BIOGRAPHICAL SKETCH

NAME: Michael A. Belfort, MD, PhD

eRA COMMONS USER NAME (credential, e.g., agency login):

POSITION TITLE: Chairman and Professor, Department of Obstetrics and Gynecology

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
University of Witwatersrand, Johannesburg	MBBCH	11/1981	Medical Degree
College of Medicine of South Africa	DA(SA)	05/1986	Diploma in Anaesthesia
University of Cape Town, South Africa	Residency	07/1989	Ob/Gyn Residency
Baylor College of Medicine	Residency	07/1993	Ob/Gyn Residency
Baylor College of Medicine	Fellowship	07/1995	MFM Fellowship
University of Cape Town, South Africa	MD	1988-1990	Cerebral Autoregulation (Thesis Degree)
Karolinska Institute, Stockholm, Sweden	PhD	1996-2000	Maternal Cerebral Autoregulation

A. Personal Statement

I am a tenured Professor and Chairman in the Department of Obstetrics and Gynecology at Baylor College of medicine in Houston, Texas and I am Obstetrician and Gynecologist-in-Chief at Texas Children's Hospital in Houston, Texas. I am board certified in Obstetrics and Gynecology and Maternal-Fetal Medicine by the American Board of Obstetrics and Gynecology, and certified as a specialist in Obstetrics and Gynecology by the Royal College of Obstetricians and Gynecologists in England (by examination-FRCOG), the Royal College of Physicians and Surgeons of Canada (by examination-FRCSC), and by the Medical and Dental Council of South Africa (by reciprocity). Prior to taking the Chair at Baylor College of Medicine I served as Director of Perinatal Research, Fetal Therapy and Obstetric Telemedicine at HCA Healthcare in Nashville, TN, and as a Professor in the Department of Obstetrics and Gynecology at the University of Utah School of Medicine and practicing MFM physician at HCA St. Mark's Hospital in Salt Lake City. My research career has been centered on cerebral perfusion. I have a research MD degree from the University of Cape Town with a thesis on neonatal piglet brain blood flow, and a PhD focused on the maternal cerebral physiology and pathophysiology of brain blood flow and cerebral autoregulation in pregnancy and preeclampsia. My clinical and translational research career has revolved around vascular reactivity in normal and complicated pregnancies. We recruited Dr. Yallampalli in September 2013 to lead Basic Sciences Perinatology Research in our department. He came to us after a successful tenure at UTMB for over 25 years. Dr. Yallampalli is an expert on the role of the calcitonin gene-related peptide (CGRP) super family and has spent a lot of his time and effort over the past years in understanding its role in vascular adaptions during pregnancy, placental function, and fetal growth regulation (primarily using rat models). After moving to Baylor, he quickly applied many of his rodent studies to allow study in women. The goal of the proposed studies is to assess whether the actions of complement inhibitory proteins (CIPs) of fetal origin, CD46, CD55, and CD59 on trophoblastic cells, are critical for the proper regulation of C at the fetal-maternal interface in preeclampsia (PE).

The pilot data for have been obtained at Baylor College of Medicine where we have a superb translational research environment including an impressive universal combinatorial obstetrical database and biospecimen repository. Our Peri Bank has more than 36,000 patients entered with an expectation for increasing numbers over time.

My role in the current project will be two-fold: (1) As Chairman of the Department of Obstetrics and Gynecology at Baylor College of Medicine, and as Obstetrician and Gynecologist-in-Chief at Texas Children's Hospital I have influence within Baylor College of Medicine and Texas Children's Hospital that will directly impact the facilitation of all aspects of this application and will be helpful to the goals of the proposed specific aims. (2) As a practicing Maternal Fetal Medicine physician, I will be actively facilitating the collection of placental tissues, as directly and indirectly participating in the enrollment and management of patients for the studies proposed in this grant application. I have knowledge and a clear understanding of the pathophysiology of human pregnancy and I know what is required in terms of commitment and resources to be successful in the Texas Children's and Baylor environments. I work closely with Administration at Texas Children's Hospital and have a good grasp on the financial reality of performing meaningful research in a value-based medical environment.

