



Raymond E. Bourey, MD. Interim Division Chief of Endocrinology, Diabetes and Metabolism and Medical Director of the Regional Center for Sleep Medicine.

Faculty Appointment:
Interim Division Chief

Training:

B.A., Biology, 1978, Carleton College

Research Student, 1978-1979 Memorial Sloan-Kettering Cancer Center

M.D. 1982, Southern Illinois University School of Medicine

Internship in Surgery Medicine, 1982-1983, The Miriam Hospital/Brown University School of Medicine

Residency in Internal Medicine 1983-1986, Southern Illinois University School of Medicine

Fellowship in Applied Physiology, 1986-1988, Washington University School of Medicine

Fellowship in Metabolism, 1988-1990, Washington University School of Medicine

Specialty Board Certification:

Internal Medicine, 1986

Endocrinology, Diabetes, and Metabolism, 1991

Sports Medicine, 1999

Sleep Medicine, 2003 and 2007

Appointments:

Instructor of Medicine, Washington University School of Medicine, 1990-1992

Assistant Professor of Medicine, Washington University School of Medicine, 1992-1994

Clinical Assistant Professor of Medicine, Medical College of Ohio, 1994-2007

Director of Diabetes Education, St. Vincent Medical Center, Toledo, 1994-2000

Assistant Professor of Medicine, University of Toledo, 2007-

Research Interests:

- Neuroendocrine control of appetite, sleep, and metabolism.
- Menopausal insomnia and obesity, insulin resistance and metabolic syndrome.
- Genomic and non-genomic mechanisms of estrogen deficiency as a cause of obesity, insulin resistance, and metabolic syndrome.

Research:

Dr. Bourey received his M.D. degree in 1982, undertook internship in surgery and medicine at The Miriam Hospital and Brown University and did his residency in Internal Medicine at Southern Illinois University School of Medicine. He did fellowships in both Applied Physiology and in Metabolism in Washington University School of Medicine, where he subsequently served as Assistant Professor of Medicine until he moved to Toledo in 1994.

After early contributions to understanding of exercise, muscle glucose metabolism and aging, Dr. Bourey has turned to focus on neuroendocrine control of appetite, sleep, and metabolism.

Dr. Bourey identified a connection between poor sleep and high morning blood sugars in diabetics. He subsequently undertook additional training and study in sleep medicine, which he felt, as an endocrinologist and exercise physiologist, represented a "back door" to study of metabolic control by brain and central nervous system.

Dr. Bourey's clinical research currently centers on deleterious effects of menopause on sleep and metabolism. Menopause can be surgical, medication-induced (chemotherapy), or a natural consequence of aging. Menopause is associated with disruption of sleep and features of the metabolic syndrome, including obesity, hypertension, hyperlipidemia, and insulin resistance. Evidence supports a direct metabolic relationship between sleep disruption and development of the metabolic syndrome. Clinical studies are in progress to assess the (1) relationship between sleep disruption as measured by EEG spectral analysis or cyclic alternating pattern of arousal (CAP) and nocturnal hyperglycemia as measured by continuous interstitial fluid glucose monitoring, (2) relationship of sleep disruption to hot flashes or vasomotor events measured by skin conductance, and (3) treatment of menopausal sleep disruption by modulators of voltage-gated calcium channels and other pharmacological interventions..

Dr. Bourey's laboratory research focuses on two related areas. Mice with fragmented sleep develop abdominal obesity, insulin resistance and other features of the metabolic syndrome. Work is in progress to evaluate related changes in intermediary liver metabolism. Rodents with insufficient estrogen action through estrogen receptor α ($ER\alpha$) also develop obesity, insulin resistance, and abnormal insulin secretory response. $ER\alpha$ is found in brain areas related to sleep, appetite, and locomotion, as well as organs of insulin action including pancreas, liver, fat, and muscle. In collaboration with other members of CeDER, progress is being made toward elucidation of non-genomic and genomic mechanisms for increased appetite, decreased metabolic rate, insulin resistance, abnormal insulin secretion, and obesity caused by estrogen withdrawal or insufficiency.

Dr. Bourey had published more than 30 peer-reviewed articles, book chapters, and reviews. He has only returned recently to academic medicine, but his research direction is fundamental to the growth of translational research in this institution.

