opentrons

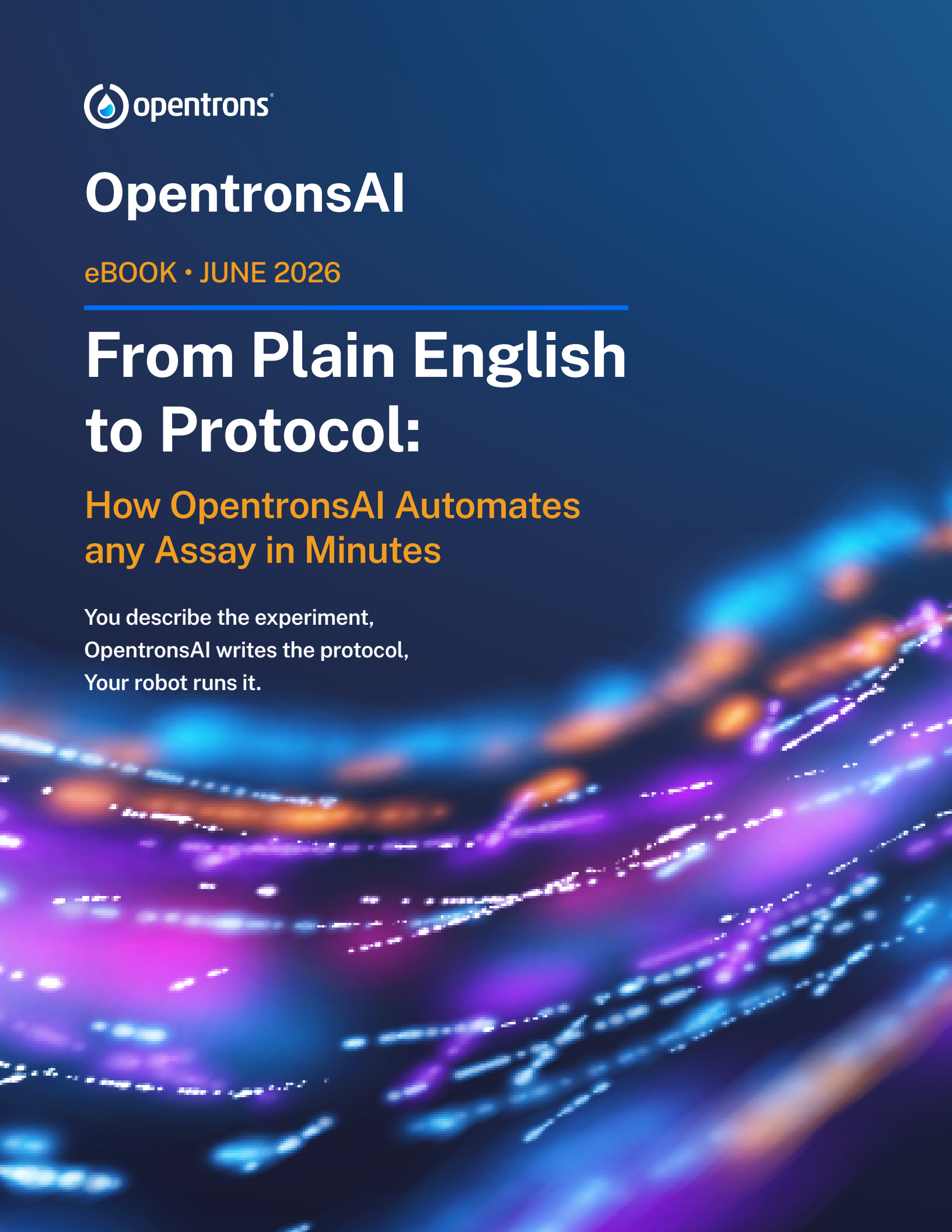
OpentronsAI

eBOOK • JUNE 2026

From Plain English to Protocol:

How OpentronsAI Automates any Assay in Minutes

You describe the experiment,
OpentronsAI writes the protocol,
Your robot runs it.



“Automation and AI is where the field is going overall. You need real experience with liquid handling automation because that’s what the entire industry will expect you to be able to do. The table stakes for doing anything relevant are familiarity with the cloud, with pipelines, with liquid handling automation and AI.”

