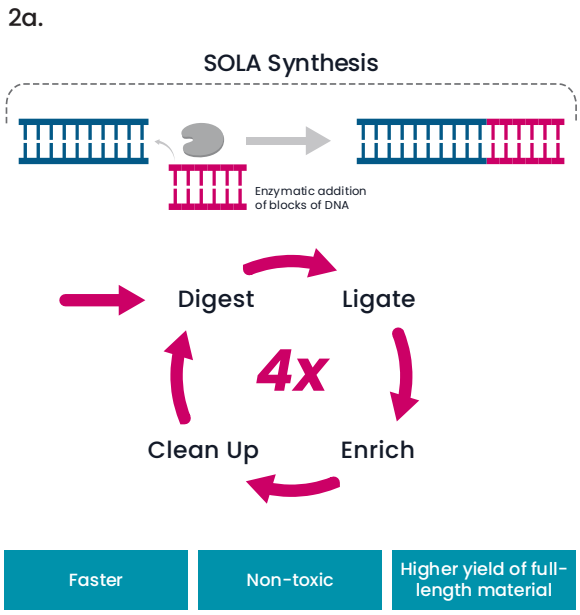
A. Rapid, Overnight Synthesis

Traditional service providers can take 2–6 weeks to return sequence-verified plasmids. The Gibson SOLA Platform condenses this timeline into a single day. With integrated design and build capabilities, SOLA allows researchers to go from digital construct to sequence-confirmed DNA overnight, enabling transfection, screening, or downstream assembly the very next morning. This acceleration is critical in applications where timelines are tied to funding cycles, competitive milestones, or clinical translation.

High-Fidelity Block-Based Assembly

Unlike single-base addition methods that introduce synthesis errors and limit buildable sequence complexity, Gibson SOLA uses a robust block-based assembly technique. Pre-qualified short DNA segments are enzymatically joined with high accuracy and minimal bias, dramatically improving the fidelity and length of assembled constructs.

The result: greater than 80% full-length DNA constructs directly off the system, with minimal need for downstream purification or correction. This method also reduces common issues like homopolymer errors and low-yield truncations seen in older enzymatic approaches.



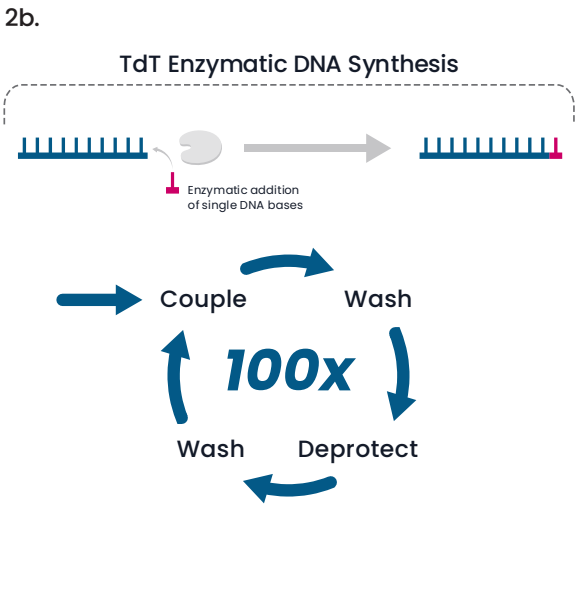


Figure 2a. By starting with pre-qualified, short building blocks, the Gibson SOLA Platform enables the on-demand synthesis of 100bp DNA constructs with significantly fewer steps than traditional DNA synthesis methods. This results in faster completion times compared to outsourcing to service providers while leveraging non-toxic reagents to achieve a higher yield of the desired full-length product.

Figure 2b. Historical approaches to DNA synthesis build DNA strands one base at a time, introducing complexity and errors with each base. The accumulation of mis-bases leads to a reduction in usable yield and restricts buildable sequences.

