Carl Myerholtz, Ph.D.
Research Executive

CURRICULUM VITAE

Education

- **Ph.D. Analytical Chemistry**, Michigan State University,

  "Developments in Triple Quadrupole Mass Spectrometry.
  I. A Distributed Processing Control System
  II. Screening Applications for Fuel Analysis"

- **M.S. Analytical Chemistry**, Michigan State University,

  "A Versatile Control System for a Triple Quadrupole Mass Spectrometer"

- **B.S. Chemistry**, Purdue University

Strengths

- 30 years industrial research management experience with teams sizes up to 50 and budgets of $15M.
- Demonstrated record of transferring innovative technologies that are successfully commercialized with significant business impact across multiple product lines.
- Knowledge of a broad range of technologies related to chemical analysis.
- Extensive change management experience, both restructuring and initiating new programs.
- Managing across diverse geographies.
- Expertise in making connections across technologies and disciplines.
- Excellent communication and presentation skills that engage the audience in a future vision.
- Partnering across industrial, academic and government organizations.
- Organizing, motivating and inspiring scientific researchers.
- Track record of identifying, recruiting and retaining top talent.
- Working across diverse organizations effectively with minimal structural authority.
- Experience mentoring, developing and leading first and second level managers.
- Direct experience with all aspects of scientific instrument development including: theory, mechanical design, electronics design, firmware and software development.
- Intellectual Property generation and management
- Ability to leverage government funding sources to support internal research programs.

Key Contributions

- Initiated and/or managed research programs contributing to $125M in incremental revenue impacting businesses generating >$600M annually.
- Pioneered the development and adoption of Time-of-Flight (TOF) mass spectrometry technology within HP/Agilent, transferred to the product division generating greater than $80M in annual revenues with continuing strong growth.
- Founded a China based research arm by recruiting and establishing a new Agilent Labs research team of seven in Shanghai.
- Successful change management, maintaining team focus, effectiveness and morale during multiple work force management (WFM) and restructuring cycles.
- Principle Investigator for the DARPA Panoptic Analysis of Chemical Traces (PACT) program. Completed the two-year $7M Phase I program and was selected as sole performer for 1.5 year $4M Phase II program.
- Sponsored the metabolomics program at Agilent Labs, which after transfer to the product division has grown to greater than $10M in annual revenues with continuing strong growth.
- Defined a Pathology Workflow Automation program and an equity investment opportunity.
- Restructured AFM research program and leadership resulting in a two-year reduction in time to transfer and a 100X performance improvement.
- Mentored and promoted several staff members to various levels of management positions.

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Research Management

My primary role is research management. Initiating and managing internal programs, commercializing new technology, developing and funding external research relationships and intellectual property generation and management.

Research Programs

I have initiated and/or managed a diverse array of research programs focused on measurement science. These programs have ranged from one to 20 years in duration with a typical duration of seven years. I have staffed the programs with teams of scientists and engineers ranging from one to 15 members spanning the disciplines of chemistry, physics, biology, electrical engineering, mechanical engineering and computer science. The more significant of these programs include:

- Mass Spectrometry Systems including GCMS, LCMS and ICPMS
- Nuclear Magnetic Resonance (NMR) probe and magnet design
- Pathology Automation, digital pathology and workflow automation
- Fluidic System, polymer and metal microfluidics
- Gas Chromatography Systems
- Atomic Force Microscopy (AFM)
- Molecular Spectroscopy, IR, NIR and UV/Vis
- Plasma Technology
- Computational Biology
- Proteomics
- Nanopore DNA sequencing
- Acoustic Biosensors
- Fiber optic sensors
- Silicon MEMS devices

Technology Commercialization

Technologies from many of the programs I managed have been successfully commercialized. They are currently responsible for over $125M in incremental revenue, impacting businesses generating well over $600M annually. These technologies include:

- High Accuracy LC-QTOF Platform 2023
- High resolution LC-QTOF Platform 2019
- High resolution GC-QTOF Platform 2017
- AdvanceBio LC-QTOF Platform 2017
- High speed Atomic Force Microscopy (AFM), 2015
- High Voltage Pulser Technology, 2013
- World's first commercial GC-QTOF, 2011
- Transportable GC-MS platform, 2011
- Ion Funnel for Mass Spec sensitivity improvement, 2010
- High performance Time-of-Flight MS data acquisition system, 2007
- LC-QTOF platform, 2005
- LC-TOF platform, 2003
- ORCA - Optimized Robot for Chemical Analysis, 1993
- Barcode sample tracking system, 1988

Organizational Development

Organizational Growth

Throughout my career, I have directly led or supervised the hiring of over 50 staff and management positions. A majority of the positions were for scientists and engineers, nearly evenly distributed between domain experts with 20 years of experience, mid-career and recent graduates. In addition, I have recruited a number of support staff such as administrative assistants and research technicians. I revitalized the Engineering Services organization with new staffing, equipment, and capabilities including 3D printing.

As a Laboratory Director, I managed a large hiring surge of 18 positions within one year. This expansion was a result of Agilent's acquisition of Varian Instruments and not only included expansion of existing programs but the creation of several new programs where we had no existing expertise.

I established a new Agilent Laboratories research center in Shanghai, China defining initial research directions, resource needs and establishing new laboratory space. Built a new research team from the ground up, growing the team to seven members and developing a new lead manager in the process.

