

Value Proposition

Pressure Cycling Technology (PCT) as an Integral Part of the Mass Spectrometry Sample Preparation Workflow

1. Introduction to Pressure Cycling Technology (PCT)

- a. Dr. Edmund Ting (V.P. of Engineering)
(Fundamentals of) High-pressure Instruments for Innovation and Discovery
Harvard Symposium May 21, 2010
<http://www.pressurebiosciences.com/downloads/publications/2010-06/High-pressure-Instruments-for-Innovation-Discovery.pdf>
- b. Dr. Alexander Lazarev (V.P. of R&D)
High Pressure in Life Sciences – Trends and Future Opportunities
Harvard Symposium May 21, 2010
<http://www.pressurebiosciences.com/downloads/publications/2010-06/High-Pressure-in-Life-Sciences.pdf>
- c. *Use of Ultrahigh Pressure on the Rise*
GEN: Genetic Engineering & Biotechnology Aug 1 2010 (Vol. 30, No. 14)
K. John Morrow
<http://genengnews.com/gen-articles/use-of-ultrahigh-pressure-on-the-rise/3360/?page=3>
- d. Chapter 1: Applications of Pressure Cycling Technology (PCT) in Proteomics
Richard T. Schumacher, Chunqin Li, Nathan P. Lawrence, James Behnke, Feng Tao, and Calvin Saravis
Separation Methods In Proteomics, Edited by Gary B. Smejkal and Alexander Lazarev, CRC Press 2006
Personal Copy (No Hyperlink)
- e. *Tired of the Same Old Grind*
Targets Innovations in Genomics and Proteomics
Patricia E. Garrett, Feng Tao, Nathan Lawrence, Jay Ji, Richard T. Schumacher, and Mark M. Manak
November 2002. Vol.1, Number 5, pp. 147-176
<http://www.pressurebiosciences.com/downloads/publications/paper11.pdf>
- f. *Applications of Ultra-high Pressure in Biotechnology*
Harvard Symposium May 21, 2010
<http://www.pressurebiosciences.com/downloads/publications/2010-05/Harvard-Symposium-Program%20-Final.pdf>

2. Enhanced Protein Extraction (Various Sample Types)

- a. **Membrane Proteins**
The Effect of Pressure Cycling on Proteolytic Cleavage Efficiency, Reaction Time and Protein Sequence Coverage
Eric Bonneil¹; Roger Biringer²; Julian Saba²; Andreas Huhmer²; Pierre Thibault¹ ¹Institute for Research in Immunology and Cancer, Université de Montréal, Montréal, Canada ²Thermo Fisher Scientific, San Jose, CA
HUPO 2010
<http://www.pressurebiosciences.com/pdf-new-2010/publications/HUPO-2010-poster.pdf>

Membrane Protein Extraction and Biomarker Analysis from Solid Metastatic Ovarian Tumors with ProteoSolve™ -TD Buffers and Pressure Cycling Technology

Luke V. Schneider, CSO, Target Discovery, Inc.

Harvard Symposium May 21, 2010

<http://www.pressurebiosciences.com/downloads/publications/2010-06/LVS-Membrane-proteins.pdf>

b. Hydrophobic Proteins

Improving the Efficiency and Throughput of an Enzymatic Digestion of Klotho using Pressure Cycling Technology (PCT)

Taha Reza, et al.

Thermo Fisher Scientific

MSACL 2011

Pre-Print Personal Copy (No Hyperlink)

Soluble Forms of the Notch Ligands Delta1 and Jagged1 Promote in Vivo Tumorigenicity in NIH3T3 Fibroblasts with Distinct Phenotypes

Sumithra Urs,* Alice Roudabush,†Christine F. O'Neill,‡ Ilka Pinz,* Igor Prudovsky,*Doreen Kacer,* Yuefang Tang,* Lucy Liaw,*and Deena Small§ From the Center for Molecular Medicine,* Maine Medical Center Research Institute, Scarborough, Maine; Department of Animal and Nutritional Sciences and New Hampshire Veterinary Diagnostics Laboratory,† University of New Hampshire, Durham, New Hampshire; Department of Biochemistry,‡ Boston University, Boston Massachusetts; and Department of Biochemistry and Molecular Biology,§ University of New Hampshire, Durham, New Hampshire

Tumorigenesis and Neoplastic Progression: The American Journal of Pathology, Vol. 173, No. 3, September 2008. Copyright © American Society for Investigative Pathology

<http://www.ncbi.nlm.nih.gov/pubmed/18688026>

Chapter 30: Adipose tissue and protein extraction followed by MS-base proteomic profiling reveals constituents of oxidative stress in obesity

Emily A. Freeman, Vera Gross, Ilyana Romenofsky, Alexander Lazarev, Alexander R. Ivanov

Harvard School of Public Health Department of Genetics and Complex Diseases, Boston MA, The Harvard School of Public Health Proteomics Resource, and Pressure BioSciences, Inc.

