

## CURRICULUM VITAE

### PART I: General Information

**DATE PREPARED:** July 2003

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### Education:

<u>Year</u>	<u>Degree</u>	<u>Institution</u>
1983	B. S.	The Pennsylvania State University, University Park, PA
1985	M. D.	Jefferson Medical College, Philadelphia, PA

### Postdoctoral training:

<u>Year</u>	<u>Title/Specialty</u>	<u>Institution</u>
1985-1988	Internal Medicine Residency	Hospitals of the University Health Center University of Pittsburgh, Pittsburgh, PA
1992-1995	Endocrinology Fellowship (Clinical and Research)	Longwood Area Joint Program in Endocrinology and Metabolism, Joslin Diabetes Center and Harvard Medical School, Boston, MA

### Licensure and Certification:

<u>Year</u>	<u>Type of License</u>
1985	Medical license, Commonwealth of Pennsylvania
1986	Diplomate, National Board of Medical Examiners
1988	Medical license, Commonwealth of Virginia
1988	Diplomate, American Board of Internal Medicine
1992	Medical license, Commonwealth of Massachusetts
1995	Diplomate, American Board of Internal Medicine, Subspecialty of Endocrinology and Metabolism

**Academic Appointments:**

<u>Year</u>	<u>Academic Title</u>	<u>Institution</u>
1988-1989	Instructor in Medicine	Eastern Virginia Medical School, Norfolk, VA
1989-1992	Assistant Professor of Medicine	Eastern Virginia Medical School, Norfolk, VA
1995-1999	Instructor in Medicine	Harvard Medical School, Boston, MA
1999-	Assistant Professor of Medicine	Harvard Medical School, Boston, MA

**Hospital or Affiliated Institution Appointments:**

<u>Year</u>	<u>Hospital Title</u>	<u>Hospital</u>
1988-1992	Staff Physician, Medical Service	Department of Veterans Affairs Medical Center, Hampton, VA
1995-1997	Staff Physician (part-time consultant)	Department of Internal Medicine McLean Hospital, Belmont, MA
1992-	Associate	Department of Medicine Brigham and Women's Hospital
1996-	Staff Physician	Department of Medicine Beth Israel-Deaconess Hospital Boston, MA
1997-	Assistant Investigator	Research Division, Joslin Diabetes Center
2000-	Director	Affymetrix Genomics Core Laboratory

**Hospital and Health Care Organization Service Responsibilities:**

<u>Year</u>	<u>Position</u>	<u>Institution</u>
1988-1992	Inpatient attending	Veterans Affairs Medical Center, Hampton, VA
1995-	Outpatient diabetes/ endocrinology physician	Joslin Diabetes Center
1995-	Inpatient attending, endocrinology/diabetes teaching service	Beth Israel/Deaconess Medical Center
1999-2000	Advisory Committee, Joslin News	Joslin Diabetes Center

**Major Administrative Responsibilities:**

<u>Year</u>	<u>Title</u>	<u>Institution</u>
1997-2000	Coordinator, Clinical Diabetes/Metabolism Conference	Beth Israel Deaconess/Joslin
1997-2000	Assistant Program Director, Joslin/Longwood Area Endocrinology Fellowship Training Program	Joslin Diabetes Center
1997-2000	Coordinator, Medical Student and Resident Education	Joslin Diabetes Center
2000-	Director	Affymetrix Genomics Core Laboratory

**Major Committee Assignments – Medical School:**

<u>Year</u>	<u>Title</u>	<u>Institution</u>
1988-1992	Animal Studies Subcommittee, Research and Development Committee	Veterans Affairs Medical Center, Hampton, VA
1989-1992	Nutrition Support Committee	Veterans Affairs Medical Center, Hampton, VA
1989-1992	Drug Utilization Review Committee	Veterans Affairs Medical Center, Hampton, VA
1997- 2000	Fellowship Education Committee	Joslin Diabetes Center

**Professional Societies and Service:**

<u>Year</u>	<u>Society</u>	<u>Role</u>
1984-	Alpha Omega Alpha	Member
1988-	American College of Physicians	Member
1993-	American Diabetes Association	Member
1993-	Endocrine Society	Member
1997-1999	Association of Program Directors in Endocrinology and Metabolism	Member
1995-	ad hoc journal reviewer – Diabetes, American Journal of Physiology, Endocrinology, JCEM, Journal of Biochemistry	
1999, 2001	Boston Obesity and Nutrition Research Center grant reviewer	
2001, 2002	Reviewer, Predoctoral Fellowship (NIH ZRG1 REN, REB) Study Section	