Talent Development

Directly grew four technical contributors into first level managers.

Mentored two managers to second level management positions. One has gone on to become one of my peers.

Transitioned a technical contributor to Agilent Research Fellow, the highest technical level in the company of which there are only three incumbents.

Sponsored the transition of three technical contributors to Master Scientist, the second highest technical level with less than 30 incumbents out of Agilent's population of more than 10,000 employees.

Promoted over a dozen engineers and scientists to Expert level.

Creating, Structuring and Refocusing Programs

Merged three separate technology and product generation teams into one integrated team. Cancelled two programs to focus resources and speed development of larger opportunities. Initiated a harmonization program to reduce product cost, time-to-market risks and product support complexity. This delivered a 2% GM improvement in 2017. Developed a modular architecture strategy to enable diversification of product lines without additional resources.

Refocused the Fluidics team onto programs more aligned with the strategic interests of the LC product line. Recruited a new Fluidics systems manager to bring a wider range of expertise and opportunities into Agilent. Transformed the UV/VIS flow cell program from having little business value to a program the business unit wanted to assume ownership of by realigning focus to address relevant business needs in under a year.

Created a new program in Pathology Workflow Automation and defined three opportunity vectors. Aligned and validated these opportunities with the Dako diagnostics team.

Established a new research program in Magnetic Resonance technology. Recruited a Project Manager and a new team of five researchers.

Initiated new research programs in Optical Spectroscopy justifying the expansion of the staff by five positions.

Assumed responsibility for the AFM program, restructured the program into two components to enable more focus on nearer term contributions. Replaced the manager of the program to provide stronger leadership, focus and engagement with the product division. This led to a two-year reduction in time-to-transfer and enabled the development of a 100X performance improvement.

Managed a major restructuring of the Molecular Systems Department, work force management (WFM) and a site relocation during which I was able to retain all staff members for a minimum of 12 months following the relocation.

Assumed responsibility for the Systems Biology program, transforming it into the Computational Biology program and focused on collaborations with significant outside engagement such as the Cytoscape consortium.

Managed the shutdown of the Medical Research department after Hewlett-Packard sold its medical business to Phillips.

Business Development

Multiple presentations to the CEO and innumerable presentations to other executives outlining the potential business impact of new technology developments. In addition, I have represented Agilent in numerous academic interactions and given presentations outside the company to other organizations, including the US patent office.

Performed patent portfolio analysis of several potential acquisitions.

Working closely with the financial lead for Agilent's Early Stage Partnership program – an internal venture fund:

- Identified an investment opportunity to gain access to a pathology automation technology. Assembled a proposal which resulted in the creation of a project to evaluate an equity investment for review by the CEO.
- Non-voting board member of a company Agilent invested in to provide business guidance.
- Brought a new startup in for funding consideration
- Provided technical evaluation of numerous funding opportunities

Generated multiple analysis of the LC/MS business, both internal and external views including:

- CAG vs. LSG sales channel analysis
- Historical QTOF and QQQ platform sales
- Small molecule MS applications
- Revised view of external LC/MS market size
- External view of Clinical LC/MS market and opportunity
- Sizing of the current LC-IMS-MS market

These analyses provided an important perspective to the executive leadership for guiding strategy.

In a cross functional role, I represented Agilent Laboratories as a member of the Life Science Product Solutions (LSPS) staff, a business unit with $1B in revenues, to assist in aligning the business strategy and issues with technology opportunities and investments.

Partnered with Pacific Northwest Laboratories to commercialize Ion Funnel technology. Transferred the Ion Funnel technology to Life Science Group in 2009, enabling the introduction of the 6490 LC-QQQ system in 2010. The same technology was leveraged into the 6550 LC-QTOF system introduced in 2011.

Led the Blue Ocean Platform Growth Opportunity segment of the Blue Ocean project to reinvigorate the gas chromatography business. Leading to major new product development initiative.

In a cross functional role, I represented Agilent Laboratories as a member of the Gas Phase Division (GPD), a business unit with $600M in revenues, to assist in aligning the business strategy and issues with technology opportunities and investments.

Contributed to a corporate wide internal strategy workshop to identify areas for technology innovation in DNA sequencing.

Supported Agilent's strategic objective to expand our presence in Brazil, worked with University Relations to evaluate programs proposed through the São Paulo Research Foundation (FAPESP) which are funded jointly by Agilent and the Brazilian government. Participated in the proposal review process and sponsored a funded proposal to place a LC/MS system at the University of Campinas with Professor Reyes and a GC/MS system at the University of São Paulo while acting as the Agilent mentor to both Professors on an ongoing basis.

Professional Experience

Associate Vice President, Mass Spectrometry Division, Agilent Technologies, Santa Clara, CA 2022-Present

AVP for MS External Research & Emerging Technologies within the Mass Spectrometry Division. Responsible for establishing and leading extremal MS technology and research collaborations, establishing and leading an external MS Scientific Advisory Board, leading IP management and competitive IP landscaping, representing MSD MS in the external scientific community, and establishing and leading a MS technology research team.

