Pharma & Biotech Innovation

JUNE 2026

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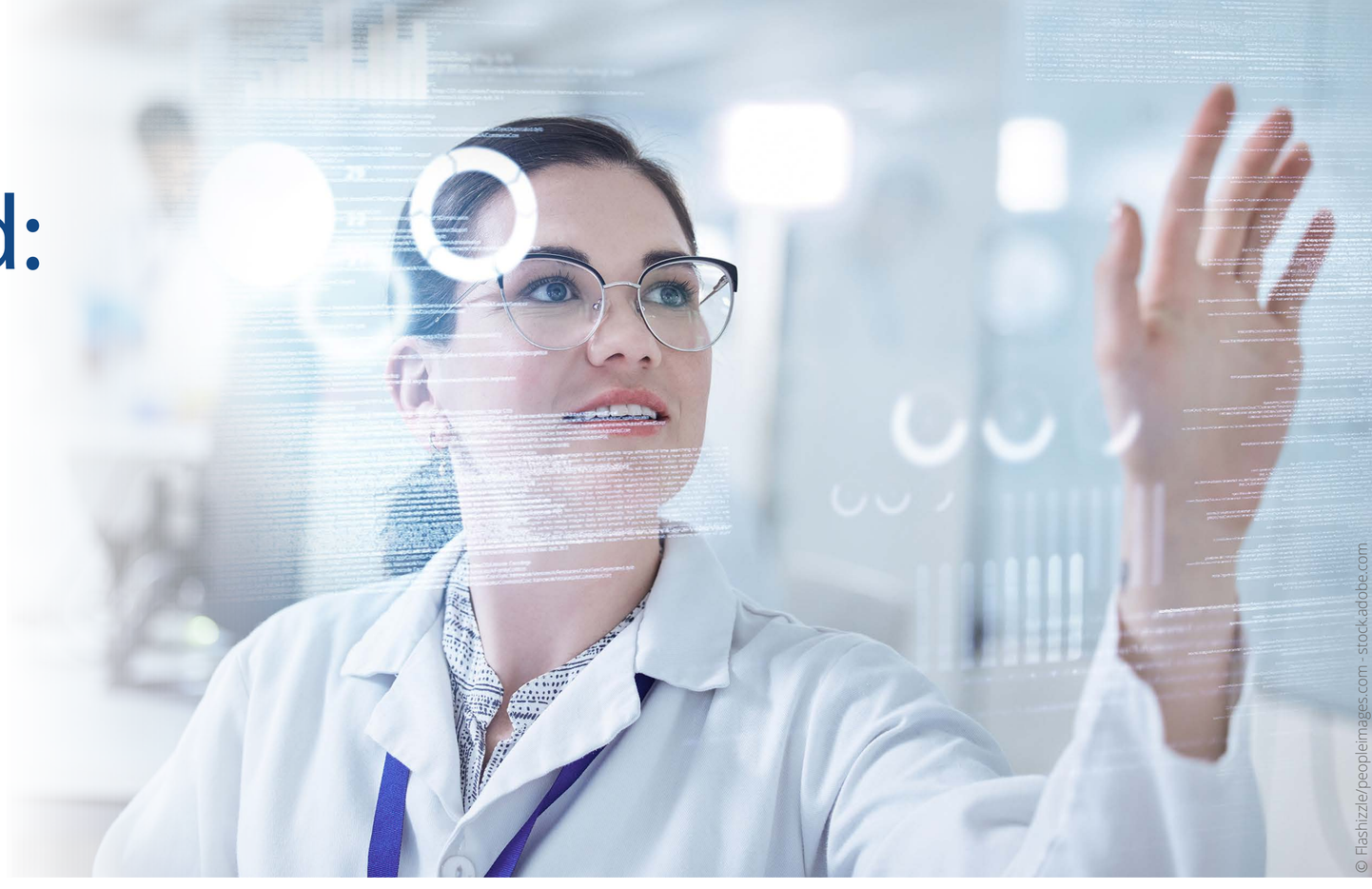
Discovery Reimagined: Where Pharma and Biotech Innovation Is Heading



Christene Smith, Editor in Chief, CHEManager International

Drug discovery has always been a race against biology, time, and money. This digital collection focused on Pharma & Biotech Innovation looks at how the industry is running that race differently in 2026, with data infrastructure and artificial intelligence reshaping nearly every stage of the value chain.

The change is real and accelerating. Big pharma companies like Roche, Boehringer Ingelheim, Merck, and Bayer have embedded AI across R&D and operations. Tech giants, meanwhile, are moving into drug development territory, which raises a question the industry is only beginning to answer: who builds the first AI-designed medicine to reach patients?

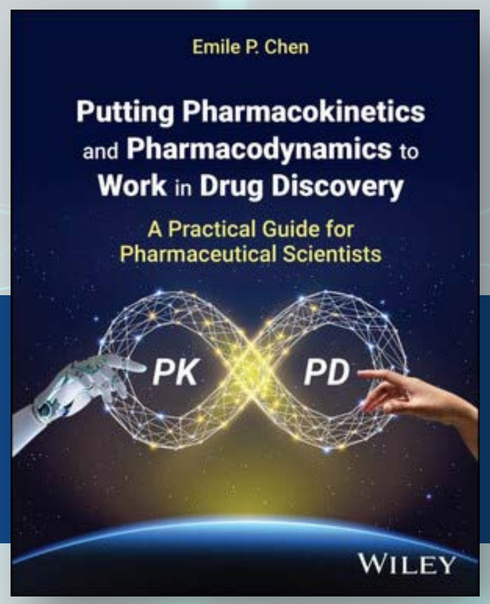
Inside, you will find CIO perspectives from pharma leaders on where digitalization is genuinely delivering. You will read about the gap between lab promise and manufactured product, and why two start-ups, Primogene and Aminoverse, are closing it from opposite ends. CDD Vault shows how integrating AI tools into a single research platform cuts through data fragmentation. Fette Compacting demonstrates what true lab-to-production continuity looks like in tablet manufacturing. Zeta makes the case that Pharma 4.0 stalls without a consistent data foundation built from day one. Enamine celebrates 35 years of advancing drug discovery, from a Kyiv startup to a global chemistry partner. And Wiley's Josh Jarrett argues that the quality of evidence underneath an AI system matters as much as the model itself.

The tools exist. The question is whether your organization can move fast enough to use them.

Christene A. Smith, Editor-in-Chief, CHEManager International

The Science Behind Better Drugs

From molecule to market — four essential references for pharma and biotech researchers.



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Emile P. Chen
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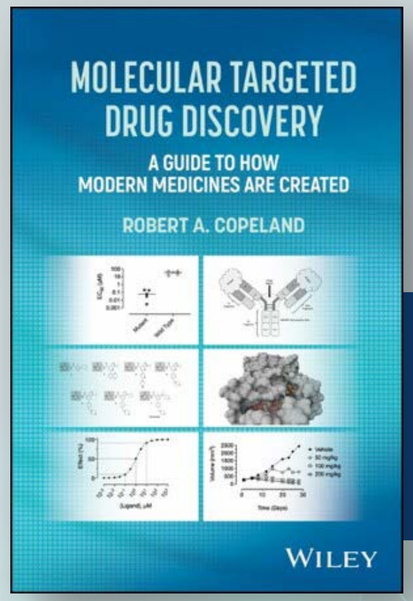

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Robert A. Copeland
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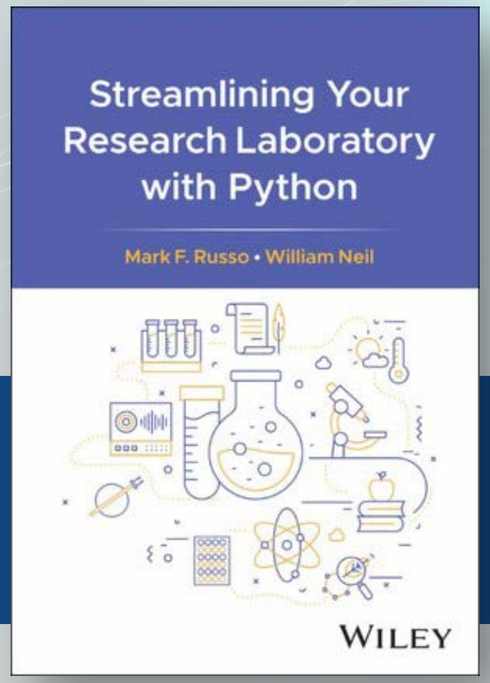

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Mark F. Russo, William Neil
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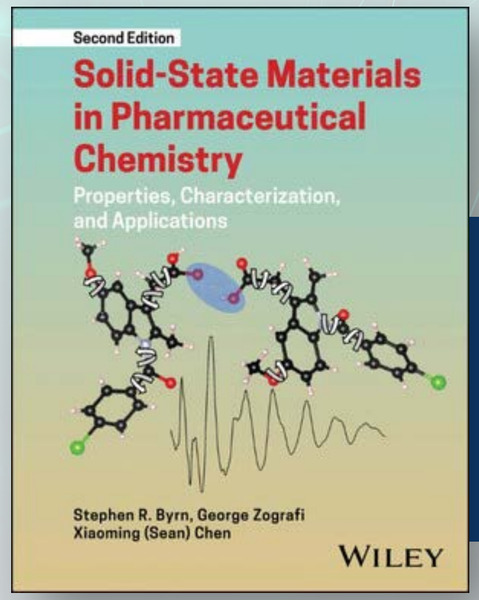

Solid-State Materials in Pharmaceutical Chemistry 2e
Stephen R. Byrn, George Zografi, Xiaoming (Sean) Chen
ISBN: 9781394254446
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Collection Celebrates Enamine Growth

“When we started this journey back in 1991, the world of drug discovery was on the cusp of a revolution. At that time, high-throughput screening was emerging as a powerful new approach, and we saw a clear opportunity to meet the rapidly growing demand for novel compound libraries, because novel and diverse chemistry was the key to success. We started with a simple conviction: access to new molecules should be fast, affordable, and diverse, but never a bottleneck in the pursuit of eventually bringing new medicines to market.

© Enamine

Thirty-five years later, I look at what we have all built, and I am genuinely humbled. From those early days, when Enamine was a small grant-funded group in the Kyiv Institute of Organic Chemistry, it has grown into a global leader and trusted partner to pharmaceutical and biotech companies, drug discovery centers, and academic institutions across the world. Now we are a team of more than 3 thousand people with sites in 6 countries. Our screening collections, building blocks, chemical libraries, and early drug discovery services are now part of countless research programs worldwide. Today, Enamine stands among the top 20 Contract Research Organizations (CRO`s) in the field worldwide… I could not even dream of anything like that back in those days.

