

DON W. ARNOLD, PH. D.

Curriculum Vitae

PROFILE

Successful scientist and business manager with strong technical background over 23 years of experience in microfluidics and micro- / nano-scale chemical and biochemical processing / analysis in integrated systems, including 20+ years of entrepreneurial experience in starting, operating and growing a start-up high-tech business serving the life science markets. Experience ranges from experimental physical chemistry to microfluidics to business development, R&D in a national laboratory environment, intellectual property development and management, technology transfer, merger and acquisition, integration into a global organization and manufacturing transfer.

EXPERIENCE

9/2017 – PRESENT – LIMITED PARTNER

Tri-Valley Ventures, Pleasanton, CA

Limited Partner with venture group focused on establishment and growth of new AI/Data, SaaS, HealthTech, Smart Devices/Hardware, FinTech companies in the Tri-Valley area of Northern California. Actively involved with scouting and evaluating new companies and technologies that fit portfolio profile.

3/2017 – PRESENT – FOUNDER, CEO

Veristad, LLC, Livermore, CA

Founder and CEO of technical and business consulting organization. Focused on two key areas: 1) assisting established companies during assessment of early stage technologies and 2) assisting early stage technology companies navigating from start-up through exit via acquisition or IPO.

3/2016 – 3/2017 – VP AND PRINCIPAL SCIENTIST, IDEATION AND OPEN INNOVATION SCIEX, REDWOOD CITY, CA

Operating within Business Development team. Coordinate with R&D and business leaders, identify opportunities to bring new technologies into SCIEX portfolio, focusing on those that require technical and / or business partnerships to fill gaps between existing internal capabilities and acquisition opportunities. This effort lead to SCIEX Acoustic Ejection MS that is now coming to market.

10/2012 – 2/2016 – VP, R&D AND PRINCIPAL SCIENTIST SCIEX, REDWOOD CITY, CA

Provide leadership for product R&D within the SCIEX Separations business unit and greater SCIEX R&D. Coordinate multi-site R&D efforts between four SCIEX R&D locations.

Participate in business development and key collaborations to support continued growth of business unit. Identify open innovation or acquisition opportunities and coordinate full evaluation efforts. Represent SCIEX in international Microfluidics consortium. Develop new technology and develop related intellectual property (member of SCIEX IP Committee). Make technical presentations at conferences and communicate with key opinion leaders / customers.

Responsibility for completing major relocation and consolidation project to transfer Eksigent product manufacturing to AB SCIEX's Singapore plant and relocate Eksigent office to a new Northern CA location between 10/2012 and 10/2013. Project transferred the three product lines and the consumables line in 12-months while simultaneously relocating the offices.

8/2010 – 10/2012 – GENERAL MANAGER EKSIGENT PART OF AB SCIEX, LLC, DUBLIN, CA

Managed all aspects of the Eksigent division of AB SCIEX including P/L ownership and integration of Eksigent into AB SCIEX (a Danaher Corporation operating company). Represented the Eksigent business on the AB SCIEX Leadership Team. Interfaced with all parts of organization to drive global expansion of Eksigent products through AB SCIEX and distributor channels. Responsibilities also included overseeing new product development and launch, ramp of production while reducing inventory and manufacturing cost, incorporation of Danaher management principles and business practices across the division.

- Three new Eksigent products launched in 2012
- Revenue growth of >60% / >35% in 2011 / 2012 for eksigent product lines (vs slow market growth)
- Lead role in formal strategic plan development for AB SCIEX Separations business
- Increased Eksigent product manufacturing output while reducing expenses and inventory

2/2010 – 8/2012 – VICE PRESIDENT

EKSIGENT PART OF AB SCIEX, LLC, DUBLIN, CA

Coordinated with AB SCIEX management team during initial integration effort. During first 6 months after acquisition served as lead contact within Eksigent part of AB SCIEX. Responsibilities included overseeing manufacturing, R&D and sales teams, introduction of Danaher management principles and business practices into the division and participating in search for General Manager for the Eksigent business unit.