Representative Publications:

- [Bourey, R.E.](#) (2011): Primary menopausal insomnia-definition, review, and practical approach. *Endocrine Practice* 2010; 17(No. 1):122-131.
- [Pappada S.M., Borst M.J., Cameron B.D., Bourey R.E., Lather J.D., Shipp D.M., Chiricolo A., Papadimos T.J.](#) (2010): Development of a patient specific neural network model: prediction of glucose levels in a trauma patient. *Patient Safety in Surgery* 2010.
- Pappada S.M., Cameron B.D., Bourey R.E., Borst M.J., Shipp D.M., Lather J.D., Sbrocchi T.J. (2010): Neural Network Based Real-time Prediction of Glucose in Patients with Insulin Dependent Diabetes. *Diabetes Technology and Therapeutics* (2011), 13:135-141
- [Bowman, T.A., M. Kaw, S.J. Lee, P.R. Patel, R.E. Bourey, P.M. Haram, L.G. Koch, S.L. Britton, U. Wisloff, A.D. Lee, S.M. Najjar.](#) (2010): Caloric restriction reverses hepatic insulin resistance and steatosis in rats with low aerobic capacity. *Endocrinology* (2010). 15:5157-5164
- [Bourey, R.E., J.R. Bourey, N. Habbal, and A. Balaa.](#) (2010): Early gain in body mass with continuous positive airway pressure therapy for obstructive sleep apnea. *Somnologie* 2010; 14:207-212
- [Ghosh S, M. Kaw, P.R. Patel, K.J. Ledford, T.A. Bowman, M.F. McInerney, S.K Erickson, R. E. Bourey, S. M. Najjar.](#) (2010): Mice with null mutation of Ceacam1 develop nonalcoholic steatohepatitis. *Hepatic Medicine: Evidence and Research* 2010;2: 1-10.
- [Ebeling P, Tuominen JA, Bourey R.E., Koranyi L, Koivisto VA.](#) (1995): Athletes with IDDM exhibit impaired metabolic control and increased lipid utilization with no increase in insulin sensitivity. *Diabetes*. 1995 Apr;44(4):471-7.
- [Tuominen JA, Ebeling P, Bourey R.E., Koranyi L, Lamminen A, Rapola J, Sane T, Vuorinen-Markkola H, Koivisto VA.](#) (1994): Postmarathon paradox: insulin resistance in the face of glycogen depletion. *Am J Physiol*. 1996 Feb;270 (2 Pt 1).