**Community Service:**

<u>Year</u>	<u>Position/Role</u>
1996,	Physician Volunteer, Medical Tent (finish line),
1998, 1999	Walk for Hunger

**Awards and Honors:**

<u>Year</u>	<u>Name of Award</u>
1983	Bachelor of Science with Highest Distinction
1984	Alpha Omega Alpha (AOA) - Member and Vice President
1984	Hobart A. Hare Honor Medical Society
1985	M.D. degree granted magna cum laude (class rank 8/214)
1985	William F. Kellow Prize (exemplifying attributes of the ideal physician)
1985	Henry Keller Mohler Memorial Prize in Therapeutics
1985	Janet M. Glasgow American Women's Association Scholarship Achievement Citation
1991	Golden Flea Award for excellence in academic teaching and dedication to outstanding patient care presented by the 1990 - 1991 housestaff, Department of Medicine, Eastern Virginia Graduate School of Medicine
1995-1996	Mary K. Iacocca Research Fellow
1996	Marios C. Baldimos Award, Massachusetts Affiliate, American Diabetes Association
1998	Harvard Medical School 50 <sup>th</sup> Anniversary Scholar in Medicine

**Part II: Research, Teaching, and Clinical Contributions****A. Narrative Report:****1. Research (75% effort)**

The primary long-term goal of my research is to define the cellular mechanisms of insulin resistance in humans, both in patients with overt diabetes mellitus and with risk factors for progression to diabetes. I have been specifically focusing on the cellular mechanisms by which “environmental” or nutritional risk factors (e.g. obesity, prenatal and postnatal nutritional environment) influence gene expression, and, in turn, diabetes development. These goals have been focused into the following specific projects:

**a. What alterations in insulin signaling and gene expression are responsible for insulin resistance and type 2 diabetes?**

In patients with type 2 diabetes, multiple abnormalities contribute to the development of hyperglycemia, including peripheral and hepatic insulin resistance and beta cell dysfunction. The earliest detectable abnormality in patients at high risk to develop diabetes is insulin resistance; however, the specific cause in most patients with common forms of diabetes remains unknown. Therefore, we are investigating cellular mechanisms for the development of insulin resistance in muscle and fat in patients with type 2 diabetes and in those at high risk to develop diabetes (e.g. those with family history of diabetes, low birth weight, or obesity). Our principal experimental focus is to identify and functionally characterize alterations in gene expression, since gene expression integrates both genetic background and environmental influences. Current projects include:

- (1) identification of diabetes-related genes using microarray analysis of gene expression in muscle, fat, and liver tissue from patients with diabetes, obesity, and those at high risk based on family history
- (2) identification of changes in gene expression in muscle and fat from humans pre and post-treatment with thiazolidinediones

- (3) gene expression in muscle from humans with low birth weight, an important risk factor for diabetes

**b. What are the cellular roles of nutritional and metabolic factors in producing insulin resistance?**

Nutrition and diet play major roles in the development of insulin resistance and type 2 diabetes in humans. For example, the incidence of diabetes increases greatly when people immigrate to the United States or other Western societies; this has been largely attributed to the high fat, high calorie diet so common in the U. S. However, the specific cellular mechanisms by which alterations in diet and metabolism contribute to the risk of diabetes remains unknown. We are currently investigating mechanisms by which saturated fatty acids act as distinct signals to block the effects of insulin on specific enzymes and proteins important for normal glucose metabolism. We hope that an increased understanding of the metabolic pathways responsible for these effects will help us to identify targets for nutritional or drug treatment of insulin resistance and diabetes.

**c. What are the mechanisms by which low birth weight increases the risk of developing insulin resistance and diabetes in adult life?**

Multiple studies from many ethnic groups and countries around the world have demonstrated that low birth weight is an important risk factor for developing diabetes. Unfortunately, the cause of this increased risk remains unknown. Available data suggest that exposure of the fetus to undernutrition during pregnancy results in changes in expression of key genes which result in insulin resistance and poor development of the insulin-secreting cells of the pancreas. As the baby grows into adulthood, particularly when obesity and inactivity are superimposed, this results in increased risk for developing diabetes. This is particularly problematic as childhood obesity is rapidly increasing in the US, and low birth weight is increasing in minority populations.

We have developed a mouse model of undernutrition-associated diabetes and confirmed that prenatal undernutrition results in impaired glucose tolerance and overt diabetes with advancing age and imposition of high fat diet. We have identified and confirmed several genes which are differentially expressed as a function of prenatal undernutrition, consistent with the “programming” hypothesis, and continue data analysis of our gene expression results in pancreas, muscle, and liver. Moreover, we are evaluate changes in gene expression in muscle from low birth weight humans.