We were expanding very fast each year, multiplying our capabilities. These years are years of hard teamwork and passion, that have led to constant growth. But what excites me most today is not what we have already delivered, but where we are headed. We live in a thrilling new era, when new approaches and methods are reshaped every day. Rather than standing on the sidelines, we at Enamine have chosen to lead. Through our drug discovery services, we have built a fully integrated platform that connects world-class chemistry, biology, and computational science with access to ultra-large chemical spaces. Together with our years of gained knowledge and expertise, this forms one seamless, powerful organism.

The Enamine Drug Discovery Conference is coming to Riga, Latvia!

Enamine celebrates its 35th anniversary in 2026. We are excited to announce that the Enamine Drug Discovery Conference will take place on September 20–23, 2026, in Riga, Latvia, at the Radisson Blu Latvija Conference & Spa Hotel. The event aims to bring together world-leading experts in Organic, Medicinal, and Computational Chemistry, as well as Biology, to discuss the latest advancements in their research work.

Don't miss the opportunity to attend this special event!

September 20 – 23, 2026
Enamine Drug Discovery Conference
Riga, Latvia

Your Trusted Partner for Integrated Drug Discovery

From Catalogue to Collaboration: Enamine's 35 Years of Advancing Drug Discovery

Marking 35 years of innovation, this collection celebrates how Enamine has grown from a regional supplier into a trusted global partner — combining world-class chemistry, biology, and computational science to accelerate your drug discovery research.

Download this complimentary Expert Insights collection today!

Inside this Expert Insights collection, you'll explore:

- How Enamine grew from a Kyiv startup to a global chemistry partner — offering nearly 3 million stock compounds, billions of synthesizable molecules, and a full range of drug discovery services to pharma, biotech, and agrochemical researchers worldwide
- A practical overview of the building blocks reshaping medicinal chemistry today — including sp^3-rich scaffolds, organoboron compounds, sulfonyl fluorides, and bicyclopentane-based motifs
- How fluorinated cycloalkyl rings (C3–C7) can improve a compound's metabolic stability, lipophilicity, and target binding — illustrated with examples from approved drugs
- A new class of water-soluble benzene mimetics that overcome solubility limitations of standard BCP scaffolds, with a scalable synthesis route suitable for broad use

Whether you are optimizing leads, exploring novel building blocks, or seeking new synthetic strategies, this collection provides practical insights and actionable tools for advancing your research.

We are no longer another catalog company that supplies compounds. We have become partners in the entire early drug discovery journey, which starts from target identification up to preclinical studies.

The challenges ahead are immense. But so is our resolve. At 35, Enamine is not a company looking back at its legacy. We are a company accelerating into its most ambitious chapter yet, with the same passion for everyday work, the same commitment, and the same belief that innovation in modern science should be accessible to the entire scientific community globally."

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Andrey A. Tolmachev,
Founder and Owner of Enamine

AI as a Game Changer

How Artificial Intelligence Is Transforming the Work of Biotech and Pharma Companies

A revolution is underway in the pharmaceutical industry: drug developers are now using artificial intelligence (AI) at nearly every stage of development to make their processes faster and more efficient and to discover new active ingredients. At the same time, technology companies are increasingly entering drug development using AI. As a result, the rules of the game in drug development are changing significantly. Here's a look behind the scenes of pharmaceutical research and production.

The Penzberg site of the Swiss pharmaceutical and diagnostics company Roche sits like an island in the Nonnenwald forest. It almost seems as if the plant wants to hide. Yet here, about 30 miles south of Munich, around 7,900 employees work on developing and producing new medicines and diagnostic tests. They now use artificial intelligence in many activities; just last year, all approximately 100,000 employees across the company were trained in handling AI. Most have a laptop, use digital tools, and store data in a secure cloud area with Google.

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Old Math, New Computing Power

Anna Bauer-Mehren is Roche's AI expert for diagnostics and pharmaceutical research in Penzberg and a member of the Bavarian AI Council . She studied bioinformatics more than 20 years ago, focusing on AI and real-world data. She is familiar with the mathematics behind many biological-pharmaceutical models: "That comes from the 1950s and '60s. For a long time, it just couldn't be computed." There simply weren't computers powerful enough to, for example, run large neural networks. The breakthrough only came much later, after 2010, with GPUs—graphics cards. These chips are specialized in performing many simple calculations simultaneously—exactly what neural networks require.

In the pharmaceutical sector, scientists use artificial intelligence to better understand targets—specific biomolecules in the body to which a drug binds to achieve a therapeutic effect. They also use AI to find new targets and build suitable molecular structures that form the basis for future drug active ingredients. To do this, scientists link existing literature information with experimental data.

This involves questions like: What has been measured about a protein in the lab so far? Can a target be switched off or upregulated to achieve a certain effect?

© Boehringer Ingelheim

Which molecule, among billions of possibilities, might fit and is worth further testing? All this information and data are linked by AI. It tries to find connections, check hypotheses, or generate new ones. "AI can speed up these processes tremendously," says Bauer-Mehren .

AI in Drug Development

Just like Roche, nearly all pharmaceutical companies, such as Sanofi , now rely on artificial intelligence. At Boehringer Ingelheim , they say: "We are changing the way medicines are discovered and developed by integrating computational biology, AI, and data excellence into every step of our innovation pipeline."

The biotech company Amgen uses AI and machine learning (ML) "to revolutionize, accelerate, and increase the success rates of drug development." The company sees this as a "game changer" in biotechnological drug development.

AI is used in the pharmaceutical industry in many ways. Generative AI models can test nearly infinite molecular combinations in hours or days—instead of years as before—to find new molecular structures. Agentic AI and autonomous systems are highly specialized assistants that autonomously carry out tasks like literature research, patent analysis, hypothesis generation, or experiment planning. In the fusion of biology and AI, digital twins are used to simulate disease progressions and the function of drugs on the computer. AI can also speed up clinical trials by analyzing real-world evidence—insights from everyday treatment—to improve protocols and demonstrate the benefits of new medicines more quickly.

Making Chemistry More Effective with AI

Now, a change of location to Garching, about 12 miles north of Munich. Here, on the campus of the Technical University of Munich (TUM), in the Center for Functional Protein Assemblies (CPA), Professor Stephan Sieber has his office. He's a professor of organic chemistry and has been working for several years with his students on how chemistry and biology in drug development can be made better and more efficient using AI. For example, they're researching how AI-based chemical language models can be used to develop new antibiotic molecule structures. "There are already many derivatives of these structures, but only a few fundamentally new developments," says Sieber. One approach is to learn from existing molecule structures in order to predict new ones that are chemically quite different. "Thanks to AI, we are now getting far more suggestions for new molecule variants than before," says Sieber.

The journey into the depths of the AI world is one of trial and error, new questions, hypotheses, and ideas for approaches. Some things work better than others. Sieber says that the absorption model, for example, already works with acceptable results. This is about how molecules are absorbed into structures such as the human body. These models are based on large amounts of physicochemical data and are therefore "extremely reliable."

According to the chemistry professor, protein structure-based generative AI models still present a challenge. New molecules need to fit into a binding pocket as perfectly as a key fits a lock and produce an effect there. The problem: There are trillions of possible molecular combinations. And even if promising candidates are found, that doesn't mean they'll deliver as expected in practice.

In particular, translating AI results into the lab—the real, molecular world—still needs further optimization, Sieber says. On the other hand, he says, "this is a very hot field, and a lot will happen in the near future."

Roche: Learning Process Through "Lab in the Loop"

At Roche in Penzberg, work is also being done at the interface between digital insights and implementation in the lab. Here, they call it "Lab in the Loop." Since the AI sequences initially only exist on the computer, they must then be synthesized and recreated. The goal is to measure their properties and check if the predictions hold true. In other words: Is the AI right or not? This knowledge is then fed back into the AI in order to keep improving the digital high-performance machine. "With each iteration—the loop—the AI gets better," says Jo Stevens, who holds the title of "Team Lead Antibody Engineering & Expert Lab Digitalization" at Roche. He adds, "Even in the digital world, you can't do without labs."

The scientist explains that in "Lab in the Loop," the goal is also to align the language of lab workers with the AI language of data scientists. "These are two completely different worlds," observes the Belgian, who after studying AI, also completed a degree in molecular biology. In the first round of Lab in the Loop, it took about five months to explain to the data scientists what the data meant and in what context they should be seen to train the models correctly. In the next round, they managed it in just five weeks.

The Challenge of Data

Data is one of the central challenges in the AI world, says TUM Professor Sieber. The question is: Can you trust it? Non-uniform data formats and missing validation frameworks—standards and specifications—often cause AI projects to fail. Roche expert Stevens has had this experience, too: " Externally collected data, such as that from patients in hospitals in different countries, is rarely compatible."

The amount of data is also a crucial factor in the AI world. While it's possible to build digital twins—that is, virtual models that simulate a lung cancer cohort that doesn't exist in reality—you can use them to test, for example, what happens when you increase the dosage of a drug or give another drug as well. "To make such predictions, however, you need good models," says Roche scientist Bauer-Mehren. "And you have to train those on extremely large amounts of data."

In the end, it's about a big goal: " Ultimately, we want to know how humans work. How do their cells function?" It's also about whether AI can replicate the human organism so that future drug development and clinical trials can take place largely digitally? Bauer-Mehren dampens the enthusiasm: "We are still a long way off."

Tech Companies as New Competitors

Meanwhile, pressure is coming from another direction. Major tech companies like OpenAI and Google are pushing into drug development with AI. According to industry experts, with their resources, these companies could reorder the balance of power. Capital, computing power, and the world's best AI talent give tech companies structural advantages that traditional pharmaceutical companies can hardly compensate for.

The first signs of a possibly profound structural change are already visible: In early 2026, the AI company OpenAI announced "ChatGPT Health" for clinics and doctors; soon after, Anthropic followed with the tool "Claude for Healthcare," after the company had already announced "Claude for Life Sciences," a partner tool for scientists and developers in the pharmaceutical industry, in fall 2025. And Isomorphic Labs , a British subsidiary of Google parent Alphabet, is testing a drug developed with the help of AI in clinical trials. Meanwhile, Amazon is investing $50 billion in OpenAI. The world's largest online retailer, which has run its own health division, Amazon Health , for years, can now access AI models from OpenAI.

Pharma Industry Turns to Collaboration

The pharmaceutical industry counters that tech companies lack comprehensive expertise in research, development, clinical trials, and production to fully digitize the drug development process. Instead, they focus on collaboration rather than competition. Since 2023, Roche has been working with chip manufacturer Nvidia and recently announced the start of an AI factory. Eli Lilly is also collaborating with Nvidia and hopes to increase the success rate of new drugs using AI. The Israeli generics manufacturer Teva relies on Aion Labs, a joint project of leading pharmaceutical and technology companies, while Pfizer is cooperating with digital startups, spin-offs, and tech firms.

Who Will Bring the First AI Drug to Market?

