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## Highlights of Qualifications

- Highly inquisitive, creative, and resourceful
- Excellent skills in communication and collaboration
- Trained and skilled in proteomics and protein biochemistry

## Relevant Skills and Accomplishments

- Expertise in Mass Spectrometry analysis on small molecules, peptides, and intact proteins.
- Broad range of experience; yeast genetics, mouse genetics, cell biology, protein biochemistry, proteomics, and bioinformatics.
- Hands-on experience on analyzing and interpreting microarray, proteomics, and RNASeq data.

## Education

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| 1999-2004 | Ph. D. Chemistry and Biochemistry, December, 2004<br>University of Colorado, Boulder, CO |
| 1995-1999 | B.S. Biochemistry, February 1999<br>Yonsei University, Seoul, Korea                      |

## Professional Training and Experience

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|-------------------|---|
| Mar 2017-present  | <b>Director</b> , Central Analytical Mass Spectrometry Laboratory, University of Colorado, Boulder, CO<br>Highlights: Managing the Facility to serve scientific communities by providing high quality mass spectrometry analysis on small molecules, peptides, and proteins |
| Sep 2014-Feb 2017 | <b>Senior Scientist</b> , Central Analytical Mass Spectrometry Laboratory, University of Colorado, Boulder, CO<br>Highlights: Method development and optimization for various proteomics projects. Helping people for data analysis and interpretation.                     |
| Apr 2009-Sep 2014 | <b>Research Specialist I</b> , Howard Hughes Medical Institute, University of Colorado, Boulder, CO<br>Advisor: Dr. Natalie Ahn   |

Highlights: microRNA biology; Quantitative proteomics; Optimization of sample preparation for proteomics; Statistical and bioinformatics analysis on data from high throughput experiments; Optimization of protein expression and purification (MAP kinase) for NMR experiments

- Oct 2005-Apr 2009 **Postdoctoral Fellow**, Department of Biochemistry, University of Wisconsin, Madison, WI  
Advisor: Dr. Elizabeth Craig  
Highlights: Purification and characterization of proteins from yeast; Genetic screening
- Jan 2005-Sept 2005 **Professional Research Associate**, Department of Chemistry and Biochemistry, University of Colorado, Boulder, CO  
Advisor: Dr. Natalie Ahn  
Highlights: Utilizing isothermal calorimetry (ITC) to characterize protein-small molecule interaction
- Jan 2002-Dec 2004 **Graduate Research Assistant**, Department of Chemistry and Biochemistry, University of Colorado, Boulder, CO  
Advisor: Dr. Natalie Ahn  
Highlights: Protein-peptide interaction using hydrogen exchange and mass spectrometry (HDX); Analyzing protein-protein interaction using protein pull-down; Enzyme kinetics (MAP kinase)
- May 2000-Jan 2002 **Graduate Research Assistant**, Department of Chemistry and Biochemistry, University of Colorado, Boulder, CO  
Advisor: Dr. Jacqueline Lee  
Highlights: Primary cell culture from mice cerebellum

## Special Competencies

### Mass Spectrometry and Proteomics:

Hands-on experience with Orbitrap Velos (Thermo Fisher), ABI Qstar-Pulsar® (qTOF) Waters Synapt G2, hydrogen/deuterium exchange system, and nanoAcquity; MaxQuant and Mascot to analyze data from label-free and SILAC-based quantitative proteomics; hydrogen/deuterium exchange- mass spectrometry (HDX-MS); estimate of stoichiometry of protein phosphorylation using LC-MS analysis; Intact protein mass determination using LC-MS, peptide sequencing using LC-MS/MS; SILAC labeling of mammalian cells for quantitative proteomics, filter-aided sample preparation (FASP) for functional proteomics

### Protein Biochemistry:

Protein expression (*E. coli* and *S. cerevisiae*), purification, and characterization; FPLC (GE Healthcare) with ion-exchange and gel filtration columns; Enzyme activity measurements (protein kinases and Hsp70); Analyzing protein-protein interactions using protein pull-down (GST- or His<sub>6</sub>-tag) and co-immunoprecipitation; Analyzing protein-small molecule interactions with isothermal titration calorimetry (ITC), fluorescent anisotropy, and HDX-MS

### Molecular Biology:

DNA recombination, subcloning; PCR; site-directed and random mutagenesis; DNA isolation from *E. coli* and *S. cerevisiae*.