Associate Vice President, Mass Spectrometry Division, Agilent Technologies, Santa Clara, CA 2014-2022

AVP of Time-of-Flight and LCMS Ion Source Technology within the Mass Spectrometry Division. Responsible for leading the cross functional team spanning R&D, Marketing, Order Fulfillment and Support to drive growth of Agilent's Time-of-Flight Mass Spectrometry portfolio through the development of differentiated technologies and processes. Managing a team of 30 product developers including three managers as well as the six-member Research Services support team. Annual budget $10M-$12M.

Senior Director, Agilent Laboratories, Agilent Technologies, Santa Clara, CA 2013-2014

Director of the Life Science and Pathology Instrumentation Laboratory within Agilent Laboratories. Responsible for instrumentation technologies for Life Science and Pathology applications. Managed programs in Mass Spectrometry technology, Fluidic systems, NMR technology and Pathology Workflow Automation. Led a team of 46 researchers including a permanent staff of 36, 10 temporary employees, and four managers. Responsible for developing a strategic technology vision, budget management, presentations to senior management, developing alignment with business unit technology and market needs, staffing and coordination of a diverse patent portfolio. Annual budget $13M-$15M.

Senior Director, Agilent Laboratories, Agilent Technologies, Santa Clara, CA 2007-2013

Director of the Molecular Detection Laboratory within Agilent Laboratories. Responsible for spectroscopic and detection technologies for chemical and biological analysis. Managed programs in Mass Spectrometry technology, Atomic and Molecular spectroscopy, Atomic Force Microscopy and Gas Phase Measurements. Led a team of 48 researchers including a permanent staff of 39, 10 temporary employees, and three managers spread across two geographies (USA, China). Also managed programs in Plasma technology and NMR technology. Annual budget $13M-$15M.

Department Manager, Agilent Laboratories, Santa Clara, CA 1999-2006

Manager of the Molecular Systems Department within the Molecular Technologies Laboratory. Responsible for spectroscopic and detection technologies for chemical analysis. Managed programs in Mass Spec technology, Intact Protein Separations, Systems Biology, Micro-plasmas and Out of Lab Measurements with a staff of 20. Also managed programs in Microfluidics, High Speed DNA Sequencing and Proteomics systems with a staff ranging from 14 – 27 members and one to four project managers. Annual budget $6M-$8M.

Project Manager, Hewlett-Packard Laboratories, Palo Alto, CA 1989-1999

Led a mass spectrometry technology development team of eight engineers and scientists. Championed the adoption of Time-of-Flight Mass Spectrometer technology within HP/Agilent. Established a foundation for TOFMS technology within the company including key development tools, 200MHz data acquisition system, TOFAcquire and TOFVolts. Contributed technology to the ESI-TOF and Q-TOF products. Led investigations into the potential of ICP/TOF configurations. Initiated research into micro machining applications for analytical instrumentation. Hired key staff members for MEMS program. Led two sensor investigations with a team of five researchers; one on fiber optic based sensors for fermentation monitoring, the second on antibody based sensors using STW devices

Member of Technical Staff, Hewlett-Packard Labs, Palo Alto, CA 1983-1989

Transferred robotics technology to the Avondale Division which was introduced as the ORCA robot, which until recently was still being manufactured and sold by Beckman Coulter Inc. Designed and developed all of the servo and communications electronics and software for the laboratory robot system as well as the system control processor.

Transferred bar code technology to the Avondale division which became the G1926A Bar Code Reader. Developed electronics and software for a portable/laboratory bar-code sampling tracking system and a 2 ml vial printing and reading system.

Summer Intern, Standard Oil of Indiana, Naperville, IL 1978,1979

Developed Hydrocarbon Compound Type analysis, Reverse Library Search Tools and elementary expert systems software to interpret mass spectrometric data. Also developed software to support x-ray diffraction measurements.

Student Programmer, Audiology Department, Purdue University 1978,1979

Developed software to record, analyze and display acoustic signals to support audiology research.

Summer Intern, Argonne National Laboratory, Argonne IL 1975,1976,1977

Developed software to collect, analyze and display data from gamma ray counting systems.

External Funding:

A major "out of the box" activity has been the engagement in acquiring extramural funding, which is extremely unusual within Agilent's commercial business model.

Principle Investigator $11M Panoptic Analysis of Chemical Traces program funded by DARPA.

- Authored a DARPA PACT proposal integrating several internal programs into a program aligned with DARPA's goals. The total program proposal spanned three phases and five years. Funding from DARPA significantly accelerated these programs that were already part of Agilent Laboratories strategy.
- The proposal was one of only two out of the 17 submissions that were selected for Phase I funding ($6.8M).
- Completed a contract with DARPA to secure phase I funding. The same contract allowed Agilent to flow into phases II and III without renegotiating the contract. Total program funding for all three phases was planned to be $19.8M over five years.
- Completed all Phase I milestones early or on time. Received full $6.8M in payment.
- Created a vision of a solution that enabled DARPA to down select to Agilent as the sole participant moving into the Phase II program. Worked closely with DARPA to redefine the Phase II goals to align with DARPA's changing budget situation. Executed a contract for a $4M Phase II program with an 18 month duration.

Principle Investigator $1M HSARPA grant for the Autonomous Remote Facility Chemical Agent Monitor (ARFCAM) program.