Sample Preparation in Biological Mass Spectrometry", Ivanov, A.R, and A.V. Lazarev, editors;

Springer ©2011

Pre-Print Personal Copy (No Hyperlink)

c. Formalin-Fixed Paraffin-Embedded Tissue (FFPE)

See Section 5: PCT Pipeline

d. Ancient

Chapter 45: Revisiting Jurassic Park: The isolation of proteins from amber encapsulated organisms millions of years old

Gary B. Smejkal, George O. Poinar Jr., Pier Giorgio Righetti and Feixia Chu

University of New Hampshire, Hubbard Center for Genome Studies, Oregon State University, Department of Zoology, Politecnico di Milano, Department of Chemistry, Materials and Chemical Engineering, Harvard University, Harvard Catalyst, The Harvard Clinical and Translational Science Center, Laboratory for Innovative Translational Technologies.

Sample Preparation in Biological Mass Spectrometry", Ivanov, A.R, and A.V. Lazarev, editors; Springer ©2011

Pre-Print Personal Copy (No Hyperlink)

e. Ocular Tissue

Strategies to Recover Proteins from Ocular Tissues for Proteomics

Nikhil Patel¹, Ekta Solanki¹, Renata Picciani¹, Valerie Cavett², Jennifer A. Caldwell-Busby²,

Sanjoy K. Bhattacharya Dr.^{1*}

PROTEOMICS Volume 8, Issue 5, pages 1055–1070, No. 5 March 2008

<http://onlinelibrary.wiley.com/doi/10.1002/pmic.200700856/abstract>

- f. Greater Reproducibility**
Development of Essential Sample Preparation Techniques in Proteomics Using Ultra-high Pressure
 Alexander R. Ivanov
 HSPH Proteomics Research Department of Genetics and Complex Diseases Harvard School of Public Health
 Harvard Symposium May 21, 2010
<http://www.pressurebiosciences.com/downloads/publications/2010-06/development-of-essential-sample.pdf>
- g. Systems Biology**
Tissue Fractionation by Hydrostatic Pressure Cycling Technology: The Unified Sample Preparation Technique for Systems Biology Studies
 Vera Gross, 1 Greta Carlson, 1 Ada T Kwan, 1 Gary Smejkal, 1 Emily Freeman, 2 Alexander R Ivanov, 2 Alexander Lazarev1
 1Pressure BioSciences, Inc., Woburn, MA; 2Harvard School of Public Health, Boston, MA
 Journal of Biomolecular Techniques, Volume 19, issue 3, JULY 2008
http://www.pressurebiosciences.com/downloads/2009pdf/Gross_etal_BioTechniques2008_compressed.pdf
- Unified Sample Preparation Approach Using Hydrostatic Pressure Cycling: Simultaneous Isolation of Proteins, Nucleic Acids and Lipids from a Single Sample*
 Vera S. Gross; Greta Carlson; Gary B. Smejkal; Ada T. Kwan; Timothy Straub; Alexander V. Lazarev
 Pressure BioSciences, Inc., West Bridgewater, MA
 USHUPO 2008
http://www.pressurebiosciences.com/downloads/posters/2008/USHUPO2008_T67.pdf
- h. Differential Lysis**
Improved Protocols for Isolation of Intact Mitochondria from Tissue Samples
 Vera Gross1; Irina Stavrovskaya2; Sergei Baranov2; Greta Carlson1; Emily Freeman3; Alexander Ivanov3; Bruce Kristal2; Alexander Lazarev1
 1Pressure BioSciences, Inc, South Easton, MA; 2Brigham and Women's Hospital; Harvard University, Boston, MA; 3Harvard School of Public Health, Boston, MA
 USHUPO 2010
<http://www.pressurebiosciences.com/downloads/posters/2010/USHUPO2010-Tue68.pdf>
- i. Quantitative Recovery**
Chapter 5: Pressure-Assisted Lysis of Mammalian Cell Cultures Prior to Proteomic Analysis
 Emily Freeman and Alexander R. Ivanov
 Harvard School of Public Health Department of Genetics and Complex Diseases, Boston MA, The Harvard School of Public Health Proteomics Resource Sample Preparation in Biological Mass Spectrometry", Ivanov, A.R, and A.V. Lazarev, editors; Springer ©2011
 Pre-Print Personal Copy (No Hyperlink)
- Application of Pressure Cycling Technology to Tissue Sample Preparation for 2-DE*
 Ringham H, Bell RL, Smejkal GB, Behnke J, Witzmann FA.
 Department of Cellular and Integrative Physiology, Indiana University School of Medicine, Indianapolis, IN 46202-2111, USA.
Electrophoresis. 2007 Mar; 28(6):1022-4.
<http://www.ncbi.nlm.nih.gov/pubmed/17300130>

3. Enhanced Protein Digestion (In-Solution and In-Gel)

a. **Significant Reduction in Time**

Application of Pressurized Solvents for Ultrafast Trypsin Hydrolysis in Proteomics: Proteomics on the Fly

Daniel Lopez-Ferrer, † Konstantinos Petritis, † Kim K. Hixson, ‡ Tyler H. Heibeck, † Ronald J. Moore, † Mikhail E. Belov, † David G. Camp II, † and Richard D. Smith*, †
Biological Sciences Division and Environmental Molecular Sciences Laboratory, Pacific Northwest National Laboratory, P.O. Box 999, Richland, Washington 99352
J Proteome Res. 2008 Aug; 7(8):3276-81. Epub 2008 Jul 8.
<http://www.scribd.com/doc/3882461/Application-of-Pressurized-Solvents-for-Ultrafast-Trypsin-Hydrolysis-in-Proteomics-Proteomics-on-the-Fly>