### **Cell Biology and Genetics:**

Mammalian cell line culture; DNA/RNA transfection; cell cycle analysis using flow cytometry; cell proliferation and viability assay to examine drug resistance; yeast gene manipulation; genetic screen for targeted genes (suppressor analysis) in *S. cerevisiae*.

### **Computer Skill:**

Python scripts to manipulate and analyze a large amount of data from functional proteomics; Python matplotlib to generate plots in publishable quality; Microsoft Word, Excel, Powerpoint; comfortable on Windows, Mac OSX, Ubuntu Linux

## **Honors and Awards**

2007-2009	Ruth L. Kirschstein Postdoctoral Fellowship, NIH
2000-2003	Molecular Genetics Training Grant, NIH
1999	University of Colorado Graduate Fellowship

## **Publications**

- **Peer-Reviewed Research Papers**

**Lee T.**, Houel S., Wang N., Coutts K., Old W., and Ahn N.G. "Synergistic effect of microRNAs on drug resistance revealed by quantitative proteomics" *In preparation*

Basken J., Stuart S.A., Kavran A.J., **Lee T.**, Ebmeier C.C., Old W., Ahn N.G. "Specificity of phosphorylation responses to MAP kinase pathway inhibitors in melanoma cells." *Mol. Cell. Proteomics*. (2017) Dec 18

Mattiroli F., Bhattacharyya S., Dyer P.N., White A.E., Sandman K., Burkhart B.W., Byrne K.R., **Lee T.**, Ahn N.G., Santangelo T.J., Reeve J.N., Luger K. "Structure of histone-based chromatin in Archaea." *Science*. (2017) 357(6351):609-612.

Audetat K.A., Galbraith M.D., Odell A.T., **Lee T.**, Pandey A., Espinosa J.M., Dowell R.D., Taatjes D.J. "A Kinase-Independent Role for Cyclin-Dependent Kinase 19 in p53 Response." *Mol Cell Biol*. (2017) 37(13).

Liang L., Liu R, Garst A.D., **Lee T.**, Nogué V.S., Beckham G.T., Gill R.T. "CRISPR Enabled Trackable genome Engineering for isopropanol production in Escherichia coli." *Metab Eng*. (2017) 16:41:1-10.

Poss Z.C., Ebmeier C.C., Odell A.T., Tangpeerachaikul A., **Lee T.**, Pelish H.E., Shair M.D., Dowell R.D., Old W.M., Taatjes D.J. "Identification of Mediator Kinase Substrates in Human Cells using Cortistatin A and Quantitative Phosphoproteomics." *Cell Report* (2016) 2;15(2):436-50

Stuart S.A., Houel S., **Lee T.**, Wang N., Old W.M., and Ahn N.G. "A Phosphoproteomic Comparison of B-RAF(V600E) and MKK1/2 Inhibitors in Melanoma Cells" *Mol Cell Proteomics*. (2015) 14(6):1599-615.

**Lee T.**, Wang N., Houel S., Coutts K., Old W. Ahn N.G. "Dose and temporal thresholds in microRNA proteomics." *Mol Cell Proteomics*. (2015) 14:289-302

Wang D., Zhang Z., O'Loughlin E., **Lee T.**, Houel S., O'Carroll D., Tarakhovskiy A., Ahn N.G., Yi R. "Quantitative functions of Argonaute proteins in mammalian development." *Genes Dev*. (2012) 26:693-704

Oyeyemi O.A., Sours K.M., **Lee T.**, Kohen A., Resing K.A., Ahn N.G., Klinman J.P. "Comparative hydrogen-deuterium exchange for a mesophilic vs thermophilic dihydrofolate reductase at 25 °C: identification of a single active site region with enhanced flexibility in the mesophilic protein." *Biochemistry*. (2011) 50:8251-8260

Ring A.Y., Sours K.M., **Lee T.**, Ahn N.G. "Distinct patterns of activation-dependent changes in conformational mobility between ERK1 and ERK2." *Int. J. Mass Spectrom.* (2011) 302:101-109.

Oyeyemi O.A., Sours K.M., **Lee T.**, Resing K.A., Ahn N.G., Klinman J.P. "Temperature dependence of protein motions in a thermophilic dihydrofolate reductase and its relationship to catalytic efficiency." *Proc. Natl. Acad. Sci.* (2010) 107:10074-10079.