- A $930,000 phase I research grant by the US Department of Homeland Security Advanced Research Projects Agency (HSARPA). The purpose of the award was to assist in the research and development of a next-generation chemical agent detection system.
- Agilent was among 40 organizations selected for this award from more than 126 proposals submitted to HSARPA.
- As part of this award, Agilent contributed to the first phase of projects related to the development of an Autonomous Rapid Facility Chemical Agent Monitor (ARFCAM). ARFCAM was designed to provide

continuous, autonomous monitoring of enclosed areas, such as government buildings and transportation facilities, for chemical warfare agents and toxic industrial compounds (TIC).

Sponsored Research: Multi-Year Programs

I have developed and/or managed five multi-year sponsored research programs with several academic institutions, all at greater than the $100,000 level. These programs were directly funded by our Laboratory budget. The program durations ranged from two to five years.

Research Project	*University*	*Country*	*Professor*
Immunohistochemical Panel Optimization comparing Multiplexed Ion-beam Imaging (MIBI) Technology	California, U of, Davis	USA	Richard Levenson
Toward a uGCxuGC with Advanced MicroscaleThermal Moducation	Michigan, U of	USA	Edward Zellers
Rapid Instrumental Methodologies for High-Throughput High-Quality Separations Technologies Applied to Bio-market identifications	Monash U	Australia	Philip Marriott
Modeling of Plasma Sources for VUV Radiation and Spectroscopic Analysis	Michigan, U of	USA	Mark Kushner
Nanopore Sequencing	Harvard, U	USA	Gene Golovchenko

Sponsored Research: Seed Grants

I have sponsored over $2M in Seed Grants ranging from $10,000 to $100,000 for nearly 50 different programs. These were funded either through Agilent's University Relations grant program with my sponsorship or directly from my own Laboratory budget. Typical program duration was one year.

Research Project	*University*	*Country*	*Professor*
Dielectric Barrier Discharge Excitation Methods	Macquarie U	Australia	Rob Carman
Pixelated Detectors based on Time-resolved SPADs for TOF Mass Spectrometry	Delft, Tech U of	Netherlands	Edoardo Charbon
HPLC Electromagnetostatic ECD/CID Tandem Mass Spectrometry	Oregon State U	USA	Douglas F Barofsky
MEA and flow field optimization for PEM fuel cells	Shanghai Jiao Tong U	China	Junliang Zhang
IR Chemical Imaging	Illinois, U of	USA	Rohit Bhargava
Development of miniaturized planar ion traps	California, U of, Berkeley	USA	Hartmut Haeffner
Research on the Organic Composition of Fogs / Hazes by Comprehensive GCxGC with SPME	Fudan U	China	Xiang Li
Turbo-stabilized Fast MAS NMR probe development	Yale U	USA	Kurt Zilm
Mid-infrared frequency combs based on crystalline microresonators	Munich, U of	Germany	Nathalie Picque

Integrated ultrasonic, microfluidic HPLC-chip and MS technologies for quantitative sonoporation	Southampton, U of	UK	Martyn Hill
Molecular Identification by High-Resolution Infrared Spectroscopy	Ohio State U	USA	Terry Miller
Ultra-broadband mid-IR frequency-comb source	Stanford U	USA	Robert Byer
Veterinary drugs: development and validation of bioanalytical methods using LC-MS/MS	University of Campinas	Brazil	Felix Guillermo Reyes Reyes
Gas dynamic virtual nozzle for generation of microscopic droplet streams	Arizona State U	USA	Bruce Doak
Chemical Analysis with 2D IR Spectroscopy	MIT	USA	Andrei Tokmakoff
Cooled sorptive rod headspace extraction technique	Dalian Instit	China	Zheng Shen
Needle trap Devices Flow Modulated Comprehensive Two-Dimensional GC in Human Breath Analysis	Fudan U	China	Jianmin Chen
Ultra-broadband mid-IR frequency-comb source	Stanford U	USA	Robert Byer
Nonlinear Devices for Frequency Comb Generation	Stanford U	USA	Martin Fejer
Prospecting Volatile compounds produced by Brazilian Cyanobacteria with allelopathic effects	University of Sao Paulo	Brazil	Ernani Pinto
Steroidomics of rheumatoid arthritis and other immune diseases	Stanford U	USA	Bill Robinson
DMD-based spectrometer for time-gated Raman spectroscopy	California, U of, Davis	USA	Sebastian Wachsmann-Hogiu
Micro-scale 2-D Gas Chromatography	Michigan, U of	USA	Edward Zellers
High Resolution Infrared Spectroscopy Using Broadband Frequency Combs	Colorado, U of, Boulder	USA	Jun Ye
GC for high resolution Mid IR spectroscopy	Colorado, U of, Boulder	USA	Jun Ye
Infrared molecular detection using OPO based frequency combs	Colorado, U of, Boulder	USA	Jun Ye
Microstructured GaAs for Generating Mid-Infrared Frequency Combs	Stanford U	USA	Martin Fejer
In-vivo/in-vitro determination of food contaminants using SPME and GC-TOFMS and GCxGC-TOFMS	Waterloo, U of	Canada	Janusz Pawliszyn
Novel SPME and portable SPME sampler for onsite environmental sample analysis	Nanjing U	China	Cheng Sun
A femtosecond OPO-based IR optical frequency comb for ultrasensitive molecular trace detections	Colorado, U of, Boulder	USA	Jun Ye
A new strategy for investigating effect of compounds in protein-protein network	Fudan U	China	Wei Fu