High Pressure Trypsin Digestion of Proteins for Proteomic Analysis

Shane A. Wyatt and Timothy R. Croley
Commonwealth of Virginia; Division of Consolidated Laboratory Services, Richmond, VA Department of Chemistry; Virginia Commonwealth University, Richmond, VA
<http://www.pressurebiosciences.com/downloads/3rdparty-2008-06-20/Virginia%20State%20Labs.Trypsin.pdf>

Ultra-Rapid Pressure Digestion and Label-Free Quantitative Proteomics of Yersinia Infected Mice Tissues

Kim K. Hixson¹, Daniel López-Ferrer¹, Matthew Bender², Patricia L. Worsham³, Karl K. Weitz¹, Nate Lawrence⁴, Amy Rasley⁵, Therese W. Clauss¹, Ljiljana Pasa-Tolió¹, Richard D. Smith¹, Mary S. Lipton¹ ¹Pacific Northwest National Laboratory, Richland WA; ²NBACC, Washington, DC; ³USAMRIID, Frederick, MD; ⁴Pressure BioSciences, Inc., South Easton, MA; ⁵Lawrence Livermore National Lab, Livermore, CA
ASMS 2009
http://www.pressurebiosciences.com/pdf-new-2009/publications/ASMS_Hixson_final_kh.pdf

b. **Quantitative Recovery**

Label-Free Mass Spectrometry-Based Relative Quantification of Proteins Separated by One Dimensional Gel Electrophoresis

Melkamu Getie-Kehtie^a, Alexander Lazarev^b, Maryna Eichelberger^c and Michail Alterman^a
^a Division of Cellular and Gene Therapies, Center for Biologics Evaluation and Research, Food and Drug Administration, Bethesda, MD 20892, USA ^b Pressure BioSciences, South Easton, MA 02375, USA ^c Division of Viral Products, Center for Biologics Evaluation and Research, Food and Drug Administration, Bethesda, MD 20892, USA
Analytical Biochemistry Volume 409, Issue 2, 15 February 2011, Pages 202-212
http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6W9V-51962WR-6&_user=10&_coverDate=02%2F15%2F2011&_rdoc=1&_fmt=high&_orig=search&_sort=d&_docanchor=&view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=982a872ae2cb6e414e8b54644e5a48ce&searchtype=a

Chapter 9: Exploring the Capabilities of the Protein Identification by Unconventional Sample Preparation Approaches: LC/MALDI/On-Target Digestion Approach and High Pressure Assisted In-Gel Tryptic Digestion

Melkamu Getie-Kehtie and Michail Alterman^a
Tumor Vaccines and Biotechnology Branch Division of Cellular and Gene Therapies, Center for Biologics Evaluation and Research, Food and Drug Administration, Bethesda, MD 20892, USA
Sample Preparation in Biological Mass Spectrometry", Ivanov, A.R, and A.V. Lazarev, editors; Springer ©2011
Pre-Print Personal Copy (No Hyperlink)

High-Pressure Assisted In-Gel Tryptic Digestion in Label-Free Quantification of Influenza Virus Proteins

Melkamu Getie-Kehtie
Division of Cell and Gene Therapy, CBER/FDA
Harvard Symposium May 21, 2010
<http://www.pressurebiosciences.com/downloads/publications/2010-06/High-Pressure-Assisted-In-Gel-Tryptic-Digestion.pdf>

c. Greater Sequence Coverage

Comparison Between Ultra-High Pressure and Atmospheric Tryptic Digestion for Proteomic Analyses

E. Bonneil¹, R. Biringer², C. Bell¹, P. Thibault¹

¹Institute for Research in Immunology and Cancer Université de Montréal; ²Thermo Fisher Scientific Harvard Symposium May 21, 2010

<http://www.pressurebiosciences.com/downloads/publications/2010-07/Comparison-ultra-high-pressure-%20athmospheric-tryptic.pdf>

Tandem Mass Spectrometry Analysis of Ex Vivo Amyloid Fibril and Tissue Samples

Zhenning Hong, ¹Giuseppe Infusini, ¹Lawreen H. Connors, ²Martha Skinner, ²Catherine E. Costello^{1, 2}

¹Mass Spectrometry Resource and ²Amyloid Treatment and Research Program, Boston University School of Medicine, Boston, MA USA

USHUPO2008

<http://www.pressurebiosciences.com/downloads/publications/2010-06/Zhenning-POSTER-ASMS-2010.pdf>

d. Controlled Enzyme Specificity

The Effect of Pressure Cycling on Proteolytic Cleavage Efficiency, Reaction Time and Protein Sequence Coverage

Roger Biringer¹, Eric Bonneil², Julian Saba¹, Andreas Huhmer¹, Pierre Thibault²

¹Thermo Fisher Scientific, San Jose, CA ²Institute for Research in Immunology and Cancer, Université de Montréal, Montréal, Canada