Sahi C., **Lee T.**, Inada M., Pleiss J.A., Craig E.A. "Cwc23, an essential J protein critical for pre-mRNA splicing with a dispensable J domain." *Mol. Cell. Biol.* (2010) 30:33-42.

Sours K.M., Kwok S.C., Rachidi T., **Lee T.**, Ring A., Hoofnagle A.N., Resing K.A., Ahn N.G. "Hydrogen exchange mass spectrometry reveals activation-induced changes in conformational mobility of p38 $\alpha$  MAP kinase." *J. Mol. Biol.* (2008) 379:1075-1093

Emrick M.A., **Lee T.**, Starkey P.J., Mumby M.C., Resing K.A., Ahn N.G. "The gatekeeper residue controls autoactivation of ERK2 via a pathway of intramolecular connectivity." *Proc. Nat. Acad. Soc.* (2006) 103:18101-18106

**Lee T.**, Hoofnagle A.N., Resing K.A., and Ahn N.G. "Hydrogen exchange solvent protection by an ATP-analogue reveals conformational changes in ERK2 upon activation." *J. Mol. Biol.* (2005) 353: 600-612

Liang Z-X, Tsigos I., **Lee T.**, Bouriotis V., Resing K.A., Ahn N.G., and Klinman J.P. "Evidence for increased local flexibility in psychrophilic alcohol dehydrogenase relative to its thermophilic homologue." *Biochemistry* (2004) 43:14676-14683

Liang Z-X, **Lee T.**, Resing K.A., Ahn N.G., and Klinman J.P. "Thermal activated protein mobility and its correlation with catalysis in thermophilic alcohol dehydrogenase." *Proc. Nat. Acad. Soc.* (2004) 101:9556-9561

**Lee T.**, Hoofnagle A.N., Kabuyama Y., Stroud J., Min X., Goldsmith E.J., Chen L., Resing K.A., and Ahn N.G. "Docking motif interactions in MAP kinases revealed by hydrogen exchange and mass spectrometry." *Molecular Cell* (2004) 14:43-55

Hoofnagle A.N., Stoner J.W., **Lee T.**, Eaton S.S., and Ahn N.G. "Phosphorylation-dependent changes in structure and dynamics in ERK2 detected by SDSL and EPR." *Biophysical Journal* (2004) 86:295-403

- **Book Chapters**

**Lee T.**, Hoofnagle A.N., Resing K.A., and Ahn N.G. "Protein hydrogen exchange measured by electrospray ionization mass spectrometry." In "Cell Biology: A Laboratory Handbook", Third Edition, JE Celis, Ed., Elsevier Science, 4, 443-449

**Lee T.**, Croy C.H., Resing K.A., and Ahn N.G. "Hydrogen exchange measurements in proteins." in "Handbook of Hydrogen Transfer", JP Klinman and RL Schowen, Ed., Wiley-VCH, 4, 1361-1392

- **Oral presentation**

**Lee T.**, Coutts K., Houel S., Anderson E., Mayer M., Sullivan K., Old W., and Ahn N. "Interrogating oncogenic B-Raf signaling to miRNAs by functional proteomics." US HUPO 7<sup>th</sup> annual conference on Proteomics: New developments and grand challenge, Raleigh, NC, March 20-23, 2011.

- **Poster Presentation**

**Lee T.**, Coutts K., Houel S., Anderson E., Mayer M., Sullivan K., Old W., Ahn N.G. "A microRNA network controlled by oncogenic B-Raf." 59<sup>th</sup> ASMS Conference on Mass Spectrometry and Allied Topics, Denver, CO, June 5-9, 2011. Poster

**Lee T.**, Hoofnagle A.N., Kabuyama Y., Stroud J., Min X., Goldsmith E.J., Chen L., Resing K.A., and Ahn N.G. "Docking interactions in MAP kinases revealed Hydrogen Exchange Mass Spectrometry" Frontiers in Biological Physics IV: Signal Transduction and Protein Phosphorylation, An ICAM Symposium supported by ICAM and the NSF, San Diego, CA, July 11-13, 2005. Poster

**Lee T.**, Resing K.A., and Ahn N.G. "Characterizing docking interactions between ERK2 and Elk1 by hydrogen exchange mass spectrometry on a QSTAR®." ABRF Conference on Translating Biology Using Proteomics and Functional Genomics, Denver, CO, February 10-13, 2003. Poster.