Conversely, recent human population based studies have indicated that birth weight may modulate risk for type 1 diabetes as well. Thus, we are analyzing diabetes incidence in NOD mice as a function of prenatal nutritional status.

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**2. Teaching (15% effort):**

(a). Fellow, resident, and student education: I have served as the assistant program director for the BIDMC/Joslin endocrinology training program and coordinated educational programs for fellows, residents, and medical students at Joslin Diabetes Center. In addition, I have developed and implemented a Joslin-based curriculum for Longwood area endocrinology fellows one-half day per week, encompassing outpatient experiences in multiple diabetes-related specialties. I served as the course director for HMS ME 508M.12 (fourth year student elective in endocrinology based at Joslin) prior to its merger with the BIDMC elective. I also precept a first-

year endocrinology fellow one half-day per week in endocrinology clinic, taught Patient-Doctor II for the 1999-2000 year, and serve as a faculty examiner for Patient-Doctor II and the Objective Structured Clinical Examination (OSCE) from 1999- present.

(b). Clinical Diabetes and Metabolism Conference coordinator: During the 1997-1998 academic year, Dr. George King and I successfully initiated a new, clinically oriented diabetes/metabolism conference. This conference is now held three times monthly and includes presentations by guest speakers, case discussions led by fellows, and journal club reviews. I played the central role in shaping the conference format, scheduling guest speakers, assisting fellows with case or journal selection and preparation, and directing administrative aspects of the conference from 1997-2000.

(c). Other teaching roles: I attend on the inpatient endocrinology/diabetes consult service at BIDMC 2-4 weeks per year. More limited commitments include serving as a focused group leader for IHP (HMS I) for 1 or 2 sessions during the past 3 years, teaching outpatient diabetes management for ambulatory care clerkship (HMS IV) students, serving as faculty examiner in the Patient Doctor II OSCE (6 hours per year), serving as faculty reviewer for observed history and physicals (Patient Doctor II, 7 hours per year) and lecturing at the BIDMC/Longwood area seminar series for fellows. This year I served as a teaching faculty member for the Endocrine Fellows Foundation Diabetes Elective, in which 4 fellows from around the US participated in an intensive diabetes-related clinical and educational experience.

### **3. Clinical (10% effort):**

I see patients, both new and established, as part of the Joslin Diabetes Center group practice in adult endocrinology and metabolism. This entails 6 hours of direct patient care scheduled per week plus related administrative duties, night and weekend call, and inpatient coverage for any of my patients admitted to BIDMC.

## **B. Research Funding Information**

<u>Years Covered</u>	<u>Funding Source</u>	<u>PI</u>	<u>Grant Title</u>
1995-1996	Mary K. Iacocca Fellowship		
1996-1997	Boston Obesity Nutrition Research Center Pilot Project	Yes	Role of Amino Acids in the Induction of Cellular Insulin Resistance
1996-1999	Markey Charitable Trust	No	Insulin Signaling in Human Skeletal Muscle
1997-1999	Diabetes and Endocrinology Research Center Pilot and Feasibility Study	Yes	Novel Mechanisms for Nutrient Regulation of Insulin Action

1997-2002	NIH Clinical Investigator Award (NIH KO8 DK02526-01)	Yes	Bifunctional Modulation of Insulin Action by Amino Acids
1998-1999	Harvard Medical School 50 <sup>th</sup> Anniversary Scholar in Medicine	Yes	Insulin Signaling in Human Skeletal Muscle
1999-2004	NIH R01 DK 45935 (C. R. Kahn)	No	Changes in Gene Expression in Diabetes by Subtractive Cloning
2001-2004	American Diabetes Association	Yes	Molecular Mechanisms of Low Birth Weight-Associated Diabetes Mellitus
2001-2002	Adler Foundation	Yes	Molecular Determinants of Low Birth Weight Associated Diabetes and Beta Cell Dysfunction
2001-2003	Iacocca Foundation	Yes	Gene Expression in Diabetes
2002-2007	NIH Diabetes Genome Anatomy Project (DGAP)	Yes	Mapping Gene Expression in Humans (Project 2 PI), Genomics Core Lab PI
2003-2007	NIH R01 DK62948	Yes	Gene Expression in Prediabetes: Potential Role of PGC1

### C. Report of Current Research Activities

<u>Project</u>	<u>Role</u>
Modulatory effects of nutrients on insulin signal transduction in cultured cells	PI
Gene expression in insulin resistant humans and functional studies of differentially expressed genes	PI
Effects of undernutrition in utero on insulin secretion and $\beta$ -cell development	PI

