EXPLORING DRUG DISCOVERY AND DEVELOPMENT

TURNING THOUGHT LEADERSHIP INTO LEADS: BIO-TECHNE's SCIENCE MILESTONE

OVERVIEW //

Bio-Techne partnered with *Drug Discovery News* on a **Science Milestone** to support the launch of their new high-throughput western analysis platform. The goal was to position the company as a long-standing innovator in protein analysis while generating qualified leads through engaging, high-quality content.

CLIENT //

- Trace the evolution of western blotting and automated western techniques
- Highlight Bio-Techne's decades-long leadership in the field
- Build awareness of their new platform
- Reach and convert a targeted audience of life science professionals

milestone

Leapfrogging to quantitative, high throughput protein detection and analysis

The ability to detect and analyze proteins has long been a key quest for scientists. For decades, the pursuit of accuracy and reliability in protein detection led to a series of technological leaps. From the early days of gel electrophoresis and the invention of western blotting to the development of automated western analysis, researchers continuously push the boundaries of what's possible with protein analysis tools.

1970s Foundational techniques

In 1807, scientists first observed that clay particles in water moved toward the positive electrode under an electric field, a phenomenon that laid the foundation of electrophoresis. It wasn't until the 1950s, with the introduction of electrophoretic substrates such as starch and polyacrylamide, that researchers could use gel electrophoresis to separate proteins in complex mixtures (1). However, these early electrophoretic methods lacked the resolution to differentiate proteins of similar sizes.

In 1970, Ulrich Laemmli, a molecular biologist studying bacteriophage T4 at the Medical Research Council Laboratory of Molecular Biology, recognized that sodium dodecyl sulfate (SDS), a protein-denaturing detergent, could help separate polypeptide chains based on their molecular weight as they migrated through gels. By creating a discontinuous two-layer gel system containing SDS and polyacrylamide at different concentrations, Laemmli was able to observe clearer protein bands. This method, now known as SDS polyacrylamide gel electrophoresis (SDS-PAGE), allowed him to identify previously unknown proteins that made up the bacteriophage T4 capsid (2).

At the same time, other researchers were using gel electrophoresis to separate biomolecules such as DNA. In 1975, Edwin Southern, a molecular biologist at the University of Edinburgh, took this technique one step further by detecting specific DNA sequences from electrophoretically separated fragments. To achieve this, he introduced a new step: blotting. After separating DNA fragments on an agarose gel, he transferred them onto a cellulose nitrate membrane, which captured the DNA (3). He then used radioactive RNA probes that could bind to specific DNA sequences and detected them with autoradiography. Southern named this invention after himself as Southern blotting.

1979 A new blot in town

As Southern blotting became a popular tool for analyzing DNA samples, it also inspired researchers to explore its potential for other applications. In 1977, George Stark, a biochemist at Stanford University, and his colleagues introduced an RNA blotting method by using diazobenzyloxymethyl (DBM) paper, a chemically modified form of cellulose, as the medium for transferring RNA molecules (4). They named this innovation northern blotting to reflect its connection to the Southern blot.

Building on the success, Stark's team further adapted the blotting idea for protein analysis and published their method in July 1979. They modified Laemmli's discontinuous gel system by incorporating a polyacrylamide/agarose gel mix to separate proteins in cell lysates. For protein transfer, they used DBM paper, and to probe the target proteins, they utilized a radioactive protein. Using this method, the group successfully identified tumor antigens in simian virus 40–infected cells (5).

Meanwhile, two biochemists on opposite sides of the world, Harry Towbin at the Friedrich Miescher Institute and Neal Burnette at Fred Hutch Cancer Center, were independently developing a similar protein blotting method. Both teams established an electrophoretic blotting procedure to transfer the proteins, which involved using an electric field to drive proteins from an electrophoresis gel onto a nitrocellulose membrane. Towbin utilized a primary antibody to bind the target protein, followed by a secondary radioactively or fluorescently labeled antibody to detect the primary antibody. Burnette's approach to protein detection was slightly different—he used a primary antibody and a secondary radiolabeled protein.

Towbin published his method in 1979, just two months after Stark's paper, while Burnette's manuscript, prepared around the same time, was initially rejected. In 1981, Burnette's article was accepted by the same journal, and continuing the wordplay, he dubbed the method western blotting (6).

Edwin Southern developed Southern blotting by introducing a blotting procedure following gel electrophoresis, enabling the detection of specific DNA sequences.