The big question: Who will ultimately bring the first AI-developed medicine to market—a pharmaceutical company, a biotech, or a tech company? While AI is revolutionizing drug development, it is still more of an assistant system than a digital replacement for real humans. As TUM Professor Sieber points out: "We still haven't understood a large part of the cell. That means we're still missing a lot of data."

Thorsten Schüller, CHEManager

Digitalization as a Strategic Lever in R&D

Digital Innovation: a Key Driver of Competitiveness and Sustainability across the Pharmaceutical Industry

Digitalization has become a central driver of pharmaceutical research, reshaping virtually every stage of the value chain. The greatest leverage of digital tools and artificial intelligence (AI) lies in making complexity manageable, virtualizing experiments, and accelerating decision-making through data-driven insights.

Accelerating Drug Research

Digitalization is no longer a standalone trend; it is fundamentally reshaping pharmaceutical research from end to end. The most significant advances are emerging at the intersection of biology, data science, and platform-based innovation.

This spans the full value chain, from target identification and drug design to preclinical development and clinical trials, through regulatory approval and regulatory affairs, and ultimately to the manufacture of finished dosage forms.

Companies such as Roche, Bayer, Merck, and Boehringer Ingelheim have long relied on digitalization to optimize their value chains. Their aim is to deploy technology strategically to improve health outcomes and, over time, help overcome serious diseases.

At Roche, the Swiss pharmaceuticals and diagnostics group, digitalization is closely tied to accelerating R&D and bringing medicines and diagnostic solutions to market faster. "We know that patients urgently need our innovative medicines, and we use digitalization to shorten the time it takes for them to gain access to our products," Steve Guise, former Head of Informatics for the business units at Roche, told CHEManager.

For research-driven Boehringer Ingelheim, much of the potential of digital technologies lies in R&D - from identifying and understanding diseases more precisely to designing molecules, predicting their properties, and advancing clinical development. "Technologies and trends such as artificial intelligence can sustainably and positively influence our entire value chain by accelerating processes and enabling more accurate predictions," said Clemens Utschig-Utschig, Head of IT Technology Strategy / CTO at Boehringer Ingelheim.

The German company has embedded its digital strategy across the value chain, with a clear emphasis on R&D. Three digital solutions are already in use to strengthen connectivity and collaboration in research, enable real-time calculation of structural molecular properties, and detect synthesis impurities.

Michael Reubold, Managing Editor, CHEManager

As data and AI become more deeply integrated, competitive advantage is shifting from pure scale to the speed of insight.

"Data and AI are increasingly becoming an integral part of our company's nervous system," said Walid Mehanna, Chief Data & AI Officer at Merck. Precise, trustworthy data creates transparency across the value chain, from early-stage research to commercial production and customer service. AI helps uncover complex relationships in those data, simulate scenarios in hours rather than weeks, and accelerate evidence-based decision-making. In turn, this can shorten time to market for new active ingredients.

Generative AI (GenAI) is also a major focus at Roche. "In drug development, for example, we are pursuing new approaches that generate innovative molecules we would not otherwise have discovered. Here, we want to use GenAI for target identification and molecular design," said Guise.

The first medicines discovered and developed largely through AI may soon reach the market. Yet AI does not make people obsolete - it enables them to focus on higher-value tasks.

People Are at the Center of Digitalization

"Digitalization is not primarily about technology or data, but above all about mindset," said Patrick Markt-Niederreiter, who served as Vice President Digital Excellence at Daiichi Sankyo until early 2025.

Clemens Utschig-Utschig shares that view: "The core of successful digitalization is always the person at the center, supported by technology." In his assessment, digital transformation succeeds only in an environment that encourages learning and lowers barriers to experimentation. What matters are an engineering mindset, targeted employee enablement, and a leadership culture that embraces technology openly.

Guise makes the same point: "The most important success factor has always been - and continues to be - the talent of our employees. We invest considerable effort in securing the best talent and the right capabilities in the right locations."

Mehanna likewise sees the main stumbling blocks not in technology, but in culture and governance. Merck is therefore focusing on three mutually reinforcing technology fields: expanding its data and AI ecosystem into a global multi-cloud landscape with on-premises capabilities, building a company-wide knowledge graph to ensure the traceability of AI-driven decisions, and further developing the myGPT suite into a central access point for systems and data.

Optimizing Processes, Recognizing Patterns, Eliminating Inefficiencies

Mehanna sees significant potential for digital technologies across the entire end-to-end value chain. In research, AI-supported in silico screening can dramatically accelerate the identification of promising molecules. In technical development, digital twin platforms help reduce the number of physical pilot runs required.

Boehringer Ingelheim is also using digitalization to optimize biopharmaceutical processes. The company applies AI in operations, while digital twin technology in manufacturing helps identify bottlenecks and inefficiencies in production.

Digitalization as a Driver of Innovation and Prevention

Bayer is concentrating on particularly promising business areas and leveraging innovation and digitalization to strengthen competitiveness and drive sustainable growth over the long term. The company sees digitalization as a central lever for addressing demographic and ecological challenges. In healthcare, Bayer is advancing the shift toward a more prevention-oriented Medicine 3.0, underpinned by digital technologies and data analytics. In pharmaceutical research, data models are helping to improve understanding of drug interactions and make clinical processes more efficient.

At Roche, digitalization is regarded as a strategic imperative. "Data & Digital is one of the central pillars of our future ambitions. This applies both at group level and within the individual divisions, across both pharmaceuticals and diagnostics," Guise explained. "In pharmaceuticals, we see a closed loop in drug research in which predictions, experiments, analyses, and modeling will form a new paradigm capable of delivering major leaps in innovation. In development, the goal is to build a fast and efficient engine for running clinical trials and preparing submissions to regulatory authorities worldwide." He added: "We will continue to invest heavily in technology, data, and digitalization in the years ahead."

Across the pharmaceutical and medical technology sectors, the overarching goal is to use digital tools and software to deliver better outcomes for patients and healthcare professionals. Digitalization also enables the industry to take a more active role in health information and prevention. It has no fixed beginning or endpoint; rather, continuous learning and experimentation remain essential to navigating change successfully and generating innovative solutions.

Michael Reubold,
Editor-in-Chief, CHEManager

Closing the Gap Between Lab and Production

Shorter development cycles and increasingly complex active ingredients are demanding integrated solutions. Guided by the principle "Together – from lab to production," Fette Compacting positions its R&D Solutions as a comprehensive process partnership.

Doreen Dunst, Application Specialist, Fette Compacting

Fette Compacting offers end-to-end support: from formulation and process development through technology transfer to ongoing optimization. The methodological backbone is Quality by Design, which links critical material properties, process parameters, and quality attributes, creating a clear framework for stable processes. Complementing this, the Qualified Experts-Database (QED) of Fette Compacting consolidates more than 75 years of tableting expertise and uses AI for early, data-driven process predictions.

"Shorter development cycles and increasingly complex active ingredients are demanding integrated solutions."

Material Understanding Starts in the Lab

The process begins with material characterization, formulation development, and feasibility studies. Using minimal sample volumes, the F Lab 10 powder compaction analysis unit delivers comprehensive data on densification and compaction behavior, making it particularly valuable for high-cost active ingredients.

When it comes to scaling up, emulators precisely replicate key sections of the production machines. The results can therefore be transferred plug-and-play, with no conversion factors required. The Galenic-Tablet Press 102i, structurally identical to its production-scale counterparts, enables the direct transfer of process parameters as well as process-relevant data like dwell time and filling behavior.

A Seamless Transition

In the GMP environment, Fette Compacting experts support validation, clinical batches, and stability studies, while embedded Process Analytical Technology (ePAT) safeguards production quality in real time. These Production Services then pick up seamlessly with subsequent technical support, process optimization, and global training. The result: shorter time-to-market, greater process reliability, and a partner that stays close from the lab to daily production.

Doreen Dunst, Application Specialist at Fette Compacting

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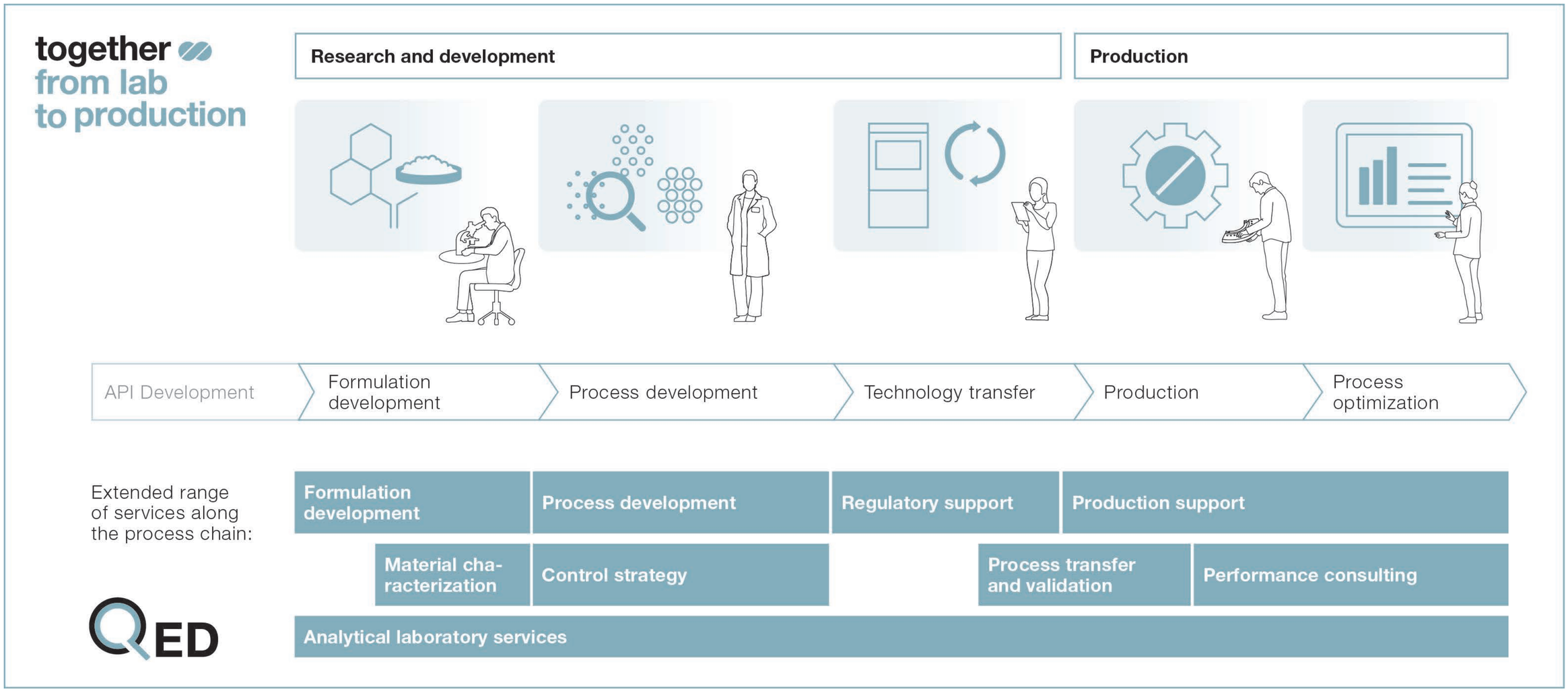


As a comprehensive process partner, Fette Compacting supports manufacturers from early formulation development to process optimization in ongoing production.