B. Positions and Honors

Positions and Employment

1994-1996	Assistant Professor (Tenure Track), Baylor College of Medicine, Division of Maternal-Fetal Medicine, Division of Anesthesiology, Houston, TX
1994-1997	Director of Labor and Delivery, Baylor College of Medicine, Ben Taub General Hospital, Houston, TX
1996-1997	Associate Professor (Tenure Track), Baylor College of Medicine, Division of Maternal-Fetal Medicine, Division of Hypertension, Department of Anesthesiology, Houston, TX
1997-2004	Perinatologist, Utah Valley Regional Medical Center, Provo, UT
1997-2000	Associate Professor (Tenure Track), University of Utah School of Medicine Division of Maternal-Fetal Medicine, Salt Lake City, UT
2001-2002	Professor (Tenure Track) University of Utah School of Medicine, Division of Maternal-Fetal Medicine, Salt Lake City, UT
2002-2010	Professor (Tenured) University of Utah School of Medicine, Division of Maternal-Fetal Medicine, Salt Lake City, UT
2004-2010	Perinatologist, St. Mark's Hospital, Salt Lake City, UT
2004-2010	Director of Perinatal Research, HCA Healthcare, Nashville, TN
2007-2010	Director of Fetal Therapy, HCA Healthcare, Nashville, TN
2008-2010	Director of Perinatal Telemedicine, HCA Healthcare, Nashville, TN
2011-	Chairman, Department of Obstetrics and Gynecology, Baylor College of Medicine, Houston, TX
2011-	Professor, Department of Obstetrics and Gynecology, Baylor College of Medicine, Houston, TX
2011-	Professor, Department of Anesthesiology, Baylor College of Medicine, Houston, TX
2011-	Professor, Department of Neurosurgery, Baylor College of Medicine, Houston, TX
2011-	Professor, Department of Surgery, Baylor College of Medicine, Houston, TX
2011-	Obstetrician-in-Chief, Texas Children's Hospital, Houston, TX
2019-	Medical Director, Texas Children's Fetal Center

Honors

1988	Coetzee Price for the Best Research Project, Department of Ob-Gyn, University of Cape Town
1988	Golden Fetus Award for the Best Research Presentation, Department of Ob-Gyn, University of Cape Town
1988	ERC Award, Medical Research Council of South Africa
1988	Merlin Award, Sixth International Congress of the International Society
1988	Best Registrar Publication, SASOG Award and Medal, South African Medical Journal
1989	Best Research Presented, Arial Goldberg Award RCOG, Cuthbert Crichton Research Society Meeting
1989-1990	Berlex Foundation Resident Education Award
1989-1990	Resident of the Year Award, Department of Ob-Gyn, Baylor College of Medicine
1991	Wyeth-Ayerst Resident Award
1994	Faculty Teaching Recognition Award, Department of Ob-Gyn, Baylor College of Medicine
2016	Kathryn Stream Award for Excellence in Women's Health

2018 Baylor College of Medicine Alpha Omega Alpha Faculty Inductee
2020 Distinguished Faculty Award

C. Contribution to Science

Investigation of the hemodynamic and respiratory status of preeclamptic women:

The hemodynamics of preeclampsia are better known now than almost 20 years ago when I started working in the field. My work at that time was centered on defining the cardiac output and basic respiratory parameters (oxygen consumption and delivery) in untreated preeclamptic women, and the effects of volume expansion on these parameters. Using invasive hemodynamic monitoring techniques (Swan Ganz catheterization) we investigated hemodynamics in women with severe preeclampsia in one of the first dedicated maternal ICU units in the world at the University of Cape Town in South Africa. In addition we investigated the effects of various vasodilator drugs on hemodynamic parameters. The findings at the time established the low cardiac output state of severe preeclampsia (previously thought of as being a high cardiac output state), the rapid cardiac output (increase) and peripheral vascular resistance (decrease) responses to volume expansion, and the fact that severe preeclamptics have a fixed oxygen extraction curve much like that seen patients with ARDS.