Dr. Peter McCaffrey, MD, MS, FCAP
VP, Chief AI + Digital Officer, UTMB

Automation used to require an engineer.

Lab automation has existed for decades.
But for most scientists, it's always sat behind a wall. Proprietary systems, custom code, specialist integration teams, and price tags that locked it to well funded core facilities and large pharma. If you weren't an engineer (or you didn't have one) automation wasn't really for you.

That wall is coming down, and the tool doing it is OpentronsAI.

60-70%
of scientist time spent on manual ops

$28B+
annual US preclinical waste from inefficiency

1.8%
average pharma R&D ROI (down from 10.7%)

With R&D ROI at historic lows, manual workflows are the bottleneck between hypothesis and experimental breakthrough.

Three forces are driving a permanent shift

01

Data is exploding

Manual execution can't keep pace with AI-driven hypothesis generation.

02

Technology is advancing

Automation literacy is now a career requirement, but legacy systems stay hard to use.

03

Workflows are more complex

From multi-step molecular biology to automated proteomics, technical demands have grown dramatically.

OpentronsAI removes these barriers and makes automating science easy.
No engineering background required.

OpentronsAI is your automation co-scientist

OpentronsAI turns your experimental intent in an executable protocol to run on the Opentrons Flex or OT-2. No Python coding required and no engineer needed.

Describe what you want to run in plain English, including your assay type, sample number, volumes and labware. Opentrons AI asks clarifying questions and generates a Python protocol that is ready to run on your robot.

Four things OpentronsAI does for you

Create protocols from plain English

Describe your workflow or upload your manual SOP. OpentronsAI creates a validated, runnable protocol.

Optimize protocols for your use case

Ask OpentronsAI to tailor your protocol to optimize run time, reagent use, or consummables waste.

Preview and simulate protocols before a run

Drag into the Opentrons App and visualize every step. Deck view, list view, well view, with microliter and millimeter precision.

Iterate your protocol in a conversation

Refine, tune, and adjust parameters across as many iterations as you need, all inside a single chat-based interface.

Trained on verified Opentrons protocols and supported by the full Opentrons ecosystem, OpentronsAI connects scientific knowledge and intent directly to physical execution on the robots you already own.

How OpentronsAI works for same-day science

The entire process, from describing your experiment to a completed robot run, can happen the same day. Here's what that looks like.

01 Describe your experiment

Use natural language to describe your workflow, or use the prompt guide to specify your hardware, labware, and liquids. Upload an existing protocol to edit.

02 Generate protocol code

OpentronsAI outputs executable Python scripts in seconds, validated for your robot, pipettes, and deck configuration.

03 Optimize for your assay

Iterate with OpentronsAI to tailor the protocol to your specification, optimizing for the fewest steps, lowest reagent cost, and consummables use.

04 Analyze your options

Compare multiple protocol versions side by side. The AI explains the rationale behind each approach and lays out the tradeoffs.

05 Simulate and visualize

Drag into the Opentrons App and see every step, whether your protocol has 10 steps or 10,000. Build confidence in the AI-generated protocol via this simple sanity check.

06 Iterate and improve

Continue to refine parameters, adjust volumes, and optimize across runs, all in the same conversational interface.

07 Execute on Flex or OT-2

Send the protocol to your robot. Load the deck with labware and samples, tap run, and let the robot do the work.

The whole process, description to completed run, can happen the same day you decide to run an experiment.

5 workflows OpentronsAI can automate today

OpentronsAI isn't a hypothetical future capability. Here are five workflows your lab runs every week that can be automated using plain English and OpentronsAI.

1 / PCR /QPCR PLATE SETUP

Stop hand-pipetting your PCR plates.

OpentronsAI sets up your PCR or qPCR plate automatically, precise volumes for reproducibility at high throughput with no human error.

2 / SAMPLE NORMALIZATION

Normalize samples without the spreadsheet.

Feed in your concentration data. OpentronsAI calculates the volumes, runs the normalization, and logs structured metadata automatically, every single time.

3 / CHERRY PICKING

Your hits, picked automatically.

Upload your annotated screening results. OpentronsAI creates a worklist to transfer them to a new plate. No transcription errors.