5/2000- 2/2010 - FOUNDER AND VICE PRESIDENT

EKSIGENT TECHNOLOGIES, LLC, DUBLIN, CA

Co-founded Eksigent Technologies, LLC in May 2000. As a business, Eksigent focused on two areas: microscale liquid chromatography systems for life science applications (proteomics, drug discovery & development) and electrokinetic pump-based delivery systems for a variety of applications. Eksigent grew to over 85 people between 2000 and 2008 with revenues in excess of \$15M in 2005. As a founder / employee, contributed in various technical and business roles, including President, VP Advanced Technologies, VP Business Development. Member of Eksigent's Board of Directors from 2000 - 2010.

Member of Eksigent leadership team responsible for M&A activities during sale of analytical instrumentation part of Eksigent business (eventual sale to Danaher Corporation in Feb 2010).

Manager and PI for Eksigent's Advanced Technologies Department. Developed microfluidic systems with integrated valves, pumps, detection and connectors for a variety of applications (e.g. HPLC, LC/MS, biological assays and diagnostics). Developed advanced electrokinetic pumping and flow control technologies for micro- and nano-flow fluid delivery systems.

NIST ATP award winner and Principal Investigator for three-year project (2002; \$2M) - "Microfabricated HPLC for High-Throughput Chemical Analysis".

Established technical and business alliances for technology development / commercialization. Partners included Beckman-Coulter, Pfizer, Merck, LLNL, GSK, US Army *et al.* for externally-funded collaborations to develop novel chip-based platforms for diagnostics, HPLC, etc.

Managed Eksigent IP portfolio (2000-2010). IP preparation, prosecution and protection; SNL license negotiations, strategic planning and outside counsel management.

1997-2000 - SENIOR MEMBER OF TECHNICAL STAFF

SANDIA NATIONAL LABORATORIES, LIVERMORE, CA

Key member of research and development team focused on development of portable micro-scale chemical analysis systems to detect explosives and chemical / biological agents in liquid samples.

Developed microfluidic designs for sample analysis to be compatible with integrated detection systems (optical, electrochemical, etc.), novel sample injection protocols, and separation methods. Worked closely with engineers to fully integrate system into a hand-held analyzer.

Developed preferred methods for fabricating fused silica microfluidic systems for the program. Trained and supervised two technicians and two post-doctoral associates as part of this program.

Played key role in SNL technology commercialization efforts as a technical lead in negotiations with major corporations interested in partnering with SNL to license and commercialize the technology.

Key contributor for high-sensitivity detection and electrokinetic pump development. Inventor on patents that lead to formation of Eksigent Technologies in May 2000.

POSTDOCTORAL RESEARCH ASSOCIATE, UNIVERSITY OF SOUTHERN CALIFORNIA

LOS ANGELES, CA 1994 – 1997 (WITH PROFESSORS CURT WITTIG AND HANNA REISLER)

Lead postdoctoral researcher on chemical physics project studying molecule-surface collision dynamics. Used state-of-the-art jet-cooled molecular beams, surface science techniques and laser spectroscopy to examine elastic, inelastic, trapping-desorption and dissociative molecule-surface collisions.

Upgraded experimental apparatus that included UHV chamber, surface characterization tools (XPS, ATR-IR, TPD (with RGA), SIMS), jet-cooled molecular beam, custom laser spectroscopy system. Updated electronics, detectors, software and lasers for new molecule-surface collision studies.

EDUCATION

University of California, Berkeley — Ph. D. Physical Chemistry, 1994 (*Professor Daniel M. Neumark*)
Thesis: Study of Molecules, Clusters and Transition State Species by Anion Photoelectron Spectroscopy
NSF Graduate Student Fellowship

Cornell University - B. A. Chemistry, 1988 / Cornell Tradition Fellow

SKILLS

Technical

Micro- / Nanofluidics & Microfabrication
Microfluidic pumping, valving, separation, detection
Microsystem integration - Chemical & biological analysis
Electrokinetic phenomenon - pumping, flow control, etc.
Sensitive detection - optical, electrochemical, MS, imaging, etc.
Biological assays - flow and bead-based, proteomics
UHV Systems - MS, Surface analysis, molecular beams
Spectroscopy - laser, ion, photoelectron
Micro-fuel cell technology (DMFC)