ASBMB 2010

http://www.pressurebiosciences.com/downloads/publications/2010-05/Biringer_ASBMB_2010_Poster.pdf

e. Improved Efficiency and Reproducibility

Rapid and Efficient Protein Digestion Using Trypsin-Coated Magnetic Nanoparticles Under Pressure Cycles

Byoungsoo Lee^{1†}, Daniel Lopez-Ferrer^{2†}, Byoung Chan Kim³, Hyon Bin Na⁴, Yong Il Park⁴, Karl K. Weitz², Marvin G. Warner², Taeghwan Hyeon⁴, Sang-Won Lee⁵, Richard D. Smith², Jungbae Kim¹·PROTEOMICS Volume 11, Issue 2, pages 309–318, No. 2 January 2011

<http://onlinelibrary.wiley.com/doi/10.1002/pmic.201000378/abstract>

f. Trypsin, Other Proteases, and Deglycosylation

A Comparative Study of In-Gel Digestions Using Microwave and Pressure-Accelerated Technologies

Rudy Alvarado, Diana Tran, Bonnie Ching, and Brett S. Phinney[†]

UC Davis Proteomics Core Facility, University of California Davis Genome Center, Davis, CA 95616, USA J Biomol Tech. 2010 September; 21(3): 148–155.

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2922831/>

Rapid Sample Preparation Methods for the Analysis of N-Linked Glycans

Zoltan Szabo, András Guttman, Tomas Rejtar and Barry L. Karger

Barnett Institute, Boston, MA, USA

Harvard Symposium May 21, 2010

<http://www.pressurebiosciences.com/downloads/publications/2010-06/PCTworkshopfinal.pdf>

A Comparative Study of In-gel Digestions Using Microwave and Pressure Accelerated Technologies

Rudy Alvarado, Diana Tran, Bonnie Ching and Brett S. Phinney

UC Davis Proteomics Core Facility, University of California Davis Genome Center, Davis, CA 95616, USA ABRF 2010

<http://www.pressurebiosciences.com/downloads/publications/2010-04/ABRF-2010-Poster.pdf>

A Comparison of Methods for Efficient Digestion of Protein Therapeutics

Lorna L. Maheu, Heather M. Connelly, Adam G. Harder, and Steven L. Cockrill

Analytical Sciences, Amgen Inc., Longmont, CO 80503

FACSS 2008

<http://www.pressurebiosciences.com/downloads/publications/2010-08/Amgen-FACSS-2008-Poster.pdf>

g. Cost Reduction

Optimization of High Pressure-Assisted Methods for Proteomic Sample Preparation

Alexander V. Lazarev^{1*}; Vera S. Gross¹; Greta Carlson¹; Edmund Ting¹; Emily Freeman²; Alexander R. Ivanov²; Melkamu Getie-Kebtie³; Michail Alterman³

¹Pressure BioSciences, South Easton, MA, USA; ²Harvard School of Public Health, Boston, MA, USA; ³FDA, CBER, Rockville, MD, USA

HPBB2010

http://www.pressurebiosciences.com/downloads/publications/2010-09/HPBB_Final.pdf

h. Standardization

Novel Efficient Alternatives for Essential Sample Preparation Techniques in Functional Proteomics

Freeman and Alexander R. Ivanov

Harvard School of Public Health, Department of Genetics and Complex Diseases

ASMS 2010

http://www.pressurebiosciences.com/downloads/publications/2010-06/ASMS2010_Poster_IvanovAR_HSPH.pdf

4. Biopharmaceuticals, Vaccines, and Biosimilars

A Separation-Free Quantitative MS-Based Profiling Approach Using 2-AA Isotopically Labeled Substrates for High-Throughput Glycan Screening

Justin M. Prien¹, Lorna Maheu¹, Brad Prater¹, and Steve Cockrill¹

¹Analytical Science, Amgen, Longmont, Colorado 80503

ASMS 2010

http://www.pressurebiosciences.com/downloads/publications/2010-06/2-AA_stable_isotope_poster_ASMS%202010_submitted.pdf

Application Of Mass Spectrometry-Based Proteomics in Influenza Virus Research and Vaccine Manufacturing

Melkamu Getie-Kebtie¹; Maryna Eichelberger²; Michail Alterman¹

¹FDA/CBER/OCTGT/TVBB, Bethesda, MD; ²FDA/CBER/OVRR/DVP, Bethesda, MD

USHUPO 2010

<http://www.pressurebiosciences.com/pdf-new-2010/publications/Flu-USHUPO-2010.pdf>

Rapid Release of N-Linked Glycans from Glycoproteins by Pressure-Cycling Technology

Zoltan Szabo, Andras Guttman and Barry L. Karger*

Barnett Institute, Northeastern University, Boston, Massachusetts 02115

Anal. Chem., 2010, 82 (6), pp 2588–2593

<http://pubs.acs.org/doi/abs/10.1021/ac100098e>

5. Potential Clinical Applications

a. Klotho

Improving the Efficiency and Throughput of an Enzymatic Digestion of Klotho using Pressure Cycling Technology (PCT)

Taha Reza et al.