## **REPORT OF TEACHING**

### 1. Local Contributions

#### Eastern Virginia Medical School:

- 1988-1992 Instructor in Physical Diagnosis for second year medical students (9 months per year, 3 hours weekly)
- 1988-1992 Student conferences three days per week for third year medical students when attending physician (6 months per year)
- 1988-1992 General medicine attending rounds with interns and residents (average 6 months per year)
- 1988-1992 Coordinator, Medical Pathology Conference

#### a. Harvard Medical School:

- 1994-1996 Seminar for HMS IV ambulatory elective students
- 1994, 1995 Substitute Tutor, HMS II case tutorial sessions
- 1996- preceptor, medical students and residents, diabetes/endocrinology outpatient clinics, Joslin Diabetes Center
- 1997- Tutor, Focused Case Seminars, Integrated Human Physiology (HMS I) – 1-2 sessions per year (1 hour preparation, 2 hour session)
- 1998-2000 Course Director, HMS ME 508M.12 – Endocrinology and Metabolism, Joslin Diabetes Center – one 4<sup>th</sup> year student per month; preparation time: 4 hours monthly, contact time: 7 hours monthly (co-director, 1999-2000)
- 1999-2000 Preceptor, Patient-Doctor II (history and physical diagnosis)
- 2000- Faculty Examiner, Objective Structured Clinical Exam (OSCE)
- 2001- Faculty Examiner, Patient Doctor II
- 2003 Faculty Examiner, 4<sup>th</sup> Year Comprehensive Exam

#### b, e. Graduate education, including clinical setting:

- 1996- attending physician, diabetes/endocrinology consult service, Beth Israel- Deaconess (1 month per year)
- 1997- Lecturer, Endocrine Lecture Series, Longwood Area (1 session per year)
- 1997-2000 Mentor and Assistant Program Director, endocrine fellowship
- 1996, 1998 Laboratory mentor, Joslin Diabetes Center summer student fellowship program (1996: Jean-Marc Gauget; 1998: Jun Park, 2001: Stephen Collins)
- 1999-2000 Preceptor, endocrinology fellow, diabetes outpatient clinic

#### g. Current trainees:

- |           |                                    |                      |
|-----------|------------------------------------|----------------------|
| 1998-2000 | Mark Ruddock, Ph.D.                | postdoctoral fellow  |
| 1998-2000 | Marcelino Hernandez-Valencia, M.D. | postdoctoral fellow  |
| 1999-2000 | Panayiotis Economides, M.D.        | endocrinology fellow |
| 2000-     | Josep Jimenez-Chillaron, Ph.D.     | postdoctoral fellow  |
| 2000-2003 | Robert Saccone, M.S.               | genomics laboratory  |
| 2002-     | Sarah Crunkhorn, Ph.D.             | postdoctoral fellow  |

2. Regional, National or International Contributions

1996 Transgenic and knockout animals—what have we learned about NIDDM? - invited speaker at American Diabetes Association 30<sup>th</sup> Research Symposium Genetics of Diabetes Mellitus, Denver, CO

1997 “Differential regulation of insulin signaling by amino acids” - invited speaker at Lessons from Animal Diabetes, satellite meeting of International Diabetes Federation, Copenhagen, Denmark

1999 “Nutrient Modulation of Cellular Insulin Action” – invited speaker at “The Metabolic Syndrome X– Searching for the Underlying Defects”, New York Academy of Sciences, Jacksonville, FL

1999 “The effects of amino acids on intracellular signaling cascades” – invited speaker at Molecular Biology in Nutritional Research Symposium, European Society for Parenteral and Enteral Nutrition Congress, Stockholm, Sweden

1999 “Attenuation of insulin signaling by free fatty acids” – invited speaker at “Nutritional Control of Gene Transcription,” American Society for Biochemistry and Molecular Biology, Taos, NM

2001, 02 Reviewer, NIH Study Section, Special Minority Pre-Doctoral Fellowship Review

2003 Invited speaker, American Diabetes Association Annual Meeting – “From Gene Expression Data to New Hypotheses in Diabetes Pathogenesis”

**E. Report of clinical activities**

1. Clinical practice of endocrinology, diabetes, and metabolism (10% effort) –  
Outpatient clinics, Joslin Diabetes Center  
Consultant for diabetes service inpatients, Beth Israel-Deaconess Medical Center  
Consultant for endocrinology service, Beth Israel Deaconess Medical Center