The Hidden Cost of How Chemical Companies Experiment

Smart Experimentation - why the combination of Design of Experiments and Bayesian Optimization with intuitive analytics is the most important productivity lever your R&D organization isn't using.

There is a pattern I see consistently across chemical and life science R&D organizations, and it is costing them more than most realize.

A development team runs forty experimental runs to identify an optimal formulation or process condition. They find something that works. They move to the next project. The knowledge from those forty runs lives in a lab notebook, a spreadsheet, or the memory of the scientist who ran the project - and the next team tackling a similar problem starts almost from scratch.

This is not a technology problem. It is a methodology problem. And in the current economic environment, it is a problem that is getting more expensive, not cheaper.

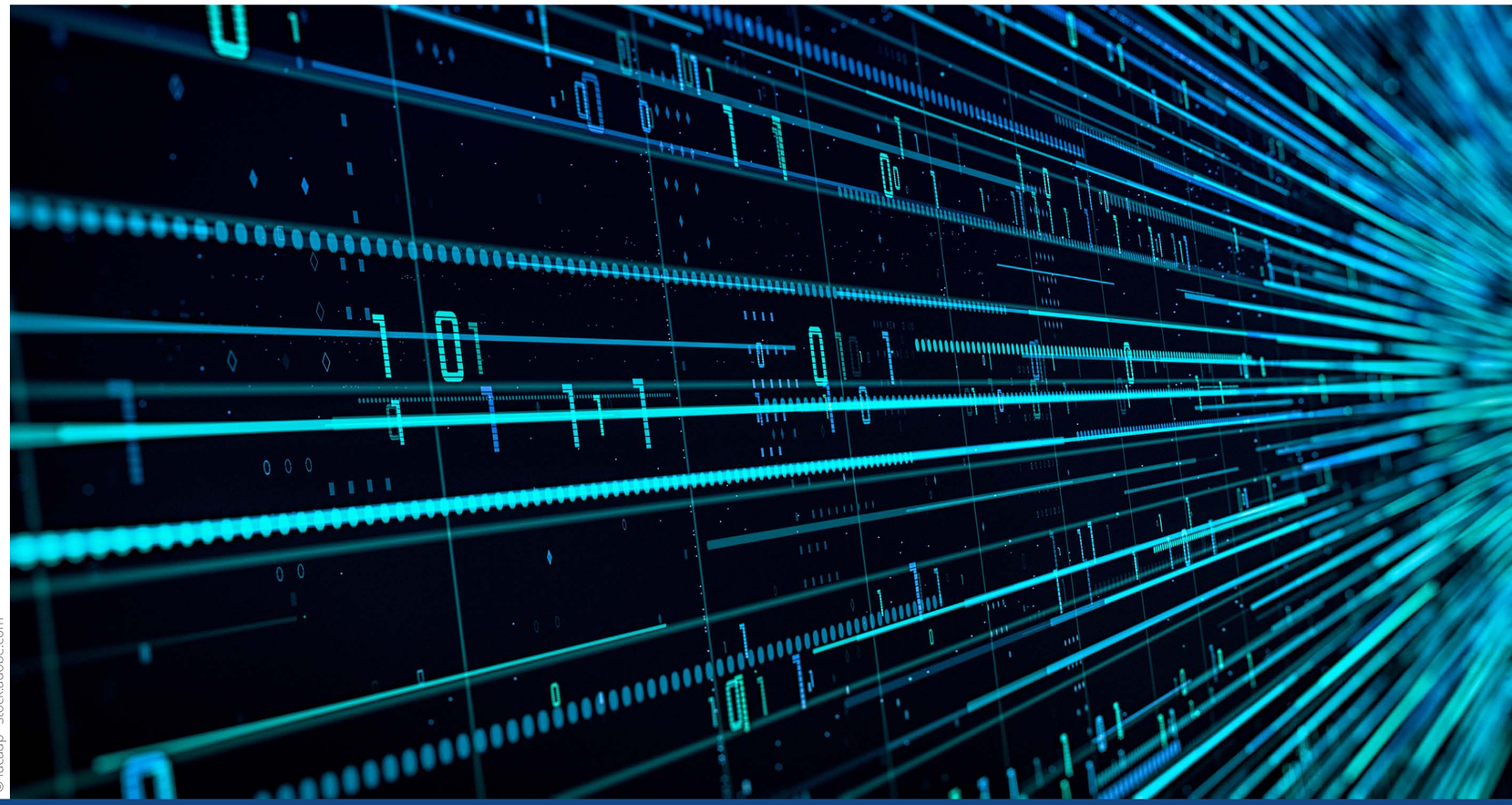
The Gap Between Knowing and Doing

Design of Experiments was, is and will be the gold standard for structured experimentation. Used well, it reduces experimental effort by 50 to 80 percent compared to one-factor-at-a-time approaches. The statistical evidence is unambiguous: properly designed experiments extract more information from fewer runs, identify interactions that sequential testing misses entirely, and produce results that can be defended to regulators and quality teams.

And yet, in many organizations, DOE lives inside a small group of specialists. The wider R&D team runs experiments the way they always have - sequentially, intuitively, expensively.

Many objections are consistent across companies and industry sectors. "…DOE conflicts with the expert's intuition...", "The process is too complex for our specific situation…", "Our work is too variable. We can solve this with just a few targeted tests...".

These objections are not wrong. A scientist who has spent fifteen years working with a particular polymer system genuinely does know things that a statistical design cannot capture. Or a process that involves many interacting variables with non-linear relationships genuinely is difficult to handle with a classical factorial design. The constraints are real as well.



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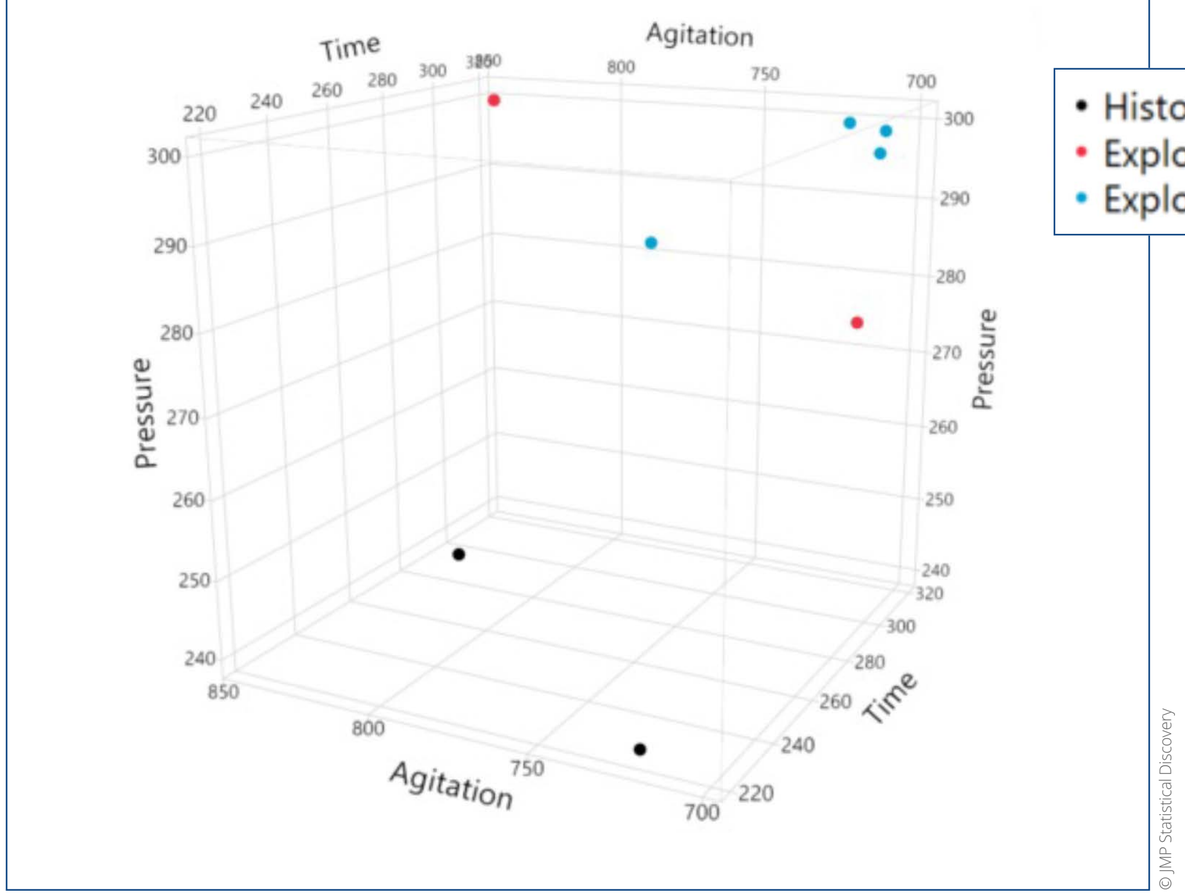
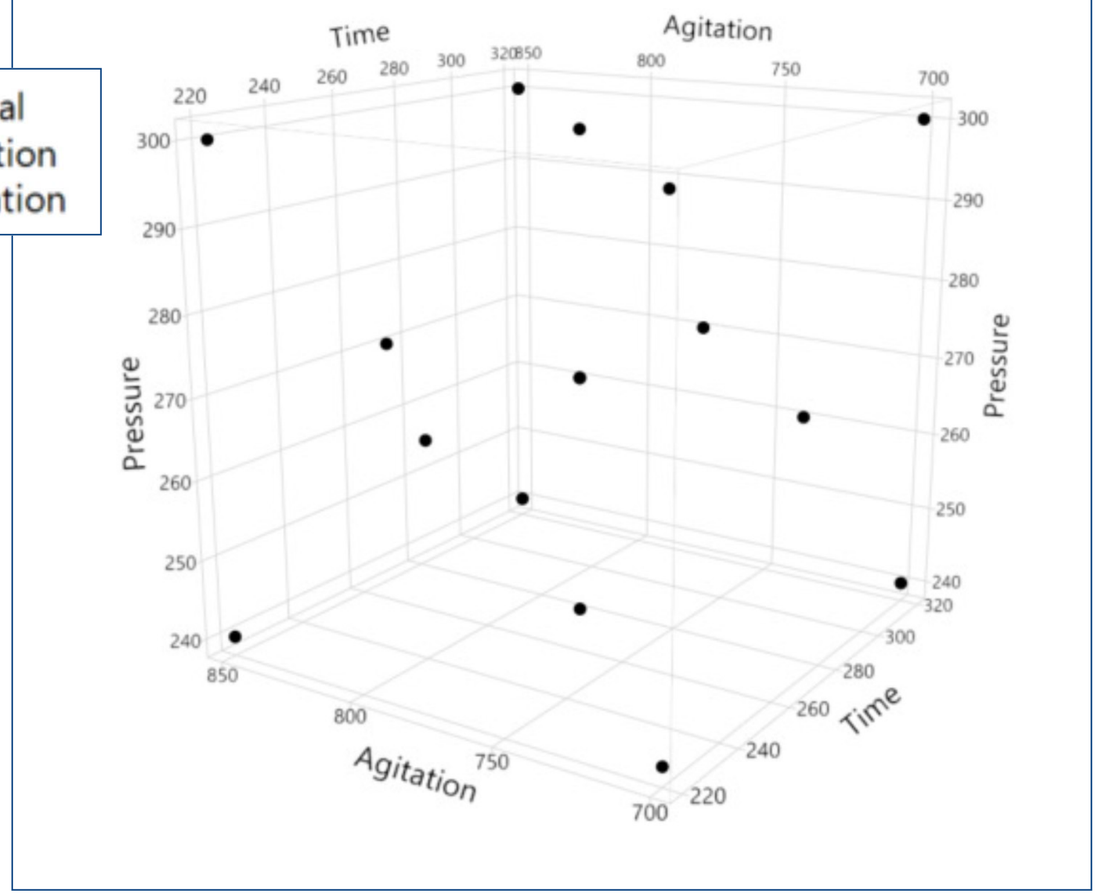


