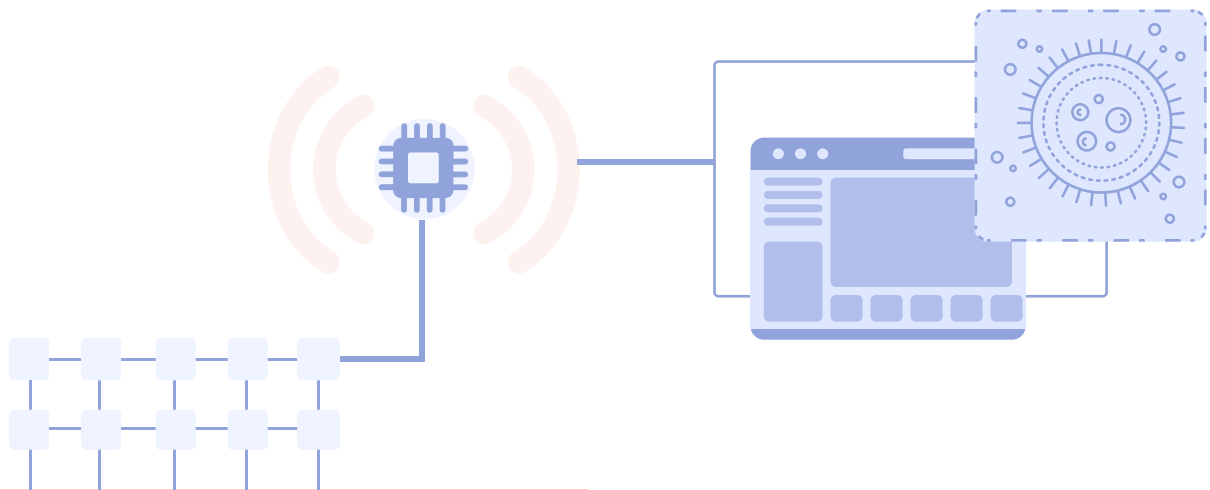CASE STUDY ——

Realizing Cellino's vision of *revolutionizing regenerative* medicine
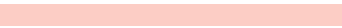
Services rendered

Product Design
Product Engineering
Continuing Design

Tech stack

React, Material UI, deck.gl, Zarr, Apollo GraphQL, Nest.js, TypeORM, PostgreSQL, Docker, Kustomize, Pub/Sub.

At A Glance

Cellino wanted to streamline the cell manufacturing process and scale autologous and allogeneic stem cell production using laser physics and machine learning. Zemoso helped Cellino accelerate the launch of their MVP using a time-boxed and outcome-oriented approach. The end result was an Automation Information Management System (AIMS) that represents all data generated from cell lines and integrates the external lab instrument controller systems with a constantly-improving AI engine.

"I was very impressed with the speed at which Zemoso operated, starting from our first conversational engagement to setting up a team and completing our Design exercise along with a proof of concept to visualize our complex datasets using interactive web technologies. We didn't hesitate to continue with several development engagements where Zemoso provided a top-notch scrum team to work very closely with our internal teams, always delivering with the mindset of maximum satisfaction. Their understanding of the complexities of an evolving solution and ability to pivot with acute urgency makes them a solid software development partner for any start-up and business out there."

Ozge Whiting

VP of Data and Machine Learning | Cellino

Breaking down the industry context

The global stem cell market size was <u>U.S. $11.92 billion in 2021 and is expected to grow 11.3%</u> every year. Cellino entered that market with an incredible vision: making personalized stem cell–derived therapies scalable and accessible. To achieve that, the team realized that they needed to solve the personalized stem cell generation problem on three fronts:

- With biology – on the stem cell engineering front
- With precision – on the laser physics front
- With automation – on the machine learning front

Ultimately, it came down to this: Cellino wants to fully automate the manufacturing of induced pluripotent stem cell (iPSC)–based cell therapies. In the words of their CEO and Co-founder, they wanted to "democratize and industrialize the future of regenerative medicine for patients in need."

So, there we were. Helping Cellino execute on that third front: automation and scaling of IPSC reprogramming processes.

The industry challenge

One of the important challenges is the amount of manual intervention currently required across the cell manufacturing processes—these manual steps introduce operator variability and make it challenging to deliver stem-cell based therapies affordably for patients. Scaling autologous and allogeneic stem cell production will be hard if a biologist has to examine these cells by eye, decide which cells were good or bad, and remove unacceptable cells via a pipette tip.