1. **Belfort MA**, Uys P, Dommisse J, Davey D. Hemodynamic Changes in Gestational Proteinuric Hypertension: The Effects of Rapid Volume Expansion and Vasodilator Therapy. *Br J Obstet Gynaecol* 1989; 96(6):634-41.
2. **Belfort MA**, Anthony J, Buccimazza A, Davey DA. Hemodynamic Changes Associated with Intravenous Infusion of the Calcium Antagonist Verapamil in the treatment of Severe Gestational Proteinuric Hypertension. *Obstet Gynecol* 1990; 75(6):970-4.
3. **Belfort MA**, Anthony J, Kirshon B. Respiratory Function in Severe Gestational Proteinuric Hypertension: The Effects of Rapid Volume Expansion and Subsequent Vasodilatation with Verapamil. *Br J Obstet Gynaecol* 1991; 98(10):964-72.
4. **Belfort MA**, Anthony J, Saade GR, Wasserstrum N, Johanson R, Clark S, Moise KJ Jr. The Oxygen Consumption: Oxygen Delivery Curve in Severe Preeclampsia: Evidence for a Fixed Oxygen Extraction State. *Am J Obstet Gynecol* 1993; 169(6):1448-55.

Investigation of the cerebral hemodynamics in normal and preeclamptic women:

The cerebral hemodynamic state of women with preeclampsia was for many years thought of as one of under perfusion and ischemia. My work has been centered for many years on understanding normal and abnormal cerebral blood perfusion in pregnancy and one of the major contributions I have made has been to understanding at least one of the pathophysiologic mechanisms of cerebral damage in preeclampsia. My work has led to an understanding of the failure of autoregulation in the brain in preeclampsia and that this can be local. This work involved initially determining the normal curves for brain blood velocity and cerebral perfusion pressure in uncomplicated pregnancy and this was a study funded by the AHA. Following the development of normative curves for standard brain blood flow parameters comparative studies were done to show that cerebral perfusion pressure is elevated in preeclampsia and the most common state of perfusion in this condition is overperfusion (hypertensive encephalopathy) rather than under perfusion or ischemia. This work culminated in a randomized clinical trial published in the New England Journal of Medicine that circumstantially proved this hypothesis when it was demonstrated that preeclamptic women receiving a selective cerebral vasodilator had a significantly higher rate of eclampsia than women receiving magnesium sulfate. In addition we have shown that magnesium sulfate reduces cerebral perfusion pressure while not decreasing cerebral blood flow velocity suggesting that this is at least one mechanism of action of this drug in decreasing and treating eclamptic convulsions. Further contributions show that cerebral autoregulation becomes abnormal initially in the middle cerebral artery distribution in preeclampsia, and that smaller diameter vessels are initially spared and protect the distal tissue until late in the disease process. This led to the theory that cerebral damage in preeclampsia is mediated at least in part by “cerebral barotrauma” and that the damage s pressure mediated rather than a high flow phenomenon. Recently, low cerebral perfusion pressure has been shown to occur early on in pregnancy, long before the appearance of clinical hypertension, and this suggests a predictive use for this parameter. Work is ongoing in this regard.

1. **Belfort MA**, Varner MW, Dizon-Townson DS, Grunewald C, Nisell H. Cerebral perfusion pressure, and

not cerebral blood flow, may be the critical determinant of intracranial injury in preeclampsia: A new hypothesis. *Am J Obstet Gynecol* 2002; 187(3):626-34.
2. **Belfort MA,** Anthony JA, Saade GR, Allen JC and the Nimodipine Study Group. A comparison of magnesium sulfate and nimodipine for the prevention of eclampsia. *N Engl J Med* 2003; 348(4):304-11.
3. **Belfort MA**, Van Veen T, White GL, Kofford S, Allred J, Postma I, Varner M. Low Maternal Middle Cerebral Artery Doppler Resistance Indices Can Predict Future Development of Preeclampsia. *Ultrasound Obstet Gynecol* 2012; 40(4):406-11.
4. Van Veen TR, Panerai RB, Haeri S, Singh J, Adusumalli JA, Zeeman GG, **Belfort MA**. Cerebral autoregulation in different hypertensive disorders of pregnancy. *Am J Obstet Gynecol* 2015; 212(4):513.e1-7.