1980s-2000s Rapid adoption, persistent challenge

Western blotting quickly captured the attention of researchers worldwide. Within the first decade of its inception, it became a key diagnostic tool for detecting disease-associated proteins. Some researchers applied western blot analysis to identify human immunodeficiency virus antibodies in blood samples (7), while others used it to detect Creutzfeldt-Jakob disease, a brain disorder caused by misfolded prion proteins (8).

During this time, technological advancements made western blotting more accessible. Researchers introduced new membrane materials, such as polyvinylidene fluoride and nylon, to improve the blotting process. These materials were durable, stable, and could bind proteins more effectively. Detection methods also evolved. Chemiluminescence, which involves the use of chemiluminescent substrates that emit light when they react with enzyme-linked secondary antibodies, became the preferred method over radioactivity for visualizing protein bands.

Despite these improvements, achieving reproducibility was a persistent challenge for researchers performing western blotting experiments. The multiple handling steps—gel electrophoresis, transfer, blotting, washing, and detection—often introduced variability and led to inconsistent results. This spurred a growing interest in building more standardized western blotting approaches. Cell Biosciences, a company that rebranded as ProteinSimple in 2011 and later became part of Bio-Techne, began exploring automated solutions.

Tom Yang, now Senior Director of Engineering at Bio-Techne, joined Cell Biosciences in 2003 after several years working on human genome sequencing. "While the western blot can be done in the lab, automating is exceptionally difficult," Yang said. "It's very hard for a robot to handle a flimsy gel, perform blotting, and take the membrane through all different incubation and washing steps." Yang and the Cell Biosciences team started finding ways to simplify the process.

The multiple handling steps involved in traditional western blotting often result in experimental variability and poor reproducibility.

2011 The birth of Simple Western

Tom Yang pioneered the development of the Simple Western assay and the first automated capillary-based Simple Western instrument, Simon.

With experience in DNA sequencing using capillary electrophoresis, Yang saw parallels between this technique and the western blot. Unlike gel electrophoresis, capillary electrophoresis separates molecules in a narrow, electrolyte-filled capillary tube, and applying this approach to protein separation allowed Yang to eliminate the need for gels.

The next goal was to conduct the remaining western blotting steps in the capillary tube, and the key challenge for this was immobilizing proteins to the capillary wall. "We applied UV light to photo-capture separated proteins to the capillary wall. By developing proprietary surface chemistry, we created coatings that were compatible with electrophoresis and our photo-capture requirement," Yang explained. "Even though we don't call it a blot, it's still a physical attachment of the proteins to the walls."

To identify target proteins, they used a primary antibody and subsequent immunodetection using horseradish peroxidase–conjugated secondary antibodies and chemiluminescent substrates—all within the capillary. These innovations led to a gel-free, blot-free protein detection method, which they named the Simple Western™ technology. "Every single step of the western blot is paralleled in Simple Western. We just do it in a way that's much easier to automate," Yang said.

With Simple Western fully established, Yang's team moved ahead with automating the technique with an instrument, bringing together an experienced team of scientists, engineers, and software developers. "We put together many existing technologies and invented a key technology that bridged everything, from protein immobilization to immunodetection," Yang said.

In 2011, the ProteinSimple team unveiled the first automated capillary-based Simple Western instrument, the Simon™ System, at the Human Proteome Organization Annual World Congress. "When we first announced and showed the instrument at that conference, there was a lot of attention. It was a very exciting time," Yang recalled. By eliminating inconsistencies in manual protein transfer, Simon demonstrated significantly improved accuracy in protein analysis (9). "We're moving into the quantitative space, where our data precision, reproducibility, data quality are just hands down better than a traditional Western blot line," Yang said.

2014-2018 Enhancing sensitivity and multiplexing

In 2010, while Yang and his team were making progress in developing Simple Western, Jessica Dermody, now Director of R&D Science at Bio-Techne, was conducting postdoctoral research in Dean Felcher's laboratory at Stanford University. There, she worked on a capillary electrophoresis-based protein separation project in collaboration with the ProteinSimple team, which led to an opportunity for her to join their product development team.

After the release of Simon, Dermody recalled, "We got a lot of feedback from scientists who use the platform, the things they liked and the things they didn't like." Driven by this, Dermody and the team worked toward developing more robust, sensitive platforms that could handle more samples in less time.