A Tandem DMA System for Secondary Aerosol Studies	Fudan U	China	Jianmin Chen
A High-Precision Optical Trap	California, U of, Berkeley	USA	Luke Lee
Fundamental Processes in Split-Ring Resonator Microplasmas	Tufts U	USA	Jeffrey Hopwood
TEM of Positional Resonant Tunneling Spectroscopy	Maryland, U of	USA	John Cumings
A novel SPME coupled for the detection of micro-components in food samples	Nanjing U	China	Cheng Sun
Location Constrained Graph Layout Algorithms	British Columbia, U of	Canada	Tamara Munzner
Lossless Compression of Proteomic MS Data	Washington, U of	USA	John Keane
High resolution miniature ion mobility spectrometer	Washington State U	USA	Herbert Hill
MEMS Integrated Sampler-Injector (MISI)	Michigan, U of	USA	Edward Zellers
Stress Response Metabolism in Chlamydomonas	California, U of, Davis	USA	Oliver Fiehn
Visualizing Biological Networks and Multiple Data Types with a Biologist's Eye	Gladstone Instit	USA	Bruce Conklin
Mass Spectrometry Characterization of Immune Complexes	Stanford U	USA	Bill Robinson
Atomic scale analysis of DNA bases for application to Resonant Quantum Tunneling Detection	Stanford U	USA	Charles Musgrave
Design and Characterization of Microplasmas for Analytical Instrumentation Applications	Tufts U	USA	Jeffrey Hopwood
Low Pressure Electrospry Ionization for Biomolecules	Fudan U	China	Pengyuan Yang
Air sampling techniques and photo-ionization detector for portable GC	Fudan U	China	Xiangmin Zhang
Atomic scale calculation of DNA base structure for application to Resonant Quantum Tunneling detection	Stanford U	USA	Charles Musgrave
Integrated sample extraction, identification, quantification	California, U of, Davis	USA	Oliver Fiehn
Investigations into metal binding to human albumin by HPLC-ICPMS	Stanford U	USA	Bill Robinson

Sponsored Research: Research Centers

To foster closer ties to academia I have sponsored Agilent's membership in a number of National Science Foundation established research centers. My involvement has ranged from approving joining the center and the staff engagement and travel necessary to benefit from membership, providing the funding from my budget, to serving on the Industrial Advisory boards at WIMS and CPAC, and serving as Chairman of the IAB at CPAC. These research centers include:

- CPAC -Center for Process Analytical Chemistry, University of Washington
- WIMS2 - Wireless Integrated Micro Systems and Sensors, University of Michigan
- MIRTHE - Mid IR Technology for Health and Environment, Princeton University
- CBST - Center for Biophotonics Science and Technology, UC Davis
- EUVERC - Extreme Ultraviolet Engineering Research Center, UC Boulder

Intellectual Property Generation:

The research programs I have been responsible for have generated over 120 issued US patents, with numerous foreign counterparts and at least a dozen applications still in process. As an intellectual property coordinator, I am responsible for reviewing invention disclosures, determining which inventions to apply for a patent, which countries to file applications in and approval of annuity payment to maintain and manage a portfolio of over 600 US and Foreign patents and applications.

Issued US Patents: Inventor or Co-Inventor

I am the inventor or co-inventor on 23 issued US Patents with numerous foreign counterparts and four active US applications covering a wide range of technologies including: sample tracking, robotics, pH dyes, GC systems and Mass Spectrometry.

8,490,466	Capsule injection system for gas chromatography
7,488,607	Electronically readable microarray with electronic addressing
7,423,259	Mass spectrometer and method for enhancing dynamic range
7,347,912	Apparatus and method for threading a biopolymer
6,700,118	Thermal drift compensation to mass calibration in TOFMS
6,586,232	Substrate preparation for chemical-species-specific binding
6,497,138	Multilayered gas chromatograph
6,455,845	Ion packet generation for mass spectrometer
6,242,735	Power-modulated inductively coupled plasma spectrometry
6,235,488	Surface preparation for chemical-specific binding
6,222,186	Power-modulated inductively coupled plasma spectrometry
5,672,870	Mass selective notch filter with quadrupole excision fields
5,661,300	Charged particle mirror
5,598,001	Mass selective multinotch filter with orthogonal excision
5,462,991	Immobilization of pH-sensitive dyes to solid supports
5,396,065	Sequencing ion packets for ion time-of-flight MS
5,384,411	Immobilization of PH-sensitive dyes to solid supports
5,306,644	Mass sensor method for measuring analytes in a sample
5,229,301	Mass biosensor method with quantified sensor renewal
5,130,631	Robot bus architecture with distributed electronics
5,130,257	Chemical sensor utilizing a surface transverse wave device
4,855,909	Forensic sample tracking system and print station therefor
4,333,336	Apparatus for computing flow rate of thermoplastic material

Issued US Patents (PI, non-inventor): Mass Spectrometry Program

In addition to the patents where I am an inventor, the mass spectrometry program I managed has generated nearly 60 issued US patents. Company and Patent office policy prevents my inclusion as inventor, however, all these inventions were developed in programs under my direction. These are the industrial equivalent of "peer-reviewed" publications from a PI's research program, as patents are extensively reviewed internally by Agilent technical staff and management as well as externally by the patent office before being issued.