Bayesian Optimization searches the space to directly uncover the most desirable solution, possibly leaving some areas unexplored.



DOE covers the entire space of possible combinations, delivering a broad understanding and fundament for statistical inference.

But the result of these objections, collectively, is that most organizations are running two to five times more experiments than necessary - on every project, every year, compounding across a development portfolio that could have moved faster and cost less.

What Bayesian Optimization Actually Does

Imagine a colleague who has read every experiment your company has ever run on a given class of problem. They remember the conditions, the results, where the promising regions are and just as important - where you have not yet tested. Every time you are about to plan the next experimental run, they tell you: "Given everything we know, here is the best next experiment to run to reach your goal."

That is roughly what Bayesian Optimization does for industrial experimentation.

It is not magic and most importantly, it does not replace the scientist. More so, it works with the scientist, in an intuitive and flexible way – just as the situation demands. It even takes your existing data - structured or not, recent or archival, even the knowledge that subject matter experts carry - builds a probabilistic model of the response surface, and recommends the next run most likely to move you toward your target. It learns from each result. Every experiment makes the next recommendation better.

The published evidence for what this approach delivers is huge. In cell culture media development, Bayesian Optimization has been shown to require 77 % fewer experiments than conventional DOE approaches to reach equivalent performance outcomes. In pharmaceutical tablet formulation, researchers achieved a 60 % reduction in experimental runs. In formulation studies, the method converged on optimal excipient combinations with at least three times less experiments than classical design of experiments.

These peer-reviewed results from applications are directly relevant to chemical and life science R&D. Even if the individual situation will be slightly different, the saving potentials are big.

The Relationship Between Design of Experiments and Bayesian Optimization

A common misunderstanding is that Bayesian Optimization competes with Design of Experiments. It does not – it's the opposite. They compliment each other on multiple levels, and the combination is more powerful than either method alone.

DOE may be the right tool when the goal is broader understanding: which factors matter, how do they interact, what does the response surface looks like across a wide design space. It generates structural knowledge about a process or system. It is also a great choice when starting from nothing – Bayesian Optimization requires only a few data points to begin learning.

Bayesian Optimization on the other side, may be the tool of choice when the goal is optimization: reaching a defined target as fast as possible given what is already known. Feed it a well-designed DOE as prior knowledge, and it converges on the optimum rapidly. Feed it historical unstructured data – like lab notebooks, development records, process logs - and it will find patterns your team may never have noticed.

The practical implication: DOE and Bayesian Optimization are most powerful when used in combination. Screen and understand with designed experiments. Optimize fast with Bayesian methods. Together, they constitute the center of what I call Smart Experimentation - a data-driven approach to R&D that leverages both statistical rigor and adaptive intelligence.

"Most organizations are running two to five times more experiments than necessary – on every project, every year, compounding across a development portfolio that could have moved faster and cost less."

Smart Experimentation as Solution, Rather Than (Another) Tool – The 4P's For Successful Deployment.

Having worked with R&D teams across the chemical industry on deploying these methods, I have found that suitable tooling goes way beyond the algorithms. The bigger challenges are almost always practical, and I see them fall into four categories.

Purpose.

What is the actual goal of the experiment? Bayesian Optimization is purpose-built to reach a defined optimum as fast as possible. If the real goal is to understand the process rather than find the best conditions, it is not the right primary tool - or at least, not alone. In practice, goals often shift. A campaign that starts as an optimization problem may become an exploration problem when an unexpected result appears. The platform a team uses needs to make switching between DOE and Bayesian Optimization genuinely frictionless instead of requiring a different tool, a different expert, or an entirely different workflow. When DOE and Bayesian Optimization live in the same environment, with the same data and the same interface, teams can follow the science rather than the software.

Prior.

What data and know-how already exists? The quality of the starting point directly determines the speed of convergence. A well-structured DOE as the prior enables Bayesian Optimization to optimize efficiently, but historical unstructured data still has value - the method can still optimize or spot current knowledge gaps. In order to extract that value, scientists and engineers need a solution that is genuinely interactive and intuitive: one that allows to visualize what the model has learned, interrogates the uncertainty in its recommendations, and incorporates its own domain knowledge directly into the optimization process. This last point is underappreciated. Subject matter expertise is not just "prior data" – it's knowledge that an experienced scientist carries, and which should seamlessly be integrated in the experimental workflow. A platform that allows that knowledge to be expressed as constraints, preferences, and boundaries on the factor space is capturing value that a purely algorithmic approach may leave gaps open.

Problems.
What are the real-world constraints? Factor constraints, execution limits, process variability, shifting project scope, tight budgets - these do not disappear when the algorithm changes. The practical challenge is that real industrial campaigns are rarely as clean as the textbook examples. Batches get interrupted. Analytical results arrive late. A priority demands decision making with the current level of knowledge at that date – DOE might be better for statistical inference, but half a DOE is not half as valuable. So, problems in a wider, real-world sense, often demand for flexible tooling to be most efficient under the limitations that are put on the experimental work and decision making.

People.
Who is running this, and what do they expect? This is the domain most absent from academic discussions of the method, and the one most likely to determine whether a deployment succeeds in practice. Human variability, interrupted campaigns, shifting project goals, mismatched expectations about how many runs are needed - these are just as likely to derail a Bayesian Optimization campaign as any technical limitation. Critically, the scientists and engineers who run these campaigns are not all statisticians. In fact, most are not. The barrier to using Design of Experiments in the first place is that many fear difficult setup and lots of workload upfront. If Bayesian Optimization is to reach beyond the specialist and become a standard working method for every R&D team, the interface through which scientists interact with it must be intuitive enough so as not become a barrier itself. This means visual, interactive tools that show what the model knows and what it doesn't, so a scientist can quickly digest the latest results and make informed decisions about whether to follow the recommendations or override them based on domain knowledge that the algorithm cannot see.

People are and must be at the heart of every consideration – the most suitable statistical method has no value, if the people executing are not capable of doing so.

The organizations that are getting the most from Smart Experimentation are not the ones with the most sophisticated algorithms. They are the ones with platforms that make the right method genuinely accessible at the point of need - across functions, experience levels, and project types.

In my opinion, successful deployment needs the flexibility to navigate through these categories and leverage the right tool for each practical scenario – the Smart Experimentation toolset.

The Economic Argument – From a Commercial Software Point of View

In a difficult economic environment, R&D budgets are under pressure across the chemical industry. The instinct in many organizations is to pause investment in capability and wait for conditions to improve.

This instinct is understandable, but I think it is also backwards.

You can do the math for yourself. A typical development project involving forty experimental runs at €5,000 each - a conservative figure once materials, personnel, lab time and analysis are included, works out to €200,000 per project. If Smart Experimentation reduces that experimental effort by 50 percent, based on the conservative end of the published evidence, the saving is €100,000 per project, from methodology alone, without cutting people or scope.

Yes, Open Source allows tools to be built for free. But is it really free? Open source needs development, deployment and maintenance, which are considerable costs as well. It also takes time to create and test in-house code, raising the opportunity risks associated with delays in reaching solutions.

I believe that organizations building smarter experimentation capability now will emerge from the current period with a structural advantage. Development cycles will be shorter. Cost per insight will be lower. Knowledge will be retained in structured data rather than lost when experienced scientists move on. And – with the availability of tested and proven solutions – cost cutting can be realized right away.

Florian Vogt, Senior Systems Engineer, JMP
www.jmp.com

Pharma 4.0:
Big Promises, Poor Data - What's Going Wrong?

Why Pharma 4.0 Only Works with a Consistent Digital Foundation

Pharma 4.0 is high on every strategic agenda. Yet many companies still struggle to turn digital ambitions into measurable results. Projects stall, systems don't align, and valuable insights remain locked in fragmented data structures. The root cause is rarely technology itself. It is the lack of a consistent, lifecycle-wide data foundation that connects engineering, automation, and operations from the very beginning.

© Zeta

Start Early – Or Pay Later

Most digital challenges arise at the start of a project, when data structures are not yet defined and teams work with inconsistent information.
A different approach is needed: digitalization must begin when processes and plants are still being designed. When data is created once and continuously reused across all phases, a seamless digital thread emerges.

The result is fewer inefficiencies, reduced rework, and a solid foundation for collaboration across disciplines.

One Backbone, One Source of Truth

Disconnected tools and parallel data sets remain one of the biggest barriers to Pharma 4.0. A unified digital backbone changes this.

With solutions such as Zeta's integrated data environment, engineering, simulation, automation, and operations are linked within a shared structure. All stakeholders work with the same consistent data models, creating transparency, accelerating decision-making, and minimizing errors.

Changes become manageable as well: adjustments made during engineering are automatically reflected downstream, without manual transfers or inconsistencies.

Martin Mayer, Digital Solutions Director, ZETA

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From Assumptions to Evidence-based Decisions

Simulation is rapidly becoming a key enabler in pharmaceutical production. It allows manufacturers to evaluate scenarios, identify bottlenecks, and validate capacities before physical implementation.

This creates a new level of planning reliability and supports data-driven investment decisions, reducing risks while increasing efficiency.

Security and Compliance by Design

With increasing convergence of IT and OT, cybersecurity has become essential, while regulatory requirements continue to evolve.

