

# Maciek R. Antoniewicz, Ph.D.

DuPont Young Professor  
Assistant Professor of Chemical Engineering

University of Delaware  
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## Honors and Awards

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- 2008 Jay Bailey Young Investigator Award for Best Paper in Metabolic Engineering
- 2008 - 2011 DuPont Young Professor Award
- 2008 - 2009 UDRF Research Award
- 2008 Invited Participant, Emerging Leaders Alliance Training Program
- 2001 - 2006 DuPont-MIT Fellowship
- 1999 Foundation Vrijvrouwe van Renswoude Scholarship, National, The Netherlands
- 1999 Foundation Schuurman Schimmel & van Outeren Scholarship, National, The Netherlands
- 1999 Propadeuse Diploma Magna Cum Laude, Delft University of Technology, The Netherlands

## Education

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- 2001 - 2006 **Ph.D. in Chemical Engineering**, Minor in Human Physiology  
Massachusetts Institute of Technology, Cambridge, MA (minor HST - MIT/Harvard)  
Thesis: *Comprehensive analysis of metabolic pathways through the combined use of multiple isotopic tracers*  
Advisor: Gregory Stephanopoulos
- 1994 - 2000 **B.S. and M.S. in Chemical Engineering**, Minor in Biotechnology  
Delft University of Technology, Delft, The Netherlands  
Thesis: *Metabolic flux analysis using mass spectrometry: development of methodologies for in vivo analysis of metabolic networks using steady state <sup>13</sup>C-tracer experiments* (Magna Cum Laude).  
Advisor: Joseph J. Heijnen

## Professional Experience

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- 2007 - present **Assistant Professor**  
University of Delaware, Department of Chemical Engineering  
*Participating Faculty, Chemistry-Biology Interface (CBI program)*
- 2007 **Postdoctoral Scientist**  
DuPont, Central Research & Development, Wilmington, DE
- 2006 **Postdoctoral Fellow**  
Massachusetts Institute of Technology, Cambridge, MA
- 2001 - 2006 **Ph.D. Candidate**  
Massachusetts Institute of Technology, Cambridge, MA
- 2000 - 2001 **Research Scientist**  
Massachusetts Institute of Technology, Cambridge, MA
- 1998 **Research Trainee**  
DSM / Gist-Brocades, Anti-Infectives Division, Delft, The Netherlands

## Teaching Experience

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### University of Delaware

- 2009 CHEG445 – Senior Lab  
12 Students; Fall 2009
- Summer Course – Molecular Biology and Metabolism (with E.T. Papoutsakis, A.S. Robinson, K.H. Lee)  
June 18-19, 2009
- CHEG621 – Metabolic Engineering  
10 Students; Spring 2009
- 2008 CHEG445 – Senior Lab  
12 Students; Fall 2008
- CHEG621 – Metabolic Engineering  
20 Students; Spring 2008
- 2007 CHEG620 – Biochemical Engineering  
35 Students; Fall 2007

### Massachusetts Institute of Technology

- 2005 Summer Course – Bioinformatics: Principles, Methods and Applications (with G. Stephanopoulos)  
35 Participants; June 6-9, 2005
- 2004 Summer Course – Bioinformatics (with G. Stephanopoulos)  
30 Participants; June 22-26, 2004
- 2001 Summer Course – Metabolic Engineering (with G. Stephanopoulos and A. J. Sinskey)  
30 Participants; June 18-20, 2001.

## Publications

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Citations as of 06/08/09 (determined using WOS Author Search). Total number of citations: 97. Author h-index: 6.

- 1 Moxley JF, Jewett MC, **Antoniewicz MR**, Villas-Boas SG, Alper H, Wheeler RT, Tong L, Hinnebusch AG, Ideker T, Nielsen J, Stephanopoulos G. *Linking high resolution metabolic flux phenotypes and transcriptional regulation in yeast modulated by the global regulator Gcn4p*. Proc Natl Acad Sci U S A, 106(16):6477-82, 2009 (Cover illustration of PNAS April 21, 2009; Paper recommended in F1000 Biology)
- 2 Yoo H, **Antoniewicz MR**, Stephanopoulos G, Kelleher JK. Quantifying reductive carboxylation flux of glutamine to lipid in brown adipocyte cell line. J Biol Chem, 283(30):20621-7, 2008
- 3 Young JD, Walther JL, **Antoniewicz MR**, Yoo H, Stephanopoulos G. *An Elementary Metabolite Unit (EMU) based method of isotopically nonstationary flux analysis*. Biotechnol Bioeng, 99(3): 686-699, 2008
- 4 **Antoniewicz MR**, Kelleher JK, Stephanopoulos G. *Accurate assessment of amino acid mass isotopomer distributions for metabolic flux analysis*. Anal Chem 79(19): 7554-9, 2007
- 5 **Antoniewicz MR**, Kraynie DF, Laffend LA, González-Lergier J, Kelleher JK, Stephanopoulos G. *Metabolic flux analysis in a nonstationary system: fed-batch fermentation of a high yielding strain of E. coli producing 1,3-propanediol*. Metab Eng 9(3): 277-92, 2007
- 6 **Antoniewicz MR**, Kelleher JK, Stephanopoulos G. *Elementary Metabolite Units (EMU): A novel framework for modeling isotopic distributions*. Metab Eng 9(1): 68-86, 2007 (Paper recommended in F1000 Biology)
- 7 **Antoniewicz MR**, Stephanopoulos G, Kelleher JK. *Evaluation of regression models in metabolic physiology: Predicting fluxes from isotopic data without knowledge of the pathway*. Metabolomics 2(1): 41-52, 2006