Business

Project management
Personnel management
Joint development agreements
Grant proposal writing / management
IP generation, development, licensing
Technology transfer
Company start-up and growth
Merger and acquisition
Integration and consolidation

PROFESSIONAL MEMBERSHIPS

American Chemical Society
Association for Laboratory Automation
Association for Biomolecular Resource Facilities
American Society for Mass Spectrometry
Royal Society of Chemistry

SCIENTIFIC PUBLICATIONS AND PRESENTATIONS

Over 35 refereed publications in a wide range of journals including: Science, Analytical Chemistry, Electrophoresis, Journal of Chemical Physics, Chemical Physics Letters, Proceedings of the National Academy of Sciences of the United States of America, Analytica Chimica Acta, Analytica Methods and Journal of Vacuum Science & Technology B and SPIE. Published several chapters in Micro Total Analysis Systems proceedings. Numerous inter-national conference and corporate presentations. Detailed publication list provided in bibliography.

INTELLECTUAL PROPERTY

Author on numerous pending U.S. and international patent applications for inventions in a range of applications covering technical advances made at Sandia National Laboratories, Eksigent Technologies, SCIEX and Veristad. Detailed list of patents and published applications provided in bibliography.

REFERRALS

Available upon request.

Publications

"Acoustic Ejection Mass Spectrometry for High-Throughput Analysis", Hui Zhang, Chang Liu, Wenyi Hua, Lucien P. Ghislain, Jianhua Liu, Lisa Aschenbrenner, Stephen Noell, Kenneth Dirico, Lorraine F. Lanyon, Claire M. Steppan, Don W. Arnold, Thomas R. Covey, Sammy S. Datwani, Matthew D. Troutman, submitted to Science, available on bioRxiv (January 29, 2020).

"A novel microchip-based imaged CIEF-MS system for comprehensive characterization and identification of biopharmaceutical charge variants", Scott Mack, Don W. Arnold, Greg Bogdan, Luc Bousse, et al., *Electrophoresis* 40 (23), 3084 (2019).

"Fast quantitation of opioid isomers in human plasma by differential mobility spectrometry/mass spectrometry via SPME/open-port probe sampling interface", Chang Liu, Germán Augusto Gómez-Ríos, Bradley B. Schneider, J. C. Yves Le Blanc, Nathaly Reyes-Garcés, Don W. Arnold, Thomas R. Covey, Janusz Pawliszyn, *Analytica Chimica Acta*, 991, 89 (2017).

"Open Port Probe Sampling Interface for the Direct Coupling of Biocompatible Solid-Phase Microextraction to Atmospheric Pressure Ionization Mass Spectrometry", Germán Augusto Gómez-Ríos, Chang Liu, Marcos Tascon, Nathaly Reyes-Garcés, Don W. Arnold, Thomas R. Covey, and Janusz Pawliszyn, *Analytical Chemistry*, 89, 3805 (2017).

"Evaluation of micro ultra-high-pressure liquid chromatography for pharmaceutical analysis", Yang, M., Gong, X. Schafer W., Arnold, D., and Welch, C. J., *Analytical Methods*, 5, 2178 (2013).

"microLC-MS-MS: The Future of Bioanalysis", Editorial in *Bioanalysis* 2013 with Shane Needham.

"HPLC at the Micro Scale", Arnold, D. W., *Innovations in Pharmaceutical Technology*, 31, 24 (2009).

"On-Chip Single-Copy Real-Time Reverse-Transcription PCR in Isolated Picoliter Droplets", Beer, N. R., Wheeler, E. K., Houghton, L. L., Watkins, N., Nasarabadi, S., Hebert, N., Leung, P., Arnold, D. W., Bailey, C. G. and Colston, B. W., *Analytical Chemistry*, 80, 1854 (2008).

"Microchip separations of protein biotoxins using an integrated hand-held device", Fruetel, J. A., Renzi, R. F., Vandernoot, V. A., Stamps, J., Horn, B. A., West, J. A., Ferko, S., Crocker, R., Bailey, C. G., Arnold, D. W., Wiedenman, B., Choi, W. Y., Yee, D., Shokair, I., Hasselbrink, E., Paul, P., Rakestraw, D., Padgen, D., *Electrophoresis* 26, 1144 (2005).