8,859,961	Radio frequency (RF) ion guide for improved performance in mass spectrometers
8,841,611	Multi-capillary column and high-capacity ionization interface for GC-MS
8,642,951	Device, system, and method for reflecting ions
8,431,887	Central lens for cylindrical geometry time-of-flight mass spectrometer
8,330,099	Mass spectrometer and mass analyzer comprising pulser
8,237,108	Mass spectral analysis of complex samples containing large molecules
8,080,782	Dithered multi-pulsing time-of-flight mass spectrometer
7,989,765	Method and apparatus for trapping ions
7,977,626	Time of flight mass spectrometry method and apparatus
7,939,798	Tandem ionizer ion source for mass spectrometer and method of use
7,919,748	Cylindrical geometry time-of-flight mass spectrometer
7,908,093	Mass spectrometer and method for enhancing resolution of mass spectra
7,863,556	Enhanced resolution mass spectrometer and mass spectrometry method
7,608,817	Adiabatically-tuned linear ion trap with Fourier transform mass spectrometry with reduced packet coalescence
7,755,040	Mass spectrometer and electric field source for mass spectrometer
7,723,680	Electron multiplier having electron filtering
7,684,932	Systems and methods for dynamically adjusting sampling rates of mass
7,619,213	Ion extraction pulser and method for mass spectrometry
7,557,343	Segmented rod multipole as ion processing cell
7,473,893	ICP/ESI mass spectrometry systems and methods of use thereof
7,450,042	Mass spectrometer and method for compensating sampling errors
7,449,687	Methods and compositions for combining ions and charged particles
7,423,259	Mass spectrometer and method for enhancing dynamic range
7,412,334	Mass spectrometer and method for enhancing resolution of mass spectra
7,397,027	Multi-channel high-field asymmetric waveform ion mobility spectrometry
7,388,193	Time-of-flight spectrometer with orthogonal pulsed ion detection
7,372,042	Lens device for introducing a second ion beam into a primary ion path
7,372,024	Two dimensional ion traps with improved ion isolation and method of use
7,372,022	Multipath data acquisition system and method
7,312,442	Enhanced gradient multipole collision cell for higher duty cycle
7,279,681	Ion trap with built-in field-modifying electrodes and method of operation
7,208,726	Ion trap mass spectrometer with scanning delay ion extraction
7,204,431	Electrospray ion source for mass spectroscopy
7,105,807	Multi dynode device and hybrid detector apparatus for mass spectrometry
6,967,073	Bottom antireflection coating color filter process for fabricating solid state image
6,858,839	Ion optics for mass spectrometers
6,822,227	Time-of-flight mass spectrometry utilizing finite impulse response filters
6,759,651	Ion guides for mass spectrometry
6,747,274	High throughput mass spectrometer with laser desorption ionization ion source
6,744,044	Time-of-flight mass spectrometry utilizing a split memory
6,727,495	Ion mobility spectrometer with high ion transmission efficiency
6,717,135	Ion mirror for time-of-flight mass spectrometer
6,717,133	Grating pattern and arrangement for mass spectrometers
6,700,118	Thermal drift compensation to mass calibration in time-of-flight mass
6,680,476	Summed time-of-flight mass spectrometry utilizing thresholding to reduce noise

6,642,516	Apparatus and method of laser dissociation for mass spectrometry
6,639,217	In-line matrix assisted laser desorption/ionization mass spectrometry
6,627,874	Pressure measurement using ion beam current in a mass spectrometer
6,617,768	Multi dynode device and hybrid detector apparatus for mass spectrometry
6,593,570	Ion optic components for mass spectrometers
6,570,153	Tandem mass spectrometry using a single quadrupole mass analyzer
6,469,296	Ion acceleration apparatus and method
6,462,337	Mass spectrometer electrospray ionization
6,455,845	Ion packet generation for mass spectrometer
6,369,384	Time-of-flight mass spectrometer with post-deflector filter assembly
6,242,735	Power-modulated inductively coupled plasma spectrometry
6,222,186	Power-modulated inductively coupled plasma spectrometry
5,672,870	Mass selective notch filter with quadrupole excision fields
5,661,300	Charged particle mirror
5,598,001	Mass selective multinotch filter with orthogonal excision fields

Issued US Patents (PI, non-inventor): Other Programs

Outside of the very strong mass spectrometry program, nearly 50 additional patents have been issued in a diverse range of technology areas from the other program areas I managed.