Thermo Fisher Scientific

MSACL 2011

Pre-Print Personal Copy (No Hyperlink)

b. Cancer

IMAGING MALDI of Colorectal Carcinoma - Field Defects in Satellite Tissue

¹Tiffany Remsen, ²M Momeni, ¹P Kessler, ³F Francois, ¹A Stern, ²S. Anand and ¹P. Pevsner

¹Dept of Pharmacology New York University School of Medicine, New York, NY, USA ²Brooklyn Hospital

Center, Brooklyn, NY, USA ³Dept of Medicine, New York University School of Medicine, New York, NY, USA

<http://www.pressurebiosciences.com/downloads/3rdparty-2008-05->

[30/MALDI%20IMAGING%20AND%20COLORECTAL%20CARCINOMA.pdf](http://www.pressurebiosciences.com/downloads/3rdparty-2008-05-30/MALDI%20IMAGING%20AND%20COLORECTAL%20CARCINOMA.pdf)

Mass Spectrometry of Buccal Mucosa-Biomarkers for Biodosimetry in Radiation Incidents

1P.H. Pevsner, 2S. Furmenty, 1T. Remsen, 1G. Krupp, 1 P. Kessler, 4G. Rothschild
3Jorge Gismo, 3J. Melamed, 2B. S. Rosenstein, 4R. Schneider, 5F. Naftolin and 1A. Stern
New York University School of Medicine 1Department of Pharmacology, 2Department of Radiation Oncology,
3Department of Pathology, 4Department of Microbiology, 5Department of Obstetrics and Gynecology-
Reproductive Biology
550 1st Avenue New York, NY 10016
AFRRI 2008
<http://www.pressurebiosciences.com/downloads/3rdparty-2008-05-30/Mass%20Spectrometry%20of%20Buccal%20Mucosa.pdf>

c. Drug Interactions

Screening for Drug-Drug Interactions Using a Targeted Proteomics Strategy

Daniel B. Kassel¹; Kheng B. Lim¹; Melinda Manuel¹; Teruaki Okuda²; Naomi Kamiguchi²; Christie L Hunter³; Brian Williamson³; Lydia Nuwaysir³
1Takeda San Diego, Inc, San Diego, CA; 2Takeda Pharmaceutical Company, Limited, Osaka, Japan; 3AB Sciex, Foster City, CA
ASMS 2010
http://www.pressurebiosciences.com/downloads/publications/2010-06/ASMS2010_Poster_CYPInduction_Final.pdf

d. Heart Disease

Discovery of Mitochondrial Protein Biomarkers of Atrial Fibrillation Using Unique Human Tissue Samples

Maryam Goudarzi¹, Mark M. Ross¹, Weidong Zhou¹, Amy Van Meter¹, Emanuel Petricoin¹, Lance Liotta¹, Lisa Martin², Chidima Martin² and Niv Ad²
1George Mason University, Manassas, VA; 2Inova Heart & Vascular Institute, Falls Church, VA
ASMS 2009
http://www.pressurebiosciences.com/downloads/publications/ASMS_2009_AF_poster_final.pdf

6. PCT Product Pipeline (2011-2011)

Pressure BioSciences, Inc. Unveils Four Key Instruments in Its 2011-2013 PCT Product Pipeline

Released: 02/07/11 10:32 AM EST
<http://markets.financialcontent.com/ir.pbio/?Module=MediaViewer&GUID=17036272&Ticker=PBIO>

Video: PBI Product Pipeline

MSACL 2011
<http://www.pressurebiosciences.com/videos/msacl2/msacl2.html>

PBI Newsletter: February 2011

<http://www.pressurebiosciences.com/newsletters-pdf/PCT-News-February-v2-2011.pdf>

a. Barocyler HUB440

Barocyler HUB440™ Pressure Generator

State-of-the-Art High Pressure Generator for Multiple Laboratory Applications
<http://www.pressurebiosciences.com/downloads/sell-sheets/HUB440-Sell-Sheet.pdf>

High-pressure EPR Reveals Conformational Equilibria and Volumetric Properties of Spin-labeled Proteins

John McCoy and Wayne L. Hubbell¹
Jules Stein Eye Institute and Department of Chemistry and Biochemistry, University of California, Los Angeles, CA 90095
PNAS January 4, 2011
<http://www.pressurebiosciences.com/downloads/publications/2011-02/McCoy-pressure.pdf>

b. Formalin Fixed Paraffin Embedded Tissue (FFPE)

Elevated Pressure Improves the Rate of Formalin Penetration while Preserving Tissue Morphology

Ingrid E. Chesnick¹, Jeffrey T. Mason¹, Timothy J. O'Leary², Carol B. Fowler^{1,2}

¹Department of Biophysics, Armed Forces Institute of Pathology, Rockville, Maryland, USA;

² Biomedical Laboratory Research and Development Service, Veterans Health Administration, Washington, DC, USA

J Cancer 2010; 1:178-183 ©Ivyspring International Publisher

<http://www.jcancer.org/v01p0178.htm>

Elevated Pressure Improves the Extraction and Identification of Proteins Recovered from Formalin-Fixed, Paraffin-Embedded Tissue Surrogates

Carol B. Fowler^{1,2}, Ingrid E. Chesnick¹, Cedric D. Moore¹, Timothy J. O'Leary², Jeffrey T. Mason¹

¹Department of Biophysics, Armed Forces Institute of Pathology, Rockville, Maryland, United States of America, ² Biomedical Laboratory Research and Development Service, Veterans Health Administration, Washington, D.C., United States of America

PLoS One. 2010 Dec 8; 5(12):e14253.