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"Electrokinetic Pump Application in Micro-Total Analysis Systems: Mechanical Actuation to HPLC", Paul, P. H., Arnold, D. W., Neyer, D. W., and Smith, K. B., *Micro Total Analysis Systems 2000*, edited by A. van den Berg, W. Olthuis, and P. Bergveld Kluwer Academic Publishers, Dordrecht, 2000, pp. 583-590.

"On-chip chiral and achiral separation of amphetamine and related compounds labeled with 4-fluoro-7-nitrobenzofurazane", Wallenborg, S. R., Lurie, I. S., Arnold, D. W., and Bailey, C. G., *Electrophoresis*, 21, 3257 (2000).

"Single Organelle Analysis with Integrated Chip Electrophoresis and Optical Tweezers", Wheeler, A. R., Morishima, K., Arnold, D. W., Rossi, A. B., and Zare, R. N., *Micro Total Analysis Systems 2000*, edited by A. van den Berg, W. Olthuis, and P. Bergveld Kluwer Academic Publishers, Dordrecht, 2000, pp. 25-28.

"Integrated optical systems for excitation delivery and broadband detection in microfluidic electrochromatography", Kemme, S. A., Warren, M. E., Sweatt, W. C., Wendt, J. R., Bailey, C. G., Matzke, C. M., Allerman, A. A., Arnold, D. W., Carter, T. R., Asbill, R. E., and Samora, S., Vol. 3952, SPIE, 2000, pp. 375-383.

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"Examination of the ²A₂' and ²E' states of NO₃ by ultraviolet photoelectron spectroscopy of NO₃⁻", Weaver, A. et al., *Journal of Chemical Physics*. 94, 1740 (1991).

"Vibrationally resolved spectra of C₂-C₁₁ by anion photoelectron spectroscopy", Arnold, D.W. et al. *Journal of Chemical Physics*, 95, 8753 (1991).

"Examination of the Br+HI, Cl+HI, and F+HI hydrogen abstraction reactions by photoelectron spectroscopy of BrHI⁻, ClHI⁻, and FHI⁻", Bradforth, S.E. et al., *Journal of Chemical Physics*, 92, 7205 (1990).

Selected Issued Patents / Applications

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"Electrospray Interface Device and Associated Methods", EP 3649668 (Application 18829155), Arnold, D. W.

"Methods and Systems for Increasing Sensitivity of Direct Sampling Interfaces for Mass Spectrometric Analysis", US 20200043712 (Application 16341718), Arnold, D. W., Covey, T. R., Liu, C.

"Open Port Probe Interfaces" WO 2020016809 A1, (Application PCT/IB2019/056124) Arnold, D. W.

"An Electromagnetic Coil Assembly Structure for Processing Fluids and Methods for Making Same", WO 2020016854 (Application PCT/IB2019/056209), Arnold, D. W., Covey, T. R., Liu, C., Potyrala, S., Tsipirovich, A.

"Electromagnetic Assemblies for Processing Fluids" US 20200011773 A1 (Application US12/480,491), Arnold, D. W., Covey, T. R., Liu, C.

"Electromagnetic Assemblies for Processing Fluids" EP 3574319 (Application 18744033), D. W. Arnold, T. R. Covey, C. Liu

"Sampling Probe and Sampling Interface for Mass Spectrometry", WO 2020003233 A1 (Application PCT/IB2019/055505), Arnold, D. W., Covey, T. R., Liu, C.

"Methods and Systems for Increasing Sensitivity of Direct Sampling Interfaces for Mass Spectrometric Analysis", EP 3526811 (Application 17860997) Arnold, D. W., Covey, T. R., Liu, C.

"Methods and Systems for Increasing Sensitivity of Direct Sampling Interfaces for Mass Spectrometric Analysis", CN109844901 (Application 201780063485.0) Arnold, D. W., Covey, T. R., Liu, C.