8,907,433	Thin film with improved temperature range
8,736,174	Plasma generation device with split-ring resonator and electrode extensions
8,563,237	Biopolymer resonant tunneling with a gate voltage source
8,507,285	Methods and devices for identifying biopolymers using mass spectroscopy
8,313,236	Thermal conductivity detector
8,291,510	Tandem piezoelectric actuator and single drive circuit for atomic force microscopy
8,217,343	Device and method using microplasma array for ionizing samples for mass spectrometry
8,136,389	Probe tip assembly for scanning probe microscopes
8,099,995	Choked flow isolator for noise reduction in analytical systems
8,063,639	Dual-use NMR probe
7,919,308	Form in place gaskets for assays
7,867,782	Nanoscale moiety placement methods
7,855,358	Method and an ion source for obtaining ions of an analyte
7,812,307	Microplasma-based sample ionizing device and methods of use thereof
7,553,730	Methods of fabrication employing nanoscale mandrels
7,537,936	Method of testing multiple fluid samples with multiple biopolymer arrays
7,531,795	Scanning microscopy using resonant quantum tunneling
7,531,303	Interrogating multi-featured arrays
7,410,564	Apparatus and method for biopolymer identification during translocation through a nanopore
7,397,560	Surface contamination detection
7,371,348	Multiple array format
7,365,852	Methods and systems for selecting pathlength in absorbance measurements
7,351,379	Fluid containment structure
7,347,921	Apparatus and method for threading a biopolymer through a nanopore
7,282,130	Apparatus and method for control of biopolymer translocation through a nanopore
7,275,562	Extensible spiral for flex circuit
7,250,115	Nanopore with resonant tunneling electrodes
7,146,030	System and methods for extracting semantics from images
7,138,672	Apparatus and method for making a tensile diaphragm with an insert
7,114,378	Planar resonant tunneling sensor and method of fabricating and using the same
7,075,161	Apparatus and method for making a low capacitance artificial nanopore
7,026,124	Method and multiple reservoir apparatus for fabrication of biomolecular arrays
6,998,850	Systems and methods for measuring picoampere current levels

6,846,702	Nanopore chip with N-type semiconductor
6,843,281	Methods and apparatus for introducing liquids into microfluidic chambers
6,789,965	Dot printer with off-axis loading
6,723,516	Method for continuously detecting the presence of analytes in a flowing liquid stream
6,706,203	Adjustable nanopore, nanotome, and nanotweezer
5,644,131	Hyperbolic ion trap and associated methods of manufacture
5,387,833	Method and device for separating acoustic wave-generated energy from directly coupled electromagnetic interference
5,333,831	High performance micromachined valve orifice and seat
5,321,331	Double-sided fluid sensor for reduced attenuation of shear transverse waves
5,283,037	Chemical sensor utilizing a surface transverse wave device
5,216,312	Fluid sensing device having reduced attenuation of shear transverse waves
5,130,257	Chemical sensor utilizing a surface transverse wave device
5,058,856	Thermally-actuated microminiature valve

Publications & Presentations from my research portfolio:

Industrial Research Laboratories focus their efforts on technologies 3-10 years in the future. Since the research directions are focused along the lines of long-term corporate strategy, a large volume of the work done in Industrial Research Laboratories is never published to avoid telegraphing our strategy and aiding our competitors. This is an unfortunate loss for the scientific community because a tremendous amount of high-quality research is never made public. Despite these restrictions, especially for the area of instrumentation technology development, my research team has generated a number of public papers and presentations. It is not my habit to attach my name to all work done under my direction. The papers listed below are all from researchers working on programs I initiated and in areas I directed them to pursue.

1. Lopez-Avila, V; and Zorio, M. "Identification of Methylhexaneamine by GC High-resolution TOFMS and Soft Ionization." *Forensic Science International* 231, April, 2013: 113–119.
2. Souza-Silva, ÉA; Lopez-Avila, V; Pawliszyn, J. “Fast and Robust Direct Immersion Solid Phase Microextraction Coupled with Gas Chromatography–time-of-flight Mass Spectrometry Method Employing a Matrix Compatible Fiber for Determination of Triazole Fungicides in Fruits.” *J. Chromatogr., A,* 1313, July 2013: 139-146.
3. Lopez-Avila, V; Cooley, J; Urdahl, R; and Thevis, M. “Determination of Stimulants Using Gas Chromatography/High-Resolution Time-of-Flight Mass Spectrometry and a Soft Ionization Source.” *Rapid Commun Mass Spectrom.* 26 (23), Oct. 15, 2012: 2714-2724. DOI: 10.1002/rcm.6398.
4. Lopez-Avila, V; Gao, W; and Urdahl, R. "Mass Spectral Fragmentation of Cathinones by High-Resolution TOFMS Using a Soft Ionization Source." *J Pharm Sci Innov* 1(6), Nov-Dec 2012: 44-53.
5. Xue, J; Urdahl, RS; and Cooley, JE. “Plasma Resonances in a Microwave-Driven Microdischarge.” *Appl. Phys. Lett.* 100 (6) Feb. 6, 2012: 064102. DOI:10.1063/1.3681146.
6. Xue, J; Cooley, JE; and Urdahl, RS. “Density of Metastable Atoms in the Plume of a Low-Pressure Argon Microplasma.” *J. Phys. D: Appl. Phys.* 45 (36), Aug. 21, 2012: 365201 (8pp). DOI:10.1088/0022-3727/45/36/365201.
7. Lopez-Avila, V; and Yefchak, G. "Mass Spectral Fragmentation Studies of Coumarin-Type Compounds Using GC High-Resolution MS." *The Open Analytical Chemistry Journal* (5), August 31, 2011: 27-36.
8. Butterworth, J; Pao, L; and Abramovitch, D. "Adaptive-Delay Combined Feedforward/Feedback Control for Raster Tracking with Applications to AFMs." *Proceedings of the 2010 American Control Conference*, June 2010: 5738 – 5744.
9. Abramovitch, DY; and Franklin, GF. "Fifty-Five Years in Control: The Story of the CSS.” *Proceedings of IEEE Conference on the History of Technical Societies* , 2009: 1 – 17.