By integrating computer vision and image-based machine learning, Cellino created algorithms that would carry out the same process with more consistency and accuracy. By integrating laser-based cell removal, Cellino created a hands-free cell selection and purification platform. In this new

paradigm of automated cell manufacturing, biologists will be freed from repetitive tasks and be able to concentrate on innovation of novel cell programming techniques and cell therapy discoveries.
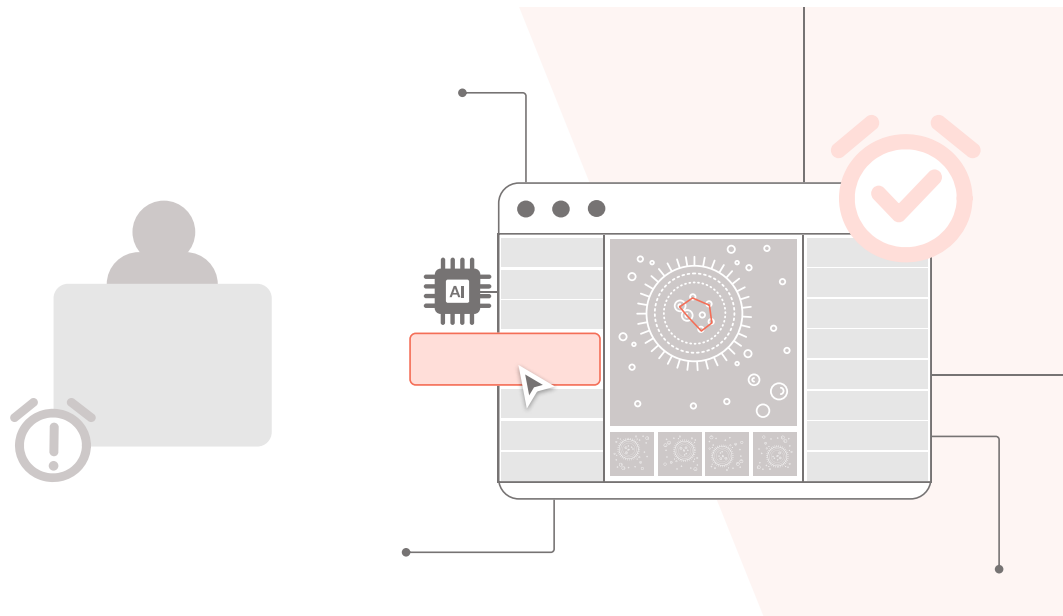

How we collaborated with Cellino

Our self-organized product pods collaborated with Cellino and helped accelerate the MVP launch of their research-grade stem cell manufacturing platform. We took a time-boxed, outcome-first approach, to first conduct a Google Ventures-inspired design sprint, and then partnered with Cellino to meet their delivery and innovation milestones, on time.

After fully understanding the complexities of the process we are digitizing, we co-created an interactive web application that presents cell manufacturing data such as high-resolution microscopy images and enables various remote monitoring workflows. It allows users to view very large images with multiple layers of AI-derived information about cell colonies and assess the next steps for that set of cell lines.