Scalable from Discovery to Production

Gibson SOLA is engineered for flexibility. Whether a team is synthesizing 20 kb per week for rapid prototyping or scaling to hundreds of kilobases per day for more advanced applications, the platform delivers consistent performance across volume ranges.

One system supports a full project lifecycle from initial construct design to production-grade DNA without need for external vendors, renegotiated specifications, or shipping delays. The Gibson SOLA Platform was built to complement existing digital biology and synthetic biology pipelines. The system provides remote monitoring, log tracking, and intelligent feedback for construct optimization, supporting both novice and expert users.

The Gibson SOLA Platform doesn't just automate DNA synthesis–it reshapes how teams think about time, quality, and control.

Fidelity, Error Rates, and Yield

High-fidelity synthesis is essential for downstream success in synthetic biology, therapeutic development, and genome editing applications. The Gibson SOLA Platform achieves error rates as low as 1 per 90,000 base pairs - comparable to or exceeding the standards of leading service providers.

Sequencing results from PacBio Revio™ system with HiFi sequencing chemistry (Pacific Biosciences, Menlo Park, CA) analysis demonstrate error-free read rates exceeding 95% across amplicons up to 6.3 kb in length (Figure 3). This high accuracy enables direct downstream use of synthesized DNA, reducing time spent on quality control, troubleshooting, or rework due to misassembled sequences.

Average error rate: 1 per ~180,000 bp
Median error rate: 1 per ~90,000 bp

PacBio Revio™ system with HiFi sequencing chemistry

	Total Reads	Error-Free Reads	Length (bp)	Error-Free DNA
TBIO_105	9,236	9,005	2,842	97.4%
TBIO_205	9,498	9,030	2,079	95.1%
TBIO_305	8,736	7,921	1,858	90.7%
TBIO_405	8,849	8,487	3,555	95.9%
TBIO_505	9,073	8,721	3,475	96.1%
TBIO_605	9,481	8,619	3,494	90.1%
TBIO_705	9,422	9,279	3,522	98.4%
TBIO_805	9,059	8,945	6,336	98.7%
TBIO_905	9,902	9,756	7,337	98.5%

Following PacBio Amplicon Analysis (https://github.com/PacificBiosciences/pbAA)

Figure 3: The Gibson SOLA Platform generates high-fidelity DNA, as seen in amplicons with error-free read rates sequenced on a PacBio Revio™ system with HiFi sequencing chemistry.

Resource Optimization and Team Efficiency

Traditional synthesis delays force labs to reschedule downstream work, delay experimentation, and reallocate labor to lower-priority tasks. These interruptions can disrupt project momentum, compromise deadlines, and reduce team efficiency.

By integrating Gibson SOLA into the workflow, labs are no longer dependent on external turnaround times. Scientists can initiate synthesis runs on-demand, reduce downtime between design and validation, and maintain a continuous experimentation rhythm. Teams gain more control over their schedules, enabling better utilization of personnel, instrumentation, and lab space. Furthermore, the platform's automation and intuitive interface reduce training time and minimize the need for hands-on intervention—freeing up valuable staff for higher-order scientific tasks.

Future Prospects in DNA Synthesis

The demand for rapid, precise, and scalable DNA synthesis is only increasing. As synthetic biology, precision medicine, and AI-driven design continue to reshape the life sciences, the need for technologies that can keep pace with digital workflows is becoming urgent. The Gibson SOLA Platform offers a timely, scalable solution, and its capabilities position labs to thrive in the next generation of biology.

Biology is no longer confined to the constraints of traditional experimental timelines. Whether designing next-generation therapeutics, engineering microbes for sustainable manufacturing, or building new biological systems from scratch, speed is now a competitive advantage.

By giving researchers the power to synthesize DNA in-house overnight, Gibson SOLA helps transform research velocity into a strategic asset. Projects that once took months to move from concept to construct can now advance in days, enabling real-time iteration, parallel experimentation, and faster validation of breakthrough ideas.

Ready to regain control of your DNA synthesis?

Learn more at: telesisbio.com/sola

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