Both can no longer be treated as add-ons but must be embedded into system architectures and data models from the start.

A structured approach ensures that standards such as GMP or 21 CFR Part 11 are inherently supported, reducing effort and increasing robustness.

Data Quality as the Key to AI

Artificial intelligence is expected to transform pharma manufacturing, from process optimization to digital twins. But without high-quality, contextualized data, even the most advanced algorithms deliver limited value.

Establishing clear data governance and consistent data models across the lifecycle is therefore essential. It creates the conditions for scalable digital innovation.

© Zeta

Integration is the Real Breakthrough

Pharma 4.0 is not defined by individual tools or technologies. It is an operating model based on integration - where data, systems, and teams are seamlessly connected.

Companies that succeed in building this foundation benefit from higher transparency, faster decisions, and future-ready production environments.

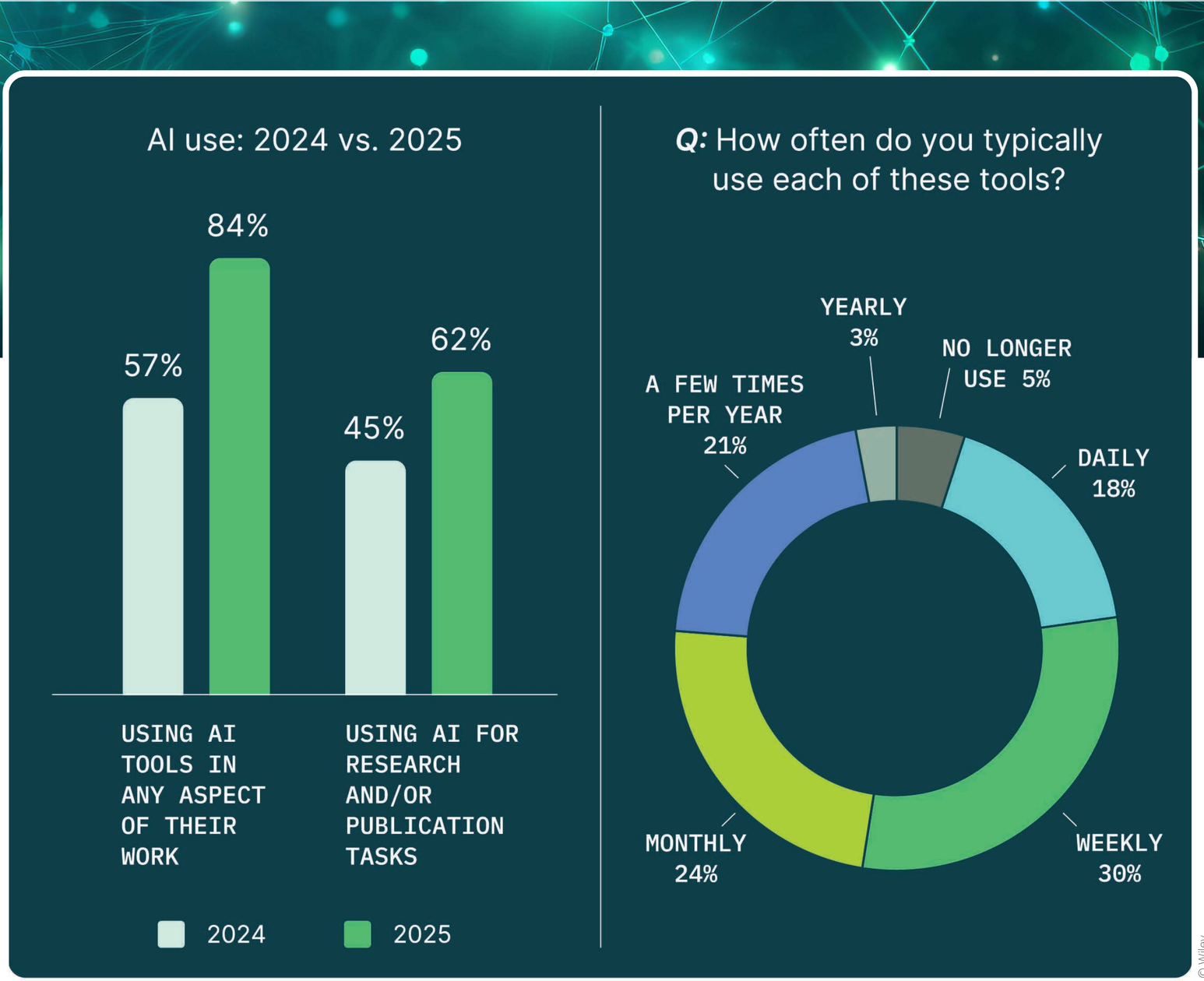
In the end, digital transformation is not about adding complexity. It is about creating clarity - through data that works across the entire lifecycle. This is exactly where Zeta supports pharmaceutical and biotech manufacturers, turning Pharma 4.0 from ambition into operational reality.

Martin Mayer,
Digital Solutions Director, ZETA

www.zeta.com

Trusted Evidence in the Age of AI

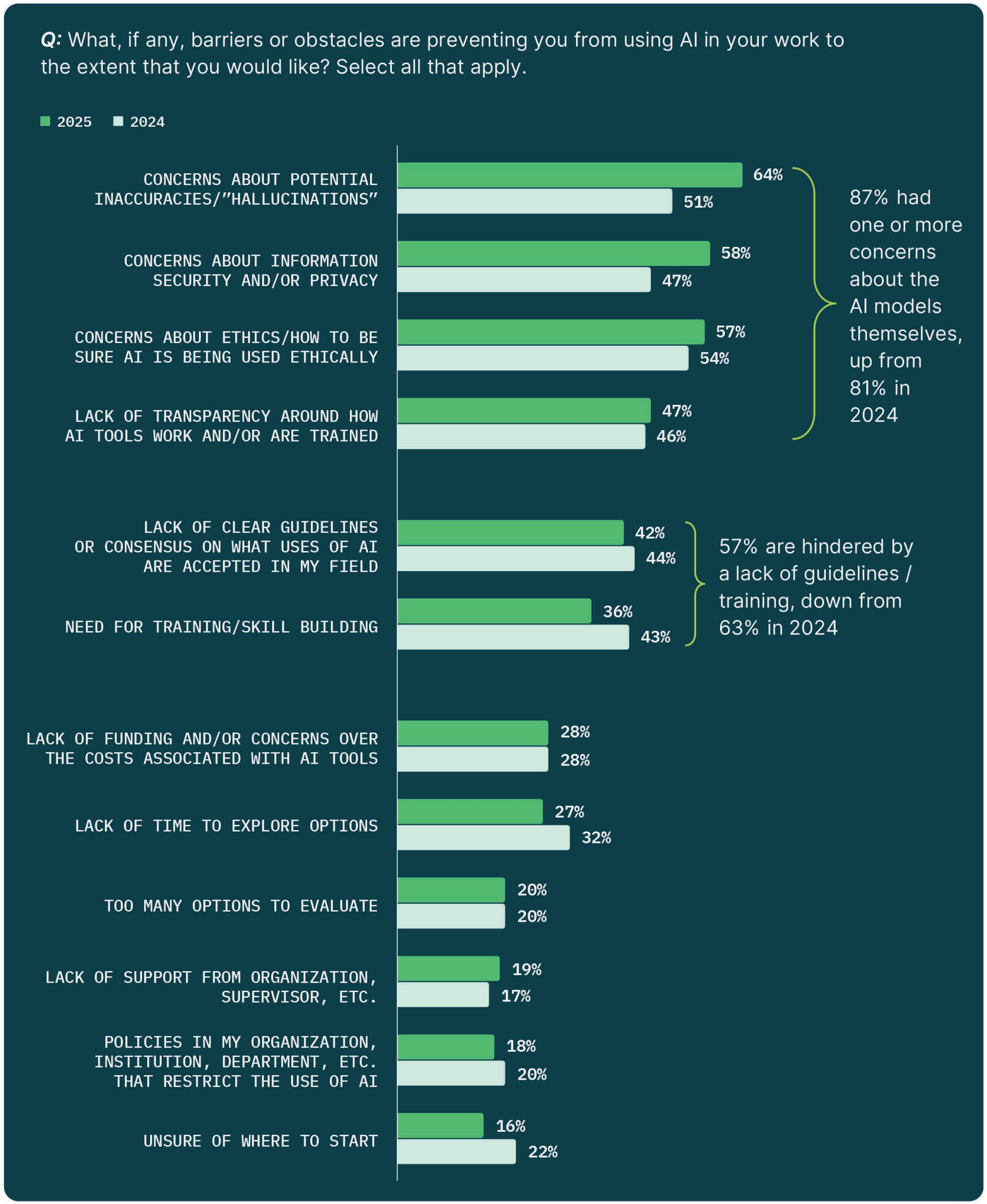
Integrating Peer-Reviewed Content into Pharma Workflows



Base: 2024 n=1,043–4,946; 2025 n=2,118–2,430

The pharmaceutical industry's relationship with AI has entered a more demanding phase in just a year's time, moving past the hype cycle and into something more demanding: the implementation cycle. This is where the real work happens and where the difference between well-built and poorly-built AI becomes consequential. In pharmaceutical R&D, medical affairs, and clinical decision-making, the stakes of getting it wrong are not abstract. They will show up in concrete and impactful ways.

I spend my days at the intersection of scientific publishing and the AI ecosystem, working with pharmaceutical companies, biotech startups, AI platform builders, and clinical technology providers on how the world's peer-reviewed research gets put to work in these new systems. What I see across that landscape is a field that is accelerating rapidly, but with uneven outputs.



Base: 2024 n=4,946; 2025 n=2,430

The organizations that will deliver the most scientific advancement are the ones that recognize that the quality of evidence underneath an AI system is every bit as important as the sophistication of the model on top.

What Makes AI Trustworthy in Pharmaceutical R&D?

At Wiley, we recently surveyed thousands of researchers on AI adoption. A year and a half ago, 57 percent reported using AI in their work. That number is now 84 percent. The striking detail is that of those 84 percent, the vast majority cited serious concerns about the quality, accuracy, and trustworthiness of the outputs they were relying on. It's likely that they're using these tools anyway because the productivity gains are too compelling to ignore, but they don't fully trust what's coming back. In fact, their concerns have increased, not decreased over the past year.

For general-purpose applications, that's a manageable tension. In pharmaceutical R&D and clinical practice, it is not. When I talk with R&D leaders about building AI they can actually rely on, I come back to three things: quality, accuracy, and attribution.

Quality, in this context, means grounding AI outputs in peer-reviewed, version-of-record content from authoritative repositories – the sources your scientists already know and cite. The "deep research" function in most general-purpose AI tools is really doing a broad sweep across whatever the model can reach on the web, which often means using incomplete information. Real depth means full-text articles from authoritative repositories. AI teams at pharmaceutical companies consistently find that public sources like PubMed are a reasonable starting point but insufficient for high-stakes applications. Sooner or later, they need the full-text literature.