10. Abramovitch, DY; Hoen, S; and Workman, R. "Semi-automatic Tuning of PID Gains for Atomic Force Microscopes." *Asian Journal of Control* 11 (2) March 2009: 188–195.

11. Butterworth, JA; Pao, LY; and Abramovitch, DY. "A Comparison of Control Architectures for Atomic Force Microscopes." *Asian Journal of Control* 11 (2), March 2009: 175 - 181.

12. Lopez-Avila, V; Robinson, WH; and Lokits, K. "Ceruloplasmin Levels in Human Sera from Various Diseases and Their Correlation with Patient's Age and Gender." *Health* 1 (2), Sept. 2009: 104-110. DOI:10.4236/health.2009.12017.

13. Lopez-Avila, V; and Yefchak, G. "Identification of Compounds in Commercial Kava Extracts by Gas Chromatography with Electron Ionization High-Resolution Mass Spectrometry." *The Open Analytical Chemistry Journal* 3, 2009: 22-31. DOI:10.2174/1874065000903010022

14. Williams, P. "Simulation of Ion Transport from Atmospheric Pressure to Vacuum", Presented at the 57th ASMS Conference on Mass Spectrometry and Allied Topics, Philadelphia, PA., June 2, 2009

15. Abramovitch, D. "A Tale of Three Actuators: How Mechanics, Business Models and Position Sensing Affect Different Mechatronic Servo Problems." *Proceedings of the American Control Conference,* June 2009: 3358 – 3371.

16. Abramovitch, DY; and Franklin, GF. "Fifty-Five Years in Control: The Story of the CSS." *Proceedings of IEEE Conference on the History of Technical Societies* , 2009: 1 – 17.

17. Abramovitch, DY; Hoen, S; and Workman, R. "Semi-automatic Tuning of PID Gains for Atomic Force Microscopes." *Asian Journal of Control* 11 (2) March 2009: 188–195.

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20. Abramovitch, DY. " Efficient and Flexible Simulation of Phase Locked Loops, Part II: Post Processing and a Design Example." *Proceedings of the American Control Conference*, June 2008. 4678 – 4683.

21. Abramovitch, DY; Hoen, S; and Workman, R. "Semi-automatic Tuning of PID Gains for Atomic Force Microscopes." *Proceedings of 2008 American Control Conference*, June 2008: 2684 – 2689.

22. Lopez-Avila, V; and Spencer, JV. "Methods for Detection of Matrix Metalloproteinases as Biomarkers in Cardiovascular Disease." *Clinical Medicine: Cardiology* 2, 2008:1–14.

23. Lopez-Avila, V; Sharpe, O; and Robinson, W. "Determination of Ceruloplasmin in Human Serum by SEC-ICPMS." *Analytical and Bioanalytical Chemistry* 386 (1), Sept. 2006: 180-188. DOI 10.1007/s00216-006-0528-9.

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27. Kuchinsky, A; Graham, K; Moh, D; Creech, M; Babaria, K; and Adler, A. "Biological Storytelling: A Software Tool for Biological Information Organization Based on Narrative Structure, " *Proceedings of AVI: International Working Conference on Advanced Visual Interfaces* Trento, Italy, May 22-24, 2002.

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1. “A Versatile Software Control System for A triple Quadrupole Mass Spectrometer”, Instruments & Computers, 3(2), 11 (1986)
2. “FORTH for a Multimicroprocessor Control System”, Instruments & Computers, 3(2), 13 (1986)
3. “Data acquisition and instrument control system for ion flight time measurements in mass spectrometry”, Rev. Sci. Instrum., 56(12), 2267 (1985)
4. “Intelligent multichannel data-acquisition system for pulsed laser applications”, Rev. Sci. Instrum. 55, 204 (1984)

Recent Presentations

1. Myerholtz, C, Chen, K, Neito, S, Sanderson, J, Hidalgo, A (2017 August) “Characterization of Contaminants in food and environmental matrices using a novel high resolution GC-QTOF platform incorporating a low-energy capable EI source and Digital Oscilloscope technoloy”, Royal Australian Chemical Institute Conference, Melbourne Australia

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  http://about.keysight.com/en/companyinfo/labs/

Hewlett-Packard/Agilent/Keysight Historical Perspective:

Hewlett- Packard was one of the companies that founded Silicon Valley and drove much of the Management Culture in this area from its origins in 1939 till 1999 when it had $50B in revenues. HP started in electronic measurement, diversified to semiconductors, medical and chemical measurements, and went on to grow in to a computer and printing giant. In 1999, Agilent split from HP taking all of the measurement and semiconductor businesses to form a new $11B company, the largest IPO in Silicon Valley history. Agilent sold the medical products business to Philips in 2000 and then spun out the semiconductor business to form Avago in 2005 with $1.5B in revenues, leaving Agilent as a $6B measurement technology company focused on Electronic and Life Science & Chemical analysis measurements. In 2014 Agilent spun out the electronic measurement business to form Keysight Technologies with $3B in revenues. By 2020 Agilent has become a $5.3B company with over 16,000 employees focused on Life Science & Chemical Analysis Measurements and Diagnostics & Genomics.

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- Engineering Management Program, Krannert School of Business, Purdue University. Completed modules on:
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