<http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0014253>

Exploring Post-translational Modification of the Mitochondrial Subproteome: and Expanding Role in Heart Disease

Jennifer E. Van Eyk, Ph.D.

Professor of Medicine, Biological Chemistry and Biomedical Engineering

Director, JHU Bayview Proteomics Center, Director, JHU NHLBI Proteomics Innovation Center on Heart Failure, Director, JHU ICTR/CTSA Biomarker Development Group

Personal Copy (No Hyperlink)

Pressure BioSciences, Inc. Announces R&D Agreement with the Armed Forces Institute of Pathology (AFIP); Initial Data on Pressure-Enhanced Processing and Analysis of FFPE Tissue Presented at the Symposium on High Pressure at Harvard Medical School

Press Release: 05/27/10

<http://markets.financialcontent.com/ir.pbio/?Module=MediaViewer&GUID=13231313&Ticker=PBIO>

Significant Benefits of Pressure Cycling Technology (PCT) Cited in Recent Cancer and Heart Disease Studies

Press Release: 12/15/10

<http://markets.financialcontent.com/ir.pbio/?Module=MediaViewer&GUID=16075945&Ticker=PBIO>

c. Automated, In-Line, On-Demand Processing (HPLC Modules)

Pressure BioSciences, Inc. and Battelle Memorial Institute Sign Exclusive Patent License Agreement

Press Release: 12/22/08

<http://markets.financialcontent.com/ir.pbio/?Module=MediaViewer&GUID=7501259&Ticker=PBIO>

Pressurized Pepsin Digestion in Proteomics: An Automatable Alternative to Trypsin for Integrated Top-down Bottom-up Proteomics

Daniel López-Ferrer^{1*}, Konstantinos Petritis^{1#}, Errol W. Robinson², Kim K. Hixson², Zhixin Tian¹, Jung Hwa Lee³, Sang-Won Lee³, Nikola Tolić², Karl K. Weitz¹, Mikhail E. Belov¹, Richard D. Smith¹ and Ljiljana Paša-Tolić^{2*}

¹Biological Science Division, ²Environmental Molecular Sciences Laboratory, Pacific Northwest National Laboratory, Richland, WA, USA and ³Department of Chemistry, Korea University, Seoul, Korea

MCP Papers Published on July 12, 2010 as Manuscript M110.001479

<http://mcponline.org/content/early/2010/07/12/mcp.M110.001479.full.pdf+html?sid=899c1671-b128-43ac-86bf-7dc3b9b9e5fb>

Development of New Technology Approaches for High-Throughput Proteome Analysis

Daniel López-Ferrer
Biological Separations & Mass Spectrometry Group
Pacific Northwest National Laboratory
Harvard Symposium May 21, 2010
http://www.pressurebiosciences.com/downloads/publications/2010-06/Lopez_Ferrer_final.pdf

Application of High Pressure and Highly Stable Trypsin Aggregate Coating on Superparamagnetic Magnetite/Silica Nanoparticles for High Performance Proteomics

Daniel López-Ferrer¹, Byoungsoo Lee², Jungbae Kim² and Richard D. Smith¹
¹Pacific Northwest National Laboratory, Richland, WA 99352; ²Korea University, Seoul, Korea
ASMS 2010
http://www.pressurebiosciences.com/downloads/publications/2010-06/ASMS_2010_DLF_Final.pdf

Improved Protein Coverage and Throughput in Proteomics using On-Line Multiplexed Enzyme Digestions and Targeted MS/MS with a Modified LTQ-FTICR

Daniel López-Ferrer¹, Konstantinos Petritis¹, Andrey Liyu¹, Jung Hwa Lee², Sang-Won Lee², Benito Cañas³, Kim K. Hixson¹, Richard D. Smith¹ and Mikhail E. Belov¹
¹Pacific Northwest National Laboratory, Richland, WA; ²Korea University, Seoul, Korea; ³Universidad Complutense de Madrid, Madrid, Spain
ASMS 2009
http://www.pressurebiosciences.com/pdf-new-2009/publications/Lopez-Ferrer_ASMS_2009_rev.pdf

New Strategies for High Pressure-Assisted Digestion in Proteomics

Kim K. Hixson^{1,2}, Daniel López-Ferrer¹, Karl K. Weitz¹, Ronald J. Moore¹, Scott R. Kronewitter¹, Heather H. Smallwood³, Mikhail E. Belov¹, and Richard D. Smith¹
¹Pacific Northwest National Laboratory, Richland, WA; ²Washington State University, Pullman, WA; ³St. Jude Children's Research Hospital, Memphis, TN
ASMS 2010
http://www.pressurebiosciences.com/downloads/publications/2010-06/Hixson_ASMS2010Final.pdf