In 2014, ProteinSimple introduced the Wes™ System, a Simple Western system that could run up to 25 samples in three hours, with sensitivity ten times greater than Simon. "Wes was a culmination of keeping all the things that scientists liked about the system and addressing their dislikes," Dermody said. "We improved the usability and dramatically increased the platform's sensitivity. Wes was a big leap forward in the technology and the baseline for today's western blot."

It wasn't long before the team set its sights on a new challenge. "Our customers were requesting higher multiplexing capabilities," Dermody said. The next phase of improvement began to take shape.

Dermody and a team of biochemists, engineers, software developers, and product managers worked in parallel on the instrument, reagents, software, and assays. Together, they incorporated dual detection capabilities—chemiluminescence and fluorescence—allowing users to detect more targets in their samples. The team also integrated built-in total protein measurement for easier data normalization. Additionally, they developed an innovative ReProbe™ Assay, which mimics the stripping and reprobing steps in traditional western blotting but within the same capillary, enabling researchers to extract more data from each sample.

This collaborative effort resulted in a platform with enhanced multiplexing capabilities, versatile assays, and the same level of automation and sensitivity. In 2018, the ProteinSimple team announced the release of this new instrument, naming it the Jess™ system after Dermody. "It was definitely a nice surprise," Dermody said. "Since then, we've got so many Jesses out there. We have labs who have multiple Jesses, some even have more than 20 instruments in their lab."

Jessica Dermody led the scientific team involved in the development of Jess, a Simple Western platform with enhanced multiplexing capabilities, which was launched in 2018.

2025 Breaking new ground

The success with Simon, Wes, and Jess only fueled the drive for more innovations at ProteinSimple. The team has since been dedicated to expanding Simple Western's capabilities to better support diverse research needs. For example, the Abby™ System, which was introduced in 2021, offers an accessible, budget-friendly solution for researchers seeking to automate western blotting workflows.

"We have systems spanning the entire drug development pipeline, from early discovery to quality release assays and clinical trials," Dermody said. "We've got customers in a broad range of fields—cancer, biology, neuroscience, cell and gene therapy, you name it. If they're interested in detecting proteins in complex samples, I can almost guarantee we've got a system for them."

Now, the Bio-Techne team is excited to introduce the latest member of the Simple Western family: the Leo™ system. It takes the strengths of its predecessors and enhances them to meet the growing demands of modern research. Capable of processing up to 100 samples in a single run and delivering results in just three hours, Leo significantly accelerates throughput, making it ideal for large-scale studies such as drug screening and biomarker discovery. Its expanded multiplexing capability allows for the detection of up to eight protein targets per sample, providing researchers with more comprehensive data from a single experiment. These features make Leo a versatile tool for supporting various research fields and drug development stages.

With decades of progress and ongoing advancements like Leo, the future of protein analysis is looking bright. "Proteins are at the heart of understanding disease biology and life sciences, and we're just getting started with protein analysis tools," Yang said. "There will be so many more important scientific discoveries to be made at the protein level."

The Leo System, powered by Simple Western technology, is a high throughput automated capillary western platform for fast, sensitive protein quantification, processing up to 100 samples per run and delivering results in just three hours.

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Explore Simple Western Technology
bio-techne.com/simplewestern
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OUR APPROACH //

Custom Content Creation

- We conducted deep research and built a timeline featuring six key milestones in western blot technology—from the 1970s invention of SDS-PAGE to Bio-Techne's innovations in Simple Western analysis.
- Interviews with two Bio-Techne scientists offered authentic, expert perspectives that enriched the narrative.
- The result: a compelling, visually engaging PDF that blended scientific history, technical depth, and personal storytelling.

PROMOTION & RESULTS //

- Leads were generated through a combination of strategic **email campaigns** and **digital placements** targeted to life science researchers and decision-makers.

PROMOTIONAL STRATEGY //

- **4** dedicated email campaigns
- Additional promotional support to drive traffic and conversions
- Campaign completed in just **7** weeks

CAMPAIGN RESULTS //

- **192** total leads captured
- **38.25%** conversion rate
- **100** leads delivered through the Milestone package
- Bio-Techne purchased **50** additional leads due to strong performance

OUTCOME //

The campaign delivered on every front—elevating Bio-Techne's reputation, engaging our scientific audience, and driving measurable results. The success of this Science Milestone demonstrates the value of pairing expert-driven content with strategic promotion.

CLIENT FEEDBACK //

"We enjoyed reading the article, and we think it looks great. We are looking forward to publication!"

– Bio-Techne