"Methods and Systems Utilizing Ultrasound-Assisted Sampling Interfaces for Mass Spectrometric Analysis" WO 2019102350 A1, (Application PCT/IB2018/059138), Arnold, D. W., Covey, T. R., Liu, C.

"Methods and Systems for Feedback Control of Direct Sampling Interfaces for Mass Spectrometric Analysis" WO 2019102352 A1 (Application PCT/IB2018/059141), Arnold, D. W., Covey, T. R., Liu, C.

"3-D Mixing and Particle Delivery via Movable Electromagnet Assemblies", WO 2019102355 A1 (Application PCT/IB20178/059146), Arnold, D. W., Covey, T. R., Liu, C.

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"Electromagnetic Assemblies for Processing Fluids" US 20180369831 (Application 1577993), Arnold, D. W., Covey, T. R., LeBlanc, Y., Liu, C., Campbell, J. L.

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"Precision Flow Control System" US 8,685,218 (2014), Paul, P. H. Arnold, D. W., Rehm, J., R.

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"Microfluidic Connections", CA 2,561,508 (2013), Arnold, D. W., Hencken, K. R., Datwani, S. S., Leung, P. P. Cyr, D. R., Rehm, J. R.

"Microfluidic Connections", US 8,021,056 (2011), Arnold, D. W., Hencken, K. R., Datwani, S. S., Leung, P. P. Cyr, D. R., Rehm, J. R.

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"Precision Flow Control System" US 7,927,477 (2011), Paul, P. H. Arnold, D. W., Rehm, J., R.

"Flow Control Systems", CA 2,450,119 (2011), Neyer, D. W., Paul, P. H., Arnold, D. W., Bailey, C. G.,

"Microfluidic detection device having reduced dispersion and method for making same", US 7,925,125, (2011), Cyr, D. R., Farrow, R. L., Arnold, D. W.

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"Electroosmotic Flow Controller", US 7,695,603 (2010), Paul, P. H., Arnold, D. W., Bailey, C. G.

"Microfluidic Device", US 7,575,722 (2009), Arnold, D. W.

"Flow Control Systems", US 7,597,790 (2009), Neyer, D. W., Paul, P. H., Arnold, D. W., Bailey, C. G.,

"Electrokinetic pump driven heat transfer", US 7,559,356 (2009), Paul, P. H., Anex, D. S., Arnold, D. W.

"Fuel Cell System with Electrokinetic Pump", US 7,521,140 (2009), Arnold, D. W., Paul, P. H., Anex, D. S.

"Precision flow control system", IN 223,349 (2008), Paul, P. H., Rehm, J. E., Arnold D. W.

"Precision flow control system" US 7,465,382 (2008), Paul, P. H., Rehm, J. E., Arnold D. W.

"Processing of particles", US 7,175,810 (2007), Arnold, D. W., Rakestraw, D. J., Paul, P. H., Leung, P.

"Particulate processing system", US 7,220,592 (2007), Rakestraw, D. J., Arnold, D. W., Paul, P. H.

"Microfluidic detection device having reduced dispersion and method for making same", US 7,336,860 (2007), Cyr, D. R., Farrow, R. L., Arnold, D. W.

"Microfluidic Detection Device", EP 1,616,164 B1 (2006), D. R. Cyr, R. L. Farrow and D. W. Arnold

"Method and apparatus for controlling cross contamination of microfluid channels", US 6,994,826 (2006), Hasselbrink, Jr., E. F., Rehm, J. E., Paul, P. H., Arnold, D. W.

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"Passive injection control for microfluidic systems", US 6,833,068 (2004), Paul, P. H., Arnold, D. W., Neyer, D. W.

"Flowmeter for pressure-driven chromatography systems", US 6,532,802 (2003), Paul, P. H., Arnold, D. W.

"Electrokinetic high pressure hydraulic system", US 6,572,749 (2003), Paul, P. H., Rakestraw, D. J., Arnold, D. W., Hencken, K. R., Schoeniger, J. S., Neyer, D. W.

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"Method for eliminating gas blocking in electrokinetic pumping systems" US 6,287,440 (2001), Arnold, D. W., Paul, P. H., Schoeniger, J. S.

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Several other applications in process that have not yet published.