Proteomics Under Pressure: Rapid Extraction and Digestion in a Single Tube

Alexander V. Lazarev¹; Emily Freeman²; Vera S. Gross¹; Greta Carlson¹; Edmund Ting¹; Alexander R. Ivanov²
¹Pressure BioSciences, South Easton, MA; ²Harvard School of Public Health, Boston, MA
ASMS 2009
<http://www.pressurebiosciences.com/pdf-new-2009/publications/ASMS09-posterTPE129.pdf>

d. High-Throughput, Multi-Well Barocycler System

Barocycler HT Multiwell (48-384)

Video: *PBI Product Pipeline*

MSACL 2011
<http://www.pressurebiosciences.com/videos/msacl2/msacl2.html>

7. Related Fields of Use

a. Forensics

Pressure Cycling Technology (PCT) Augments Sensitivity of Detection of Forensic DNA Analyses

Bruce Budowle
Executive Director of the Institute of Investigative Genetics
Professor in Department of Forensics and Investigative Genetics
University of North Texas, Fort Worth Texas
<http://www.pressurebiosciences.com/downloads/publications/2010-06/Pressure-and-DNA-RecoveryBudowle.pdf>

Poster: Application of Pressure Cycling Technology (PCT) in Differential Extraction

Deepthi Nori*, MFS; Dr. Bruce R. McCord, PhD

International Forensic Research Institute, Department of Chemistry and Biochemistry Florida International University, Miami, FL USA

<http://www.pressurebiosciences.com/downloads/publications/2011-02/AAFS-Poster-2010.pdf>

Seminar: Application of Pressure Cycling Technology (PCT) in Differential Extraction

Deepthi Nori*, MFS; Dr. Bruce R. McCord, PhD

International Forensic Research Institute, Department of Chemistry and Biochemistry Florida International University, Miami, FL USA

<http://www.pressurebiosciences.com/downloads/publications/2011-02/AAFS-Seminar-2010.pdf>

b. Agriculture

Improved Extraction of DNA of *Ca. Liberibacter* Species from Plants and Cultivated Cells Using Pressure Cycling Technology (PCT)

Aaron Sechler¹, A. Marques², N. Lawrence³, and Norman Schaad¹

¹FDWSRU, USDA-ARS, Fort Detrick, MD USA

²EMBRAPA, Brasilia, Brasil

³Pressure BioSciences Inc., South Easton, MA, USA

APS 2009

http://www.pressurebiosciences.com/downloads/publications/2010-08/2010_Poster_Final%20APS.pdf

Improved extraction of *Rhizoctonia* and *Pythium* DNA from wheat roots and soil samples using pressure cycling technology

Patricia A. Okubara, Chunqin Li, Kurtis L. Schroeder, Richard T. Schumacher and Nathan P. Lawrence

Can. J. Plant Pathol. 29: 304-310 (2007)

http://www.pressurebiosciences.com/downloads/3rdparty-2007-12/PCT_CJPP-2007.pdf

c. Environmental Biology

Pressure BioSciences, Inc. to Collaborate With the Lawrence Berkeley National Laboratory on the Analysis of Microorganisms in Oil Spills: Results Could Lead to Improved Strategies for Environmentally-Safe Clean-up

Press Release: 08/23/10

<http://markets.financialcontent.com/ir.pbio/?Module=MediaViewer&GUID=14400977&Ticker=PBIO>

GEN Co-Sponsors Roundtable Discussion on Novel Bioremediation Techniques

Press Release: 11/01/10

<http://markets.financialcontent.com/ir.pbio/?Module=MediaViewer&GUID=15375825&Ticker=PBIO>

d. Food

Intact Protein Liquid Chromatography Mass Spectrometry for Bacteria Strain Differentiation and Bacterial Toxin Detection

John H. Callahan; Denis Andrzejewski; Rebecca Bell; Eric Brown; Steve Musser

FDA/CFSAN, College Park, MD

[http://www.pressurebiosciences.com/downloads/3rdparty-2008-05-30/Callahan%20-](http://www.pressurebiosciences.com/downloads/3rdparty-2008-05-30/Callahan%20-%20Intact%20Protein%20LCMS%20for%20Bacteria%20Strain%20Differentiation%20and%20Bacterial%20Toxin%20Detection.pdf)

[%20Intact%20Protein%20LCMS%20for%20Bacteria%20Strain%20Differentiation%20and%20Bacterial%20Toxin%20Detection.pdf](http://www.pressurebiosciences.com/downloads/3rdparty-2008-05-30/Callahan%20-%20Intact%20Protein%20LCMS%20for%20Bacteria%20Strain%20Differentiation%20and%20Bacterial%20Toxin%20Detection.pdf)

Top-Down Identification of Bacterial Intact Protein Expression Profile Markers

Melinda A. McFarland; John H. Callahan; Denis Andrzejewski; Rebecca Bell; Steven M. Musser

FDA/CFSAN, College Park, MD

ASMS 2009

<http://www.pressurebiosciences.com/downloads/3rdparty-2009-06/Top-Down-Identification-of-Bacterial-Intact-Protein.FDA.ASMS.2009.pdf>

7. Extraction and Digestions in MicroTubes and MicroCaps

PCT MicroTube Adapter Kit

Processing time, sample throughput, accuracy, efficiency, and standardization are key elements of the sample preparation process in mass spectrometry. The PCT MicroTube Adapter Kit, in combination with the PCT SPS, can reliably and reproducibly control the enzymatic digestion of proteins while reducing the time of digestion from hours to minutes with the same or better quality as other, currently available techniques. The PCT MicroTube Adapter Kit comes complete with an ergonomically designed, space-saving Work Station containing PCT MicroTubes and PCT MicroCaps, as well as tools and hardware, to enable the user to process between one to forty eight samples simultaneously in the PCT SPS.