Accuracy means grounding AI system responses in current evidence in real time – typically using retrieval-augmented generation (RAG) – rather than relying on model weights. Model weights return probabilistic results, not deterministic, which is the source of hallucinations. The analogy I always use: model weights are a closed-book exam. In pharmaceutical R&D, you always want open book. This matters especially given how fast the literature moves; in some medical specialties, knowledge is doubling every 73 days.

Attribution means full citation back to the original source so that the user can follow the chain of evidence all the way back. AI that cannot show its work is a liability in scientific contexts. When a system can point to the specific study behind a recommendation and a researcher can click through to verify it, you build a feedback loop of credibility and reproducibility.

How Pharma Companies are Using AI in Drug Discovery and Clinical Trials

So, what are the most compelling examples of evidence-backed AI being deployed in pharmaceutical contexts?

Target identification and compound design. We're already seeing use cases play out. Insilico Medicine's rentosertib for idiopathic pulmonary fibrosis was identified and designed entirely by AI, moving from target identification to preclinical candidate in 18 months at roughly $2.6M, a process that typically takes four to six years. Novartis offers a parallel example: using generative AI to design 15 million potential compounds computationally, then working with roughly 60 in the lab to arrive at a promising scaffold in a fraction of the traditional timeline.

Clinical trial design. Late-stage trial failure is the industry's most expensive failure mode. AI can offer a material risk management tool by analyzing historical trial data and published outcomes to sharpen patient cohort selection, biomarker identification, and inclusion criteria. An example is Exscientia and Sumitomo Dainippon Pharma advancing a novel OCD candidate into human trials in under 12 months, partly by using AI-guided trial planning to compress the design phase.

Pharmacovigilance. AI tools monitoring clinical and toxicology literature for safety signals are shortening the gap from detection to risk assessment. The FDA has deployed its own AI regulatory review tool, reportedly cutting document review from three days to six minutes.

Point-of-care support. On the clinical side, AI decision support built on real-time access to systematic reviews and specialty guidelines is beginning to reach physicians during patient interactions. For example, Wiley recently announced a partnership with OpenEvidence to bring our trusted scientific and medical content to physicians at the point of care. The 17-year average lag from research publication to standard clinical care is a dissemination problem that AI, built on current peer-reviewed evidence, is well-positioned to solve.

Why Peer-Reviewed Content Is Essential for AI in Life Sciences

None of the above works without a reliable evidence layer underneath. That layer, comprised of peer-reviewed, current, rights-cleared, full-text research cannot be assembled by scraping the open web. It requires sustained partnerships with the institutions that produce and curate scientific knowledge.

Scientific publishers have historically been the background infrastructure connecting research institutions and learned societies to the enterprises that need their content. The AI era requires a whole new infrastructure to deliver this. A PDF behind a paywall is no longer sufficient. Content needs to be real-time, API-accessible, vectorized, and bundled with the provenance metadata that makes downstream citation possible.

The publishers responding well to this moment are shifting from content distribution to content infrastructure: curated knowledge feeds by therapeutic area, pre-enriched and continuously updated, accessible via API for RAG implementations and integrated directly into the research and clinical platforms where work actually happens. This has been central to our approach at Wiley, where we've been working directly with pharmaceutical companies on their AI programs.

The pharmaceutical industry is at a pivotal moment with AI. The science has always been there. The tools to deploy it at scale now exist. The organizations that will pull ahead are not necessarily the ones with the most sophisticated models. They are the ones that take the quality of the evidence foundation as seriously as the technology built on top of it. Get that right, and you are building a durable advantage in one of the most demanding fields in science.

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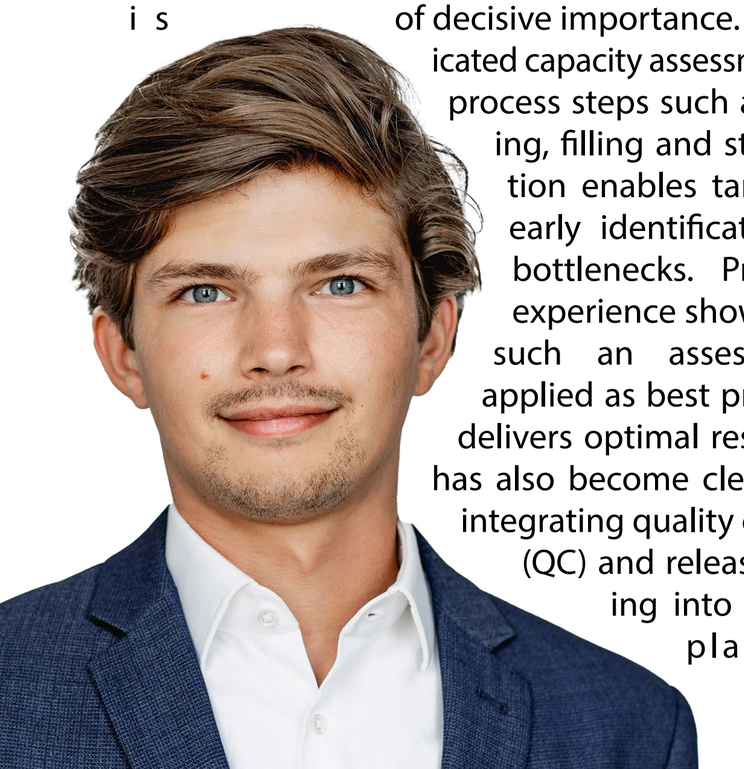
Josh Jarrett, SVP & GM,
Applied Research Intelligence, Wiley

Digital Twins for the Pharma Supply Chain

The Key to Effective Demand & Supply Planning in the Pharmaceutical Industry

The dynamic world of the pharmaceutical industry faces the challenge of efficiently integrating complex production processes and stringent regulatory requirements into supply planning. Precise planning is essential to safeguard security of supply. Deploying a Digital Twin offers a data-driven, proactive approach to increasing transparency and resilience along the full value chain.

In pharmaceutical supply planning, the precise planning and control of production processes is of decisive importance. A dedicated capacity assessment of process steps such as mixing, filling and sterilisation enables targeted, early identification of bottlenecks. Practical experience shows that such an assessment, applied as best practice, delivers optimal results. It has also become clear that integrating quality control (QC) and release testing into supply planning is essential, as a core element of the supply chain in the pharmaceutical industry, in particular with regard to meeting regulatory requirements and accounting for capacity constraints.



Jan Betz, Senior Consultant, Valantic

Increase Transparency and Resilience

By deploying a Digital Twin in supply chain management, companies increase the transparency of their processes and strengthen resilience in both long-term planning (S&OP) and short-term execution (S&OE). In the S&OP process, the Digital Twin enables the simulation of different demand trajectories, supporting strategic decisions on resource allocation and the early detection of bottlenecks. In S&OE, it enables real-time responses to operational disruptions and adjustments that prevent short-term shortages. This dual function strengthens the adaptability and efficiency of the entire supply chain and translates into greater growth opportunities, for example through improved on-time-in-full (OTIF) deliveries and higher product availability for sales. In addition, the Digital Twin enables working capital to be optimised through a more refined inventory strategy.

In contrast to conventional planning concepts, which rely on static data and predefined rules, the planning Digital Twin draws on up-to-date information such as inventory data from the ERP system, sensor data from production, customer orders and simulation-based scenarios. This allows the supply chain to respond more flexibly to change, to identify bottlenecks early and to adjust plans dynamically. The Digital Twin also enables more accurate positioning and optimisation of the decoupling point, since real-time data and simulations allow for more precise management of the transition between forecast-driven and order-based production.

Gereon Küpper, Partner, Valantic

Application Potential

In the pharmaceutical industry, which frequently has to contend with production instabilities, yield losses and batch rejections, the Digital Twin therefore offers decisive advantages.

1 CODP = Customer Order Decoupling Point

The technology enables precise simulation of the entire supply chain and visualisation of the impact of such issues at every level, from inventories through to distribution.

Senior management benefits from the simulation capability as well as from the early identification of bottlenecks and potential cost increases. Proactive measures allow optimisation levers to be activated and countermeasures to be taken, raising operational efficiency and resilience. The Digital Twin thus enables well-founded adjustments to production and logistics processes. This ensures that the supply chain remains resilient and responsive, even under variable production conditions.

Technical Implementation

To unlock the full potential of a Digital Twin, seamless integration between demand & supply planning is decisive, enabling a holistic, end-to-end planning approach. This link forms the basis for the simulation of different demand scenarios.

In practice, implementing a supply chain Digital Twin requires creating an interface between the leading ERP system and a separate simulation environment. This approach permits more flexible modelling and scenario adjustment without impairing the operational performance of the ERP system, and it minimises the risks associated with processing large data volumes in real time. Model-based assumptions and simplifying logic reduce complexity and computation time. Within this environment, input parameters such as make-to-stock and make-to-order decisions, safety stocks and lead times can be flexibly adjusted, with a range of scenarios simulated for efficiency and risk assessment. This permits a detailed analysis of the effects of operational changes and supports well-founded decision-making.

In practice, a three-stage approach has proven effective for the successful implementation of a Digital Twin. The first step is to optimise existing processes, with particular emphasis on validating the interplay between demand & supply planning and on designing target processes. This ensures that well-aligned process steps are integrated into the Digital Twin. In the second phase, interfaces to the ERP system are defined and individual process steps are mirrored incrementally. This staged mirroring allows the impact of new processes to be tested within the digital model and to make adjustments where required. In the final step, the mirrored processes are combined into a comprehensive, integrated model. This holistic model forms the basis for precise simulations and allows different scenarios to be run for efficiency and risk assessment.

A high level of data quality and consistency is of central importance throughout, since the accuracy of the simulation depends decisively on reliable data from a variety of sources. Only on this basis can the Digital Twin deliver long-term efficiency gains and sustainably greater supply chain resilience.

Conclusion

Deploying a Digital Twin in demand & supply planning in the pharmaceutical industry represents a decisive step towards optimising the entire supply chain. Through the precise simulation and analysis of operational processes, bottlenecks can be identified at an early stage, risks minimised and production workflows organised more efficiently. The connection to existing ERP systems and the linking of demand & supply planning enable holistic, end-to-end control. To exploit the full potential of a Digital Twin, however, high data quality, a well-thought-out implementation and the continuous refinement of processes are indispensable. Over the long term, the Digital Twin strengthens not only resilience but also competitiveness in a dynamic and heavily regulated sector such as the pharmaceutical industry. The ongoing development of this technology, together with the growing availability of real-time data and artificial intelligence, will further extend the possibilities of the Digital Twin in the coming years, offering pharmaceutical companies considerable potential to sustainably enhancing their competitive position.