Quality and Safety Research Efforts:

During my tenure at HCA with Steven Clark I was intimately involved in introducing a number of major quality programs in the largest hospital network in the world (HCA Healthcare) - a network of over 130 obstetric facilities nationwide. We performed both retrospective and prospective studies with direct relevance to maternal mortality and morbidity, un-indicated preterm delivery and its risks, and operative vaginal delivery. In one interesting study we demonstrated that recently pregnant women are at increased risk for readmission for 3 specific infections; appendicitis, cholecystitis and pneumonia.

1. Clark S, **Belfort MA**, Saade G, Hankins G, Miller D, Frye D, et al. Implementation of a conservative checklist-based protocol for oxytocin administration: maternal and newborn outcomes. *Am J Obstet Gynecol* 2007; 197(5):480 e1-5. PMID: 17980181.
2. Clark SL, **Belfort MA**, Dildy GA, Herbst MA, Hankins GDV, Meyer JA, "Maternal Death in the 21st Century: Causes, Prevention, and Relationship to Cesarean Delivery" *Am J Obstet Gynecol* 2008; 199(1):36.
3. **Belfort MA**, Clark SL, Saade GR, Kleja K, Dildy GA, van Veen T, Akhigbe E, Frye D, Meyers J. Hospital readmission after delivery: evidence for an increased incidence of nonurogenital infection in the immediate postpartum period. *Am J Obstet Gynecol* 2010; 202:35.e1-7. (Editors Choice)
4. Clark SL, Frye D, Meyers J, **Belfort MA,** Dildy GA, Kofford S, Englebright J, Perlin JA "Reduction in elective delivery at <39 weeks of gestation: comparative effectiveness of 3 approaches to change and the impact on neonatal intensive care admission and stillbirth." *Am J Obstet Gynecol* 2010; 203(5):449.e1-6.

Placenta Accreta:

I have for many years had an interest in placenta percreta and was one of the first proponents of a multidisciplinary approach to the management of this condition. Since my arrival in Houston we have set up a placenta percreta team and have been committed to providing the most comprehensive management solutions for this devastating condition.

1. Hudon L, **Belfort MA**, Broome DR. "Diagnosis and Management of Placenta Percreta: A Review." *Obstet Gynecol Surv* 1998; 53(8):509-17.
2. **Belfort MA**. Publications Committee, Society for Maternal-Fetal Medicine, Placenta Accreta. *Am J Obstet Gynecol*. 2010; 203(5):430-9.
3. Shamshirsaz AA, Salmanian B, Fox KA, Diaz-Arrastia CR, Lee W, Baker BW, Ballas J, Chen Q, Van Veen TR, Javadian P, Sangi-Haghpeykar H, Zacharias N, Welty S, Cassady CI, Moaddab A, Popek EJ, Rocky Hui SK, Teruya J, Bandi V, Martin SR, Coburn M, Cunningham T, **Belfort MA**. "Maternal morbidity in patients with morbidly adherent placenta treated with and without a standardized multidisciplinary approach." *Am J Obstet Gynecol* 2015; 212(2):218.e1-9.
4. Fox KA, Shamshirsaz A, Carusi D, Secord AA, Lee P, Turan O, Huls C, Abuhamad A, Hyagriv S, Barton J, Wright J, Silver R, **Belfort MA**. Conservative management of morbidly adherent placenta: Expert Review. *Am J Obstet Gynecol* 2015; 213(6):755-60.