- 8 **Antoniewicz MR**, Kelleher JK, Stephanopoulos G. *Determination of confidence intervals of metabolic fluxes estimated from stable isotope measurements*. *Metab Eng* 8(4): 324-337, 2006
- 9 vanGulik WM, **Antoniewicz MR**, deLaat WT, Vinke JL, Heijnen JJ. *Energetics of growth and penicillin production in a high-producing strain of *Penicillium chrysogenum**. *Biotechnol Bioeng* 72(2): 185-93, 2001

## Invited Seminars and Presentations

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- 2008 Amyris Biotechnologies, Emeryville, CA. December 2008  
University of Delaware, Chemistry-Biology Interface (CBI) Seminar. Newark, DE. April 2008
- 2007 Delaware Biotechnology Institute, DBI Seminar Series. Newark, DE. December 2007  
E. I. DuPont de Nemours, Horizons in Biotechnology Seminar. Wilmington, DE. December 2007  
2nd International Metabolomics Symposium. Louisville, KY. March 2007  
University of Maryland, Dept. of Chemical and Biomolecular Engineering. College Park, MD. March 2007  
University of Delaware, Department of Chemical Engineering. Newark, DE. February 2007  
National Institutes of Health, Brain Physiology and Metabolism Section. Bethesda, MD. January 2007
- 2006 E. I. DuPont de Nemours, Central Research & Development. Wilmington, DE. June 2006
- 2005 Duke University, Sarah W. Stedman Nutrition & Metabolism Center. Durham, NC. October 2005  
Broad Institute of MIT and Harvard, Broad Metabolism Initiative. Cambridge, MA. January 2005
- 2004 7th International Meeting of the Microarray Gene Expression Data Society. Toronto, Canada. Sept. 2004
- 2003 E. I. DuPont de Nemours, Central Research & Development. Wilmington, DE. November 2003

## Conference Presentations

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### Presentations based on research at University of Delaware

- 2009 Ahn WS, Slusser C, Crown S, **Antoniewicz MR**. *Estimation of gluconeogenesis flux in Fao rat hepatoma cell line*. 2nd Annual Mid-Atlantic Frontiers at the Chemistry-Biology Interface Symposium. Baltimore, MD. May 2, 2009 (Poster Presentation)  
Crown S, Ahn WS, **Antoniewicz MR**. *A study of the gluconeogenesis pathway in FAO hepatoma cells*. 2nd Annual Mid-Atlantic Frontiers at the Chemistry-Biology Interface Symposium. Baltimore, MD. May 2, 2009 (Poster Presentation)
- 2008 Leighty RW, **Antoniewicz MR**. *Dynamic metabolic flux analysis with linear flux functionality*. Metabolic Engineering VII Conference. Puerto Vallarta, Mexico. September 14, 2008 (Poster Presentation)  
Choi J, **Antoniewicz MR**. *Tandem mass spectrometry method for metabolic flux analysis*. Metabolic Engineering VII Conference. Puerto Vallarta, Mexico. September 14, 2008 (Poster Presentation)