<http://www.pressurebiosciences.com/products/pressure-enhanced-enzymatic-proteolysis.html>

High Throughput Pressure-Enhanced Protein Extraction and Enzymatic Digestion with Pressure Cycling Technology (PCT) and PCT MicroTubes

C. Dussault, G. Carlson, V. Gross, N. Lawrence, A. Lazarev, M. Potter, R. T. Schumacher, and E. Ting
Pressure BioSciences, Inc. 14 Norfolk Avenue, S. Easton, MA 02375
ASMS 2010

<http://www.pressurebiosciences.com/downloads/publications/2010-05/Corporate-ASMS-2010-052110-Final.pdf>

Proteomics Under Pressure: Rapid Extraction and Digestion in a Single Tube

Alexander V. Lazarev¹; Emily Freeman²; Vera S. Gross¹; Greta Carlson¹; Edmund Ting¹; Alexander R. Ivanov²
¹Pressure BioSciences, South Easton, MA; ²Harvard School of Public Health, Boston, MA
57th ASMS

<http://www.pressurebiosciences.com/downloads/publications/2010-11/ASMS09%20posterTPE129.pdf>

8. PBI Shredder Systems for Mechanical Pre-Processing

The PCT Shredder or The SHREDDER SG3

PBI Shredder Systems are low shear mechanical disruption process for gentle, rapid, and safe disruption of tissues and organisms. Either *The PCT Shredder* or *The SHREDDER SG3*, when used with PBI Shredder PULSE Tubes and various buffers, can provide effective extraction of DNA, RNA, proteins, mitochondria, lipids and small molecules from tissues and organisms.

Both systems use a variety of PBI Shredder PULSE Tubes to directly and rapidly grind a biological sample providing easy handling and reducing sample contamination. And, although not required for all extractions, additional extraction efficiency can be achieved when this process is combined with pressure cycling technology (PCT).

<http://www.pressurebiosciences.com/products/the-pct-shredder.html>

<http://www.pressurebiosciences.com/downloads/sell-sheets/The-Shredder-SG3.Final.030111.pdf>

Intact and Functional Mitochondria from Solid Tissue: Effective Semi-Automated Extraction Using Gentle Mechanical Homogenization and Pressure Cycling Technology

Alexander Lazarev¹, Vera S. Gross¹, Greta Carlson¹, Emily Freeman², Alexander R. Ivanov², Heather Greenberg³, Sergei Baranov³, Irina Stavrovskaya³, Bruce Kristal³.¹Pressure BioSciences, Inc., South Easton, MA. ²HSPH Proteomics Resource, Harvard School of Public Health, Boston, MA. ³Brigham and Women's Hospital; Harvard University, Boston, MA
MSACL 2011

<http://www.pressurebiosciences.com/downloads/publications/2011-02/MSACL-2011-mitochondria-poster-v4.pdf>

Simple Protocols for Isolation of Intact Mitochondria Using The SHREDDER SG3 and PBI Mitochondria Isolation Kits

Pressure BioSciences, Inc.
14 Norfolk Ave. South Easton, MA 02375
ASCB 2010

<http://www.pressurebiosciences.com/downloads/publications/2010-12/ASCB-2010-booth-poster.pdf>

PBI Shredder System Application Notes and Preparations (PrEPs)

<http://www.pressurebiosciences.com/pub/application-notes-preparations.html>

9. Related PCT Application Notes - PBI

Proteolysis (Trypsin)-PrEP: In-Solution PCT-Enhanced Trypsin Digestion for Proteomics

<http://www.pressurebiosciences.com/PrEP-files/Proteolysis-Trypsin-PrEP.pdf>

ProteoSolve-TD2 PrEP: Enzyme-Linked Immunosorbant Assays (ELISA) Conducted on Proteins Recovered from Ovarian Tumors Using ProteoSolve-TD2 and Pressure Cycling Technology (PCT)

http://www.pressurebiosciences.com/PrEP-files/Protocol_ELISA.Final.032410.pdf

ProteoSolve-TD2 PrEP: Total Protein Recovery from Solid Ovarian Tumors With ProteoSolve-TD2 and PCT

<http://www.pressurebiosciences.com/PrEP-files/Protocol.Total-Protein-Recovery-from-Solid-Ovarian-Tumors.Final.032410.pdf>

ProteoSolve-TD2 PrEP: Membrane Protein Recovery from Metastatic Ovarian Tumors Using ProteoSolve-TD2 and Pressure Cycling Technology (PCT)

<http://www.pressurebiosciences.com/PrEP-files/Protocol.Membrane-Protein-Recovery-from-Metastatic-Ovarian-Tumors.Final.032410.pdf>

10. Product Sell Sheets – PBI

<http://www.pressurebiosciences.com/products.html>

11. Issued Patents – PBI

<http://www.pressurebiosciences.com/issued-patents.html>