- [Spina RJ, Bourey R.E., Ogawa T, Ehsani AA.](#) (1994): Effects of exercise training on alpha-adrenergic mediated pressor responses and baroreflex function in older subjects. *J Gerontol.* 1994 Nov;49(6):B277-81.
- [Schalin-Jantti C, Yki-Jarvinen H, Koranyi L, Bourey R.E., Lindstrom J, Nukula-Ijas P, Franssila-Kallunki A, Groop LC.](#) (1994): Effect of insulin on GLUT-4 mRNA and protein concentrations in skeletal muscle of patients with NIDDM and their first-degree relatives. *Diabetologia.* 1994 Apr;37(4):401-7.
- [Bourey R.E., Kohrt WM, Irwan JP, Staten MA, King DS, Holloszy JO.](#) (1993): Relationship between glucose tolerance and glucose-stimulated insulin response in 65-year-olds. *J Gerontol.* 1993 Jul;48(4):M122-7.
- [Ebeling P, Bourey R.E., Koranyi L, Tuominen JA, Groop LC, Henriksson J, Mueckler M, Sovijarvi A, Koivisto VA.](#) (1993): Mechanism of enhanced insulin sensitivity in athletes. Increased blood flow, muscle glucose transport protein (GLUT-4) concentration, and glycogen synthase activity. *J Clin Invest.* 1993 Oct; 92(4):1623-31.
- [Kirwan JP, Kohrt WM, Wojta DM, Bourey R.E., Holloszy JO.](#) (1993): Endurance training reduces glucose-stimulated insulin levels in 60- to 70-year-old men and women. *J Gerontol.* 1993 May; 48(3):M84-90.
- [Koivisto VA, Bourey R.E., Vuorinen-Markkola H, Koranyi L.](#) (1993): Exercise reduces muscle glucose transport protein (GLUT-4) mRNA in type 1 diabetic patients. *J Appl Physiol.* 1993 Apr; 74(4):1755-60.
- [Kohrt WM, Kirwan JP, Staten MA, Bourey R.E., King DS, Holloszy JO.](#) (1993): Insulin resistance in aging is related to abdominal obesity. *Diabetes.* 1993 Feb;42(2):273-81.
- [Eriksson J, Koranyi L, Bourey R.E., Schalin-Jantti C, Widen E, Mueckler M, Permutt AM, Groop LC.](#) (1992): Insulin resistance in type 2 (non-insulin-dependent) diabetic patients and their relatives is not associated with a defect in the expression of the insulin-responsive glucose transporter (GLUT-4) gene in human skeletal muscle. *Diabetologia.* 1992 Feb;35(2):143-7. Erratum in: *Diabetologia* 1992 Jun; 35(6):594.
- [Olansky L, Welling C., Giddings S, Adler S, Bourey R.E., Dowse G, Serjeantson S, Zimmet P, Permutt MA.](#) (1992): A variant insulin promoter in non-insulin-dependent diabetes mellitus. *J Clin Invest.* 1992 May; 89(5):1596-602.
- [Yki-Jarvinen H, Vuorinen-Markkola H, Koranyi L, Bourey R.E., Tordjman K, Mueckler M, Permutt AM, Koivisto VA.](#) (1992): Defect in insulin action on expression of the muscle/adipose tissue glucose transporter gene in skeletal muscle of type 1 diabetic patients. *J Clin Endocrinol Metab.* 1992 Sep; 75(3):795-9.
- [Koranyi L, Bourey R.E., Turk J, Mueckler M, Permutt MA.](#) (1992): Differential expression of rat pancreatic islet beta-cell glucose transporter (GLUT 2), proinsulin and islet amyloid polypeptide genes after prolonged fasting, insulin-induced hypoglycemia and dexamethasone treatment. *Diabetologia.* 1992 Dec; 35(12):1125-32.
- [Kohrt WM, Malley MT, Coggan AR, Spina RJ, Ogawa T, Ehsani AA, Bourey R.E., Martin WH 3rd, Holloszy JO.](#) (1991) Effects of gender, age, and fitness level on response of VO₂max to training in 60-71 yr olds. *J Appl Physiol.* 1991 Nov; 71(5):2004-11.
- [Koranyi LI, Bourey R.E., Vuorinen-Markkola H, Koivisto VA, Mueckler M, Permutt MA, Yki-Jarvinen H.](#) (1991): Level of skeletal muscle glucose transporter protein correlates with insulin-stimulated whole body glucose disposal in man. *Diabetologia.* 1991 Oct; 34(10):763-5.
- [Koranyi LI, Bourey R.E., Slentz CA, Holloszy JO, Permutt MA.](#) (1991): Coordinate reduction of rat pancreatic islet flucokinase and proinsulin mRNA by exercise training. *Diabetes.* 1991 Mar; 40(3):401-4.
- [Kirwan JP, Bourey R.E., Kohrt WM, Staten MA, Holloszy JO.](#) (1991): Effects of treadmill exercise to exhaustion on the insulin response to hyperglycemia in untrained men. *J Appl Physiol.* 1991 Jan; 70(1):246-50.
- [Bourey R.E., Coggan AR, Kohrt WM, Kirwan JP, King DS, Holloszy JO.](#) (1990): Effect of exercise on glucose disposal: response to a maximal insulin stimulus. *J Appl Physiol.* 1990 Nov; 69(5):1689-94.
- [Henriksen EJ, Bourey R.E., Rodnick KJ, Koranyi L, Permutt MA, Holloszy JO.](#) (1990): Glucose transporter protein content and glucose transport capacity in rat skeletal muscles. *Am J Physiol.* 1990 Oct; 259(4 Pt 1):E593-8.
- [Bourey R.E., Koranyi L, James DE, Mueckler M, Permutt MA.](#) (1990): Effects of altered glucose homeostasis on glucose transporter expression in skeletal muscle of the rat. *J Clin Invest.* 1990 Aug; 86(2):542-7.
- [Bourey R.E., Santoro.](#) (1988): Interactions of exercise, coagulation, platelets, and fibrinolysis--a brief review. *Med Sci Sports Exerc.* 1988 Oct; 20(5):439-46. Review.
- [Papierniak CK, Bourey R.E., Kretschmer RR, Gotoff SP, Colombetti LG.](#) (1976): Technetium-99m labeling of human monocytes for chemotactic studies. *J Nucl Med.* 1976 Nov; 17(11):988-92.
- Borst, M.J., S. M. Pappada, B. D. Cameron, R. E. Bourey, J. D. Lther, D. M. Shipp, A. Chiricolo, T. J. Papadimos. Development of a patient specific neural network model: prediction of glucose levels in a trauma patient. *Patient Safety in Surgery* 2010; 4:15-19.
- Bourey, R.E. and C. P. Lambert. Drug Treatment of Obesity. In: Angelopoulos, T. and J. Rippe. *Obesity: Prevention and treatment.* 2007 CRC Press, Boca Raton. (In Press)