### Presentations based on research at Massachusetts Institute of Technology

- 2007 **Antoniewicz MR**. *Estimation of gluconeogenesis using  $[U-^{13}C, ^2H_8]$  glycerol tracer in mice*. AIChE Annual Meeting. Salt Lake City, UT. November 8, 2007 (20 min Oral Presentation)
- 2006 **Antoniewicz MR**. *Comprehensive analysis of the gluconeogenesis pathway through the combined use of multiple isotopic tracers*. AIChE Annual Meeting. San Francisco, CA. November 16, 2006 (20 min Oral Presentation)  
**Antoniewicz MR**. *Elementary Metabolite Units (EMU): A novel framework for modeling isotopic tracer distributions and determining metabolic fluxes*. AIChE Annual Meeting. San Francisco, CA. November 15, 2006 (20 min Oral Presentation)  
Kelleher JK\*, **Antoniewicz MR**. *Evaluation of regression models in metabolic physiology: Predicting fluxes from isotopic data without knowledge of the pathway*. 4th International Conference on Pathways, Networks and Systems. Mykonos, Greece. October 11, 2006 (45 min Oral Presentation, \*presenter)

- Antoniewicz MR**, Stephanopoulos G. *Elementary metabolite units (EMUs): A novel framework for modeling isotopic tracer distributions and determining metabolic fluxes*. Metabolic Engineering VI Conference. Noordwijkerhout, The Netherlands. October 4, 2006 (25 min Oral Presentation)
- Antoniewicz MR**. *Analysis of dynamics of PDO biosynthesis in E. coli*. DuPont-MIT Alliance Symposium. Cambridge, MA. September 25, 2006 (15 min Oral Presentation)
- 2005 **Antoniewicz MR**. *Advances in metabolic flux analysis from stable isotope experiments*. AIChE Annual Meeting. Cincinnati, OH. November 2, 2005 (20 min Oral Presentation)
- 2004 **Antoniewicz MR**. *Metabolic flux determination through the combined use of multiple isotopic tracers*. AIChE Annual Meeting. Austin, TX. November 10, 2004 (30 min Oral Presentation)
- Antoniewicz MR**. *Comprehensive analysis of bioreaction networks through the use of multiple isotopic tracers*. DuPont-MIT Alliance Symposium. Cambridge, MA. October 13, 2004 (20 min Oral Presentation)
- Antoniewicz MR**, Alemán JO, Kelleher JK, Stephanopoulos G. *Combined use of multiple isotopic tracers for the determination of gluconeogenesis*. Metabolic Engineering V Conference. Lake Tahoe, CA. September 21, 2004 (Poster Presentation)
- 2002 **Antoniewicz MR**, Kelleher JK, Stephanopoulos G. *MEtabolic TRacer ANalysis (METRAN): software for metabolic flux analysis and isotopomer spectral analysis*. Metabolic Engineering IV Conference. Il Ciocco, Italy. October 9, 2002 (Poster Presentation)

## Professional Activities

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### Membership in Professional Societies

- American Institute of Chemical Engineers (AIChE)
- Society for Biological Engineers (SBE)
- American Chemical Society (ACS)
- ACS Division of Biochemical Technology (BIOT)
- ACS Division of Biological Chemistry (BIOL)

### Journal Reviewer

- Metabolic Engineering
- Biotechnology and Bioengineering
- American Journal of Physiology: Endocrinology and Metabolism
- Biochemical Engineering Journal
- Journal of Mass Spectrometry
- Applied Biochemistry and Biotechnology

### Conferences

- ACS BIOT meeting 2010, Session Chair, Advances in Metabolic Engineering, March, 2010
- AIChE Annual Meeting 2009, Session Chair, Mathematical Approaches in Systems Biology: Genome Scale Models, Nov, 2009
- AIChE Annual Meeting 2009, Session Chair, Mathematical Approaches in Systems Biology: Probabilistic Processes, Nov, 2009
- AIChE Annual Meeting 2009, Session Chair, Mathematical Approaches in Systems Biology: Kinetics and Dynamic Processes, Nov, 2009
- 3rd Conference on Foundations of Systems Biology in Engineering FOSBE, Session Chair, Alternative Fuels, Aug, 2009
- 3rd Conference on Foundations of Systems Biology in Engineering FOSBE, Program Committee, Aug, 2009
- Metabolic Engineering Conference VII, Poster Session Chair, Sep, 2008

### Other

- Guest Editor for Special Edition in the Journal of Biomedicine and Biotechnology on “Computational Approaches in Metabolic Engineering”
- Represented AIChE at the Emerging Leaders Alliance Program, Oct, 2008

## Software

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### **METRAN**

METRAN is a state-of-the-art software for the analysis of metabolic networks and metabolic fluxes through the use of stable-isotopes ( $^{13}\text{C}$ ,  $^2\text{H}$ ,  $^{18}\text{O}$ , etc) and measurements of isotopomer enrichments of small molecules by GC/MS and NMR. METRAN provides advanced tools for flux estimation, flux observability analysis, theoretical yield calculations, and calculation of statistical properties and confidence intervals of fluxes.