### **Part III: BIBLIOGRAPHY**

#### Original Articles

1. Poindexter EH, Gerardi GJ, Rueckel ME, Caplan PJ, Johnson NM, Biegelsen DK. Electronic traps and Pb centers at the Si/SiO<sub>2</sub> interface: Band-gap energy distribution. *J Appl Physics* 1984; 56:2844-2849.
2. Araki E, Lipes E, Patti ME, Bruening JC, Haag BL, III, Johnson RS, Kahn CR. Alternative pathway of insulin signalling in mice with targeted disruption of the IRS-1 gene. *Nature* 1994; 372:186-190.
3. Patti ME, Sun X-J, Bruening JC, Araki E, Lipes MA, White MF, Kahn CR. 4PS/Insulin Receptor Substrate (IRS)-2 is the alternative substrate of the insulin receptor in IRS-1 deficient mice. *J Biol Chem* 1995; 270: 24670-24673.
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5. Goldfine AB, Simonson DC, Folli F, Patti ME, Kahn CR. *In vivo* and *in vitro* studies of vanadate in human and rodent diabetes mellitus. *Mol Cell Biochem* 1995; 153: 217-231.
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7. Patti ME, Brambilla E, Luzi L, Landaker EJ, Kahn CR. Bidirectional modulation of insulin action by amino acids. *J Clin Invest* 1998; 101: 1519-1529.
8. Patti ME, Virkamaki A, Landaker EJ, Kahn CR, Yki-Jarvinen H. Activation of the hexosamine pathway by glucosamine induces insulin resistance of early post-receptor signaling events in skeletal muscle. *Diabetes* 1999; 48: 1562-1571.
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11. Cusi K, Maezono K, Osman A, Pendergrass M, **Patti ME**, Pratipanawatr T, DeFronzo RA, Kahn CR, Mandarino LJ. Insulin resistance differentially affects the PI 3-kinase and MAP kinase pathways of insulin receptor signaling in human muscle. *J Clin Invest* 2000; 105: 311-320.
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- Patti ME.** High fructose diet preserves B cell mass and prevents diabetes in nonobese diabetic mice: a potential role for increased insulin receptor substrate 2 expression. *Metabolism* 2001; 50: 1369-1376.
13. Fraenkel PG, Rutkove SB, Matheson JK, Fowkes M, Cannon ME, **Patti ME**, Atkins MB, Gollob JA. Induction of myasthenia gravis, myositis, and insulin-dependent diabetes mellitus by high-dose interleukin-2. *Journal of Immunotherapy* 2002; 25: 373-378.
  14. Yechoor VK, **Patti ME**, Saccone R, Kahn CR. Coordinated patterns of gene expression for substrate and energy metabolism in skeletal muscle of diabetic mice. *PNAS* 2002; 99: 10587-10592.
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#### Reviews, Chapters, and Editorials:

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3. Patti ME, Kahn CR. Lessons from transgenic and knockout animals about NIDDM. *Trends Endo Metab* 1996; 7: 311-319.
4. Patti ME, Kahn CR. Transgenic animal models: insights into the pathophysiology of NIDDM. *Diabetes Reviews* 1997; 19: 149-164.
5. Patti ME, Kahn CR. The insulin receptor – a critical link in glucose homeostasis and insulin action. *J Basic Clin Physiol Pharmacol* 1998, 9: 89-109.
6. Patti ME. Nutrient modulation of cellular insulin action. *Annals of New York Academy of Sciences* 1999; 892: 187-203.

#### Abstracts:

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2. Patti ME, Vestergaard H, Reynet C, Moyers J, Pedersen O, Kahn CR. Rad expression in human skeletal muscle correlates inversely with insulin-stimulated glucose disposal. *J Investigative Med.* 1995; 43(Supp. 2):332A.
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17. Stein A, Ruddock M, Patti ME. PPAR and RXR ligands reverse fatty acid-mediated insulin resistance in hepatoma cells. *Diabetes* 2002; 51 (Supp. 2): A 348.
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19. Saccone RA, Rauniyar RK, Patti ME. Expression data derived from high density oligonucleotide microarrays: practical experience from an academic core laboratory. *University of Massachusetts Bioinformatics Conference*, 2002.
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21. Andersen KL, Poulsen P, Vaag A, Beck-Nielsen H, Saccone R, Yechoor V, Kahn CR, Pedersen O, Patti ME. Acute insulin regulation of gene expression in skeletal muscle: impact of genotype in monozygotic twins vs. non-twins. *Diabetes* 2003; 52 (Supp. 1): A248.
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