Gereon Küpper, Partner, and
Jan Betz, Senior Consultant

Valantic, Düsseldorf
www.valantic.com

Biopharma Innovation: From Bold Idea to Delivered Product

The biopharma sector has never lacked ambition. What it has often lacked is the infrastructure and manufacturing rigor to convert scientific promise into a product sitting reliably on a shelf. That gap between discovery and delivery is where the most consequential innovation is happening.

Christene Smith,
CHEManager International

In April 2026, CHEManager hosted a webinar on strategic outsourcing in biopharmaceuticals, part of our Bioprocess Forum series. The speaker, Hedley Rees, Managing Consultant at Pharma Flow and author of *Transforming the Pharmaceutical Supply Chain* (Wiley, 2025), opened with Boeing's Dreamliner program: outsourcing design and manufacturing across hundreds of global partners produced years of delays, billions in overruns, and a loss of the visibility needed to solve problems at suppliers.

The Outsourcing Paradox

The direct parallel to biopharma manufacturing was clear. As Rees put it during the event: "The critical assets required to differentiate your product from the competition — particularly in R&D and full commercialization program — cannot be handed to third parties without losing something you may not get back."

CDMOs and CROs are essential partners, especially for smaller biotechs without capacity for in-house manufacturing. The risk arises when companies enter non-clinical development without identifying the supply chain partners they will need for the full product lifecycle — locking themselves into contractors that cannot scale into clinical trials or commercial supply. Re-platforming later is slow, costly, and damaging to IP continuity.

The procurement framework Rees outlined distinguishes commodity purchasing from strategic CDMO partnerships, where shared investment and close collaboration between sponsor and service provider become defining conditions. This echoes conversations we had with CDMO leaders at CPhI Frankfurt last year — partnership is everything.

Novo Holdings' acquisition of Catalent suggests that major product license holders are reaching the same conclusion: capacity and responsiveness cannot always be rented.

Process Is the Product

Biologics complicate outsourcing in ways small molecules do not. A tablet's chemistry is largely independent of who makes it. A biologic is not. Cell lines, fermentation conditions, and purification sequences all shape the final molecule. Change the process, change the product. This is why biosimilar development remains considerably more demanding than generic substitution, and why CMC strategy needs to be embedded at the non-clinical stage rather than retrofitted once clinical data arrives.

The Innovators Closing the Gap

The companies most attuned to these manufacturing realities tend not to be the largest ones. Across biotechnology and specialty chemistry, a new generation of start-ups is building directly on the constraints the industry has struggled with by developing production platforms where the science and the scalability are designed together from the outset, rather than one following the other. Two featured in the CHEManager Innovation Pitch program illustrate the range of that work.

Start-up Spotlight: Primogene

Leipzig, Germany-based Primogene was founded in 2023 around a precise problem: for over 30 years, neonatal diseases linked to premature birth have ranked among the leading causes of lost healthy life years worldwide, yet the bioactive compounds these infants need have not been manufactured at viable industrial scale. CEO Reza Mahour frames it not as a scientific failure but as a failure to address the right problem: biology is understood — the production pathway has been missing. "There is no one-size-fits-all solution in bioproduction," he adds.

Primogene's platform is cell-free and enzymatic. Conventional microbial fermentation struggles with the complex molecules Primogene targets. Multi-enzyme bioprocesses sidestep these constraints. The resulting human-identical compounds range from molecules that cross the blood-brain barrier to support cognitive health, to skin-penetrating hydration ingredients, to microbiome-compatible bioactives. The company already operates a pilot production facility in Leipzig and is running a €1.3 million collaboration with the Fraunhofer Institute for Cell Therapy and Immunology on breast milk bioactives, co-funded by the Free State of Saxony and the EU.

At the CHEManager Innovation Pitch 2025, Primogene won the "Value to Society" category from a field of 18 start-ups across the globe.

© Pharma Flow

"The critical assets required to differentiate your product from the competition — particularly in R&D and full commercialization program — cannot be handed to third parties without losing something you may not get back."

Hedley Rees, Managing Consultant, Pharma Flow

Start-up Spotlight: Aminoverse

Where Primogene addresses what needs to be made, Aminoverse addresses how to make it more efficiently. The Dutch start-up, founded in 2020 in Nuth, Netherlands, enables manufacturers to replace conventional synthesis routes with biocatalytic processes that are cleaner, more selective, and less costly. Industrial adoption of biocatalysis has historically lagged because enzyme development is slow and uncertain.

Aminoverse removes those bottlenecks through three AI-augmented platforms: EnzyNAV AI navigates more than four billion enzyme sequences to identify the right candidate for a given reaction; EnzyMAP AI maps every possible point mutation to identify the changes most likely to improve performance, cutting wet lab screening by up to 80%; and EnzyREC AI recombines beneficial mutations into stable, manufacturable enzymes. Together they increase success probability tenfold and cut R&D spend by up to 75%.

The business model is fee-for-service with clients retaining full IP ownership. Aminoverse has served over 50 customers across pharma, flavors and fragrances, and agrochemicals — including BASF, Novonesis, and IFF — and reached profitability 3.5 years after founding without VC funding. The next milestone is de novo enzyme design: moving from optimizing existing enzymes to building them from scratch, which Schönauer expects to unlock applications current approaches cannot reach.

Manufacture, Then Market

Biopharma innovation is increasingly understood as a manufacturing and supply chain challenge as much as a scientific one. Protecting critical assets, investing early in supply chain foundations, and building genuine partnerships with CDMOs are what separate products that reach distribution from those that stall in development. Discovery earns the patent. **Getting the product onto a shelf takes everything else.**

Christene A. Smith, Editor-in-Chief,
CHEManager International

© Primogene

“There is no one-size-fits-all solution in bioproduction.”

Reza Mahour, CEO, Primogene

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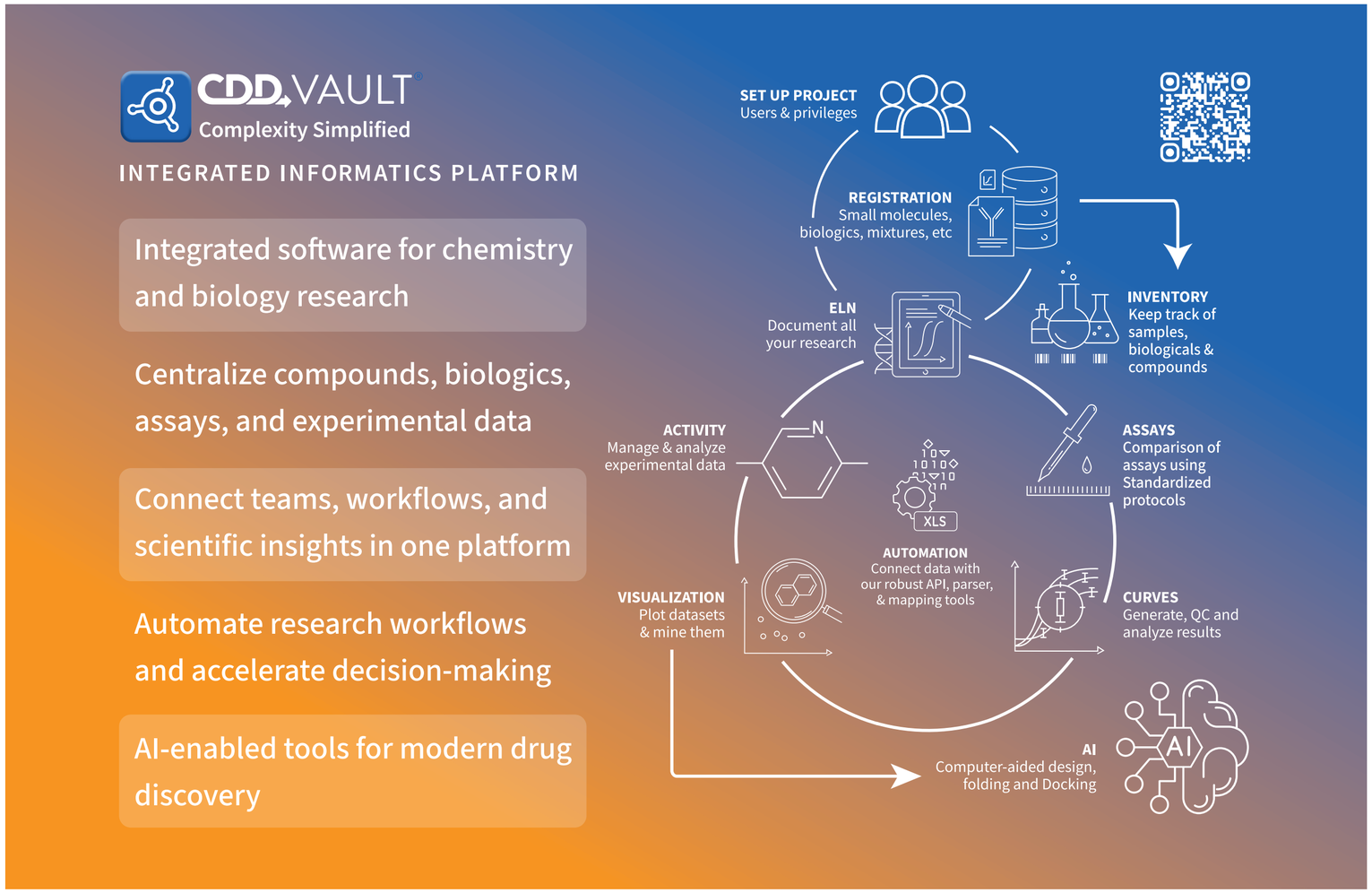
Elevating AI-Driven Discovery: Simplifying Complexity with CDD Vault

Modern drug discovery generates vast amounts of data, yet turning that information into meaningful insight remains a major challenge. **CDD Vault** addresses this by integrating chemical and biological research into a secure platform tailored for reproducibility and AI-driven workflows.

For many teams, critical information remains fragmented across spreadsheets and disconnected systems. CDD Vault unifies these streams into a **centralized System of Record** for compounds, biologics, assays, and experimental results. This **single source of truth** improves traceability and ensures data is reusable throughout the project lifecycle.

To accelerate discovery, CDD Vault **integrates computational and AI tools** directly into the primary research environment. Scientists can perform **computer-aided design, docking, and protein folding** without leaving their protected research environment. **Automated modeling** enables real-time scoring of new compounds and instant identification of biological endpoints, allowing researchers to focus on interpreting results rather than organizing data.

Maintaining data consistency across workflows while eliminating manual handoffs is enabled by a **flexible API and an Orchestration Layer** that seamlessly connects laboratory instruments, internal systems and external applications. Built-in **visualization and curve-fitting tools** then help teams analyze complex results and identify trends more efficiently.



Whether **documenting experiments in the ELN** or reviewing large-scale assay data, CDD Vault provides an integrated environment that helps teams **move faster and make better-informed scientific decisions. Complexity Simplified.**

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