Fetal Surgery:

Since my arrival at Baylor I have focused on the establishment of the nations' most comprehensive Fetal Center at Texas Children's Hospital. We have recruited some of the world's most experienced imagers and

fetal treatment experts and our Fetal Center now offers the most comprehensive package of fetal therapies in the world – tracheal occlusion for congenital diaphragmatic hernia, laser therapy for twin twin transfusion syndrome and other conditions, fetal cardiac procedures for hypoplastic left ventricle and severe aortic stenosis, and most recently innovative fetoscopic surgery for the repair of open neural tube defects.

1. Ruano R, Rodo C, Peiro JL, Shamshirsaz A, Haeri S, Nomura ML, Salustiano EM, de Andrade KK, Sangi-Haghpeykar H, Carreras E, **Belfort MA**. Fetoscopic laser ablation of the placental anastomoses in twin-twin transfusion syndrome using the "Solomon" technique." *Ultrasound Obstet Gynecol* 2013; 42(4) 434-9.
2. Peiro JL, Fontecha CG, Ruano R, Esteves M, Fonseca C, Marotta M, Haeri S, **Belfort MA**. Single-Access Fetal Endoscopy (SAFE) for myelomeningocele in sheep model I: amniotic carbon dioxide gas approach. *Surg Endosc* 2013; 27(10):3835-40.
3. Ruano R, Ali RA, Patel P, Cass D, Olutoye O, **Belfort MA**. "Fetal endoscopic tracheal occlusion for congenital diaphragmatic hernia: indications, outcomes, and future directions." *Obstet Gynecol Surv* 2014; 69(30):147-58
4. **Belfort MA**, Whitehead WE, Shamshirsaz AA, Ruano R, Cass DL, Olutoya OO. Fetoscopic Repair of Meningomyelocele. *Obstet Gynecol* 2015; 126(4):881-4.
5. Dong Y, Betancourt A, Chauhan M, Balakrishnan M, Lugo F, Anderson ML, Espinoza J, Fox K, **Belfort MA**, Yallampalli C. "Pregnancy Increases Relaxation in Human Omental Arteries to the CGRP Family of Peptides." *Biol Reprod* 2015; 93(6):134.

D. Research Support

Ongoing Research Support

K12HD103087 **Belfort (PI)** 2020-2025
NIH
The ultimate goal is to prepare the future academic research leaders in Obstetrics and Gynecology who are prepared to ask and comprehensively address the most important research questions that when answered can ultimately improve women's health.

5R01 HL 58144-18 Co-Investigator, (Chauhan, Yallampalli) 01/15/2019–11/31/2023
NIH/NHLBI
Sex Steroid Hormones and Calcitonin Gene-Related Peptide
The major goals of this project are to determine role of calcitonin gene-related peptide family peptides in vascular adaptations in pregnant and in steroid hormone treated rats. These include studies on the effects of pregnancy and steroid hormone on 1) regulation of peptide expressions; 2) CGRP family peptide modulation of blood pressure fetal growth, placental function; and 3) the mechanisms involved.

1R44HD096987-01 Orejuela (PI) 2018-2020
NIH 0.60 calendar months
The primary goal of this project is to evaluate the preliminary safety and feasibility of the maternal medical device to shorten delivery time during childbirth.

5R01 HL 58144-18 Co-Investigator, (Chauhan, Yallampalli) 01/15/2019–11/31/2023
NIH/NHLBI
Sex Steroid Hormones and Calcitonin Gene-Related Peptide
The major goals of this project are to determine role of calcitonin gene-related peptide family peptides in vascular adaptations in pregnant and in steroid hormone treated rats. These include studies on the effects of pregnancy and steroid hormone on 1) regulation of peptide expressions; 2) CGRP family peptide modulation of blood pressure fetal growth, placental function; and 3) the mechanisms involved.

Completed Research Support

R43 HD094456 Varadhachary (PI) 2017-2018
NIH
The primary goal of this project is to evaluate a novel cinching-dual anchor device in rabbit and sheep models.