How we supported Cellino's vision

We partnered with Cellino to integrate the external lab instrument controller systems and front-end action items with a constantly-improving AI engine, and build an Automation Information Management System (AIMS) to represent all data generated from manufacturing processes of many cell lines. This system would be a listener and viewer for the colossal amounts of data captured, analyzed, and sent over by their instrumentation as well as AI/ML core. AIMS helped biologists to monitor cell manufacturing processes in the following ways:
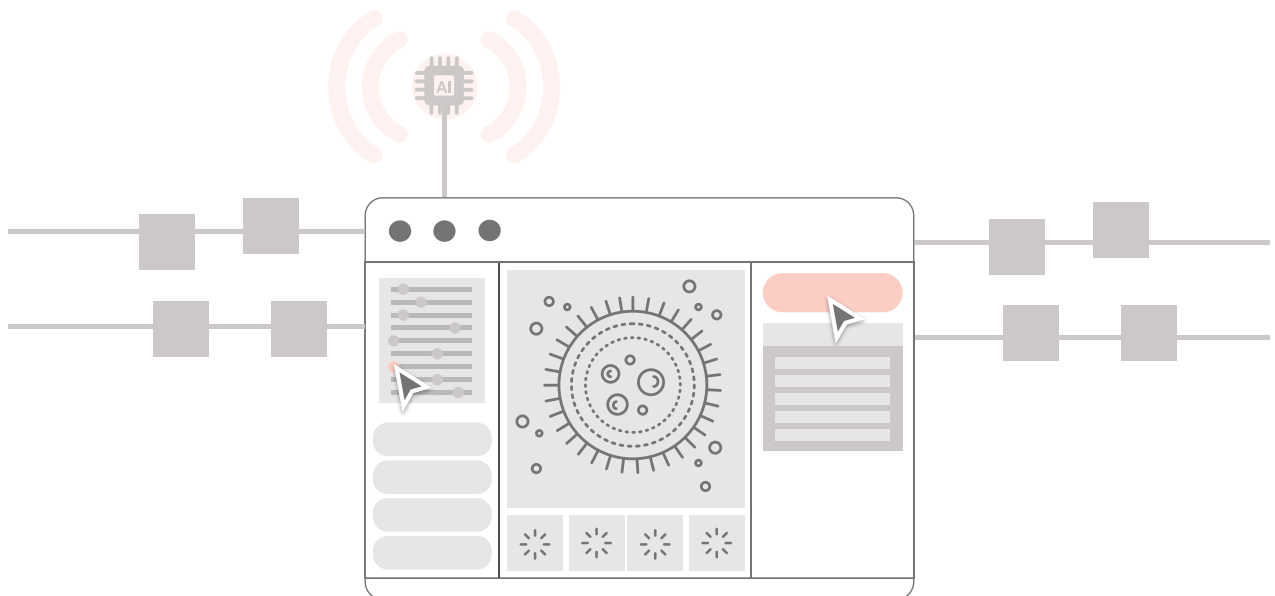
Data capture and management: Multitudes of data points, including n-dimensional high-resolution, multi-scaled images of cell clusters get sent to AIMS to be converted to human readable form. AIMS ensures a traceable transition, and seamlessly integrates them into existing workflows to identify and nurture the best stem cells.

Rendering images in the image viewer: Our teams worked with Cellino to create a highly capable image viewer for microscopic instrumentation data and other types of inference images. These are high resolution and multiple channel images with layers of AI-derived data such as labels, points, shapes, surfaces, etc. that correspond to a different data type, visualization, and interactivity. The AIMS image viewer renders the massive image data in milliseconds thanks to web optimized tiling and enables zooming to very high resolution layers seamlessly. Users also examine related metadata such as protocols, derived-features and other administrative data in the attribute panel for each data layer.

Play around with Brightfield and Fluorescence images: Biologists can utilize the image viewer to interact with sub-micron resolution images with various modalities at a lightning speed. They can adjust brightness, colormaps, opacity, contrast, select channels, adjust layer blending modes, annotate, draw, and do so much more with the images for observation and inspection of cells.

Collaboration: Our Slack integration makes seamless communication and collaboration across lab technicians, biologists and engineering teams possible as many cell lines are run through the manufacturing platform.

Intuitive UI: The user-friendly interface of AIMS presents all this data, from manufacturing run information to plate status, in a way that's easy to consume, and even easier to analyze with connections to BI tools. They can then quickly make informed decisions about the quality of each cell cluster and identify next steps of experimentation.

How the AIMS system enables biologists

- Can monitor experiments remotely from their system, without entering the lab
- View and annotate high resolution microscopic images with layers of information at a single platform
- Expedite information access and analysis by eradicating the need to shuffle through multiple tools for note-taking, viewing images, communicating with colleagues, etc.
- Acts as a single source of truth for all the ML analysis related to a plate and experiment protocols run on it

- Monitor processes through the user-friendly dashboard
- Automate the experiment cycles with connections to instrument controllers for scanning images of cell clusters, and zapping of bad cells at regular intervals

This has streamlined the process optimization and made it efficient, accelerating Cellino's road to discovery significantly. AIMS prototype and solution also enabled Cellino to present a tangible version of its idea to their investors and the advisory board, even before the clinical-grade platform goes into action.

Tech stack/Tools

Tech stack: React, Material UI, deck.gl, Zarr, Apollo GraphQL, Nest.js, TypeORM, PostgreSQL, Docker, Kustomize, Pub/Sub.

Tools: Lucid chart, cloud workstation, Confluence, Figma, Jira, Slack, Miro Board

In conclusion

The success of our partnership with Cellino is an example of Zemoso's ability to deliver on our promise of speed and excellence, even in the face of the most challenging and ambiguous innovations. We feel privileged to have had the opportunity to work with such a remarkable partner and look forward to continually supporting their world-changing vision and ideas as they change the future of regenerative medicines.

Contact us to learn more about how we can help you bring your product innovation to the next level.

To hire your custom product pod, write to sales@zemosolabs.com today!