4 / SERIAL DILUTION

Serial dilutions, done in a sentence.

Describe your dilution series, concentrations, replicates, and plate format. OpentronsAI writes the protocol and runs it.
No pipetting errors.

5 / ELISA SETUP

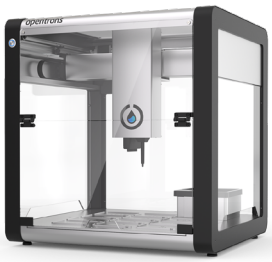
Run your ELISA. Not your pipette.

Describe your ELISA from standard curve to samples to plate coating, blocking and washing. OpentronsAI handles the plate setup. Consistent volumes, every well, every time.

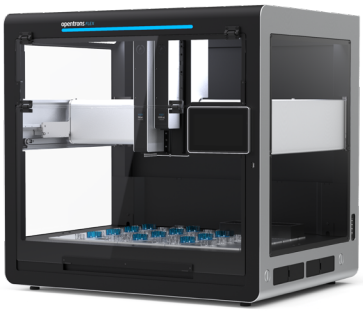
Every workflow above can be described in a single sentence.
No code. No engineering background. Just your science.

Built on a proven platform

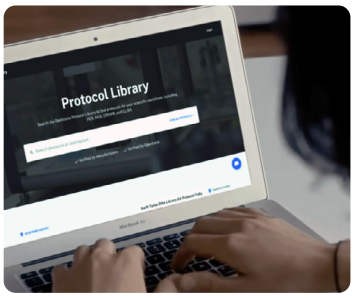
OpentronsAI runs on the open-source automation platform trusted by thousands of labs worldwide, and is cited is over 400 scientific publications to date.



OT-2 - Your personal pipetting robot
OpentronsAI works natively with the OT-2 with no new hardware or software required.



Opentrons Flex - next-generation lab automation
With a larger deck, higher throughput, and camera-enabled, the Opentrons Flex supports longer workflows, extended walk-away time, and real-time perception and feedback.



Protocol Library - Start from a protocol that already works
Access hundreads of verified protocols.
Use OpentronsAI to modify, extend, and adapt them to your exact conditions.

Autonomous experimentation: a glimpse of what's next

In December 2023, Gabe Gomes' team at Carnegie Mellon University published one of the first papers demonstrating an AI co-scientist planning, designing, and executing complex chemical reactions, on an Opentrons robot. They chose Opentrons for its open hardware and software architecture, which let them build a fully autonomous experimentation loop: design, execute, analyze, repeat, with minimal human intervention.

OpentronsAI is the accessible entry point to this future. Available today, for every scientist.

Download the paper here

The AI-native lab: where we're headed

OpentronsAI is the first step in a layered infrastructure that will eventually power fully autonomous, closed-loop laboratories.

Intent & orchestration **Today, OpentronsAI**	Natural language to validated protocol. Any scientist can describe an experiment and run it, no code required. Built on 1000's of publicly available Opentrons protocols, the world's largest training set
Perception & cognition **Coming, Vision on Flex**	Camera vision on the Opentrons Flex will enable real-time perception and feedback: the robot sees what's happening on the deck and responds.
Intelligence & action **Future, Autonomous experimentation**	Vision language action models (VLA) will enable the robot to plan, execute, and iterate experiments with minimal human intervention, the self-driving laboratory.

If automation is the engine, and AI is the driver, OpentronsAI is the first step toward the self-driving laboratory.

What this means for your lab

When your team stops spending 60% of its time on manual operations, the math changes quickly.

10-20x	Improvement in experimental accuracy
<12 months	ROI payback on full automation stack
$500k - $1M+	weekly savings from accelerated lead ID
500 days	potential reduction in development timeline

The bigger picture

The bottleneck in drug discovery isn't the science, it's the time lost between insight and execution. When any scientist on your team can automate a workflow without writing a line of code, your whole organization moves faster.
That's not just efficiency, it's a structural advantage.

Ready to describe your first protocol?

Try OpentronsAI today

opentrons.com/ai

Need more information?

- For general sales information, email info@opentrons.com
- For services and installation, email support@opentrons.com
- Want to speak with a sales representative? Call between 9:00 AM - 6:00 PM EST. Mon – Fri, +1 (908) 869-8907