

## CURRICULUM VITAE

**NAME:** Joseph Randall Moorman, M.D.

**PRESENT POSITION:** Professor of Medicine, Physiology and Biomedical Engineering  
University of Virginia

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**EDUCATION:**  
1971-74 B.A. with special distinction, University of Mississippi, Oxford MS  
1974-78 M.D. cum laude, University of Mississippi Medical Center, Jackson, MS

### **POST-GRADUATE EDUCATION**

1978-79 Medical Internship, Duke University Medical Center, Durham, NC  
1979-81 Medical Residency, Duke University Medical Center  
1981-82 Clinical Cardiology Fellowship, Duke University Medical Center  
1982-83 Chief Medical Resident, Duke Hospital  
1983-85 Cardiology Research Fellowship, Duke University Medical Center

### **FACULTY APPOINTMENTS**

1982-85 Associate in Medicine, Duke University Hospital, Durham, NC  
1985-90 Assistant Professor of Medicine, UTMB, Galveston, Texas  
1990-2002 Associate Professor of Medicine and Physiology, University of Virginia  
2002- Professor of Medicine and Physiology, University of Virginia  
2009- Professor of Biomedical Engineering, University of Virginia

### **OTHER POSITIONS AND HONORS**

2013-16 Vice-president, Society for Complex Acute Illness  
2014 University of Virginia Innovator of the Year  
2014-20 Editor-in-chief, *Physiological Measurement*  
2016- Founding director, UVa Center for Advanced Medical Analytics

### **BOARD CERTIFICATION:**

Diplomate of American Board of Internal Medicine  
Internal Medicine (1981)  
Cardiovascular Diseases (1983)

**Selected publications on mathematical time series analysis:**

Lake DE, **Moorman JR**. Accurate estimation of entropy using very short physiological time series: the problem of atrial fibrillation detection in implanted ventricular devices. *American Journal of Physiology. Heart Circ Physiol*. 300:H319-25, 2011. PMID 21037227

Moss TJ, Lake DE, **Moorman JR**. Local dynamics of heart rate: detection and prognostic implications. *Physiological Measurement* 2014. 35:1929-42.

Carrara M, Carozzi L, Moss TJ, de Pasquale M, Cerutti S, Ferrario M, Lake DE, **Moorman JR**. Heart rate dynamics distinguish among atrial fibrillation, normal sinus rhythm and sinus rhythm with frequent ectopy. *Physiological Measurement* 36: 1873-1888, 2015.

DeMazumder D, Lake DE, Cheng A, Moss TJ, Guallar E, Weiss RG, Tomaselli GF, **Moorman JR**. Dynamic analysis of cardiac rhythms for discriminating atrial fibrillation from lethal ventricular arrhythmias. *Circulation Arrhythmia and Electrophysiology*. 2013; 6:555-61. PMID: 23685539

Lake DE, Richman JS, Griffin MP, **Moorman JR**. Sample Entropy analysis of neonatal heart rate variability. *American Journal of Physiology*, 283: R789-797, 2002. **\*\* Cited more than 800 times.**

Richman JS, **Moorman JR**. Physiological time series analysis using approximate entropy and sample entropy. *American Journal of Physiology*, 278: H2039-2049, 2000. **\*\* Cited more than 3900 times.**

**Selected publications on predictive monitoring in adults:**

Ruminski CM, Clark MT, Lake DE, Kitzmiller RR, Keim-Malpass J, Robertson MP, Simons TR, **Moorman JR**, Calland JF. Impact of predictive analytics based on continuous cardiorespiratory monitoring in a surgical intensive care unit. *J Clin Monit Comput*. 2018

Blackburn HN, Clark MT, **Moorman JR**, Lake DE, Calland JF. Identifying the low risk patient in surgical intensive and intermediate care units using continuous monitoring. *Surgery*. 2018 163:811-818. PMID:29433853

Keim-Malpass J, Kitzmiller RR, Skeeles-Worley A, Lindberg C, Clark MT, Tai R, Calland JF, Sullivan K, **JR Moorman**, Anderson RA. Advancing Continuous Predictive Analytics Monitoring: Moving from Implementation to Clinical Action in a Learning Health System. *Critical Care Nursing Clinics of North America* 2018

Moss TJ, Clark MT, Calland JF, Enfield KB, Voss JD, Lake DE, **Moorman JR**. Cardiorespiratory dynamics measured from continuous ECG monitoring improves detection of deterioration in acute care patients: A retrospective cohort study. *PLoS One*. 2017 Aug 3;12(8):e0181448. PMID:28771487

Moss TJ, Calland JF, Enfield KB, Gomez-Manjarres DC, Ruminski C, DiMarco JP, Lake DE, **Moorman JR**. New-onset atrial fibrillation in the critically ill. *Crit Care Med*. 45:790-797, 2017. PMID:28296811. **Featured article: editorial accompanies.**

Blackburn HN, Clark MT, Moss TJ, Young JS, **Moorman JR**, Lake DE, Calland JF. External validation in an intermediate unit of a respiratory decompensation model trained in an intensive care unit. *Surgery*. 2017. 161(3):760-770. PMID:27894709

Moss TJ, Lake DE, Calland JF, Enfield KB, Delos JB, Fairchild KD, **Moorman JR**. Signatures of subacute potentially catastrophic illness in the ICU: model development and validation. *Crit Care Med*. 2016;44:1639-48. PMID:27452809. **Featured article: editorial accompanies.**

Carrara M, Carozzi L, Moss TJ, de Pasquale M, Cerutti S, Lake DE, **Moorman JR**, Ferrario M. Classification of cardiac rhythm using heart rate dynamical measures: validation in MIT-BIH databases. *J Electrocardiol* 48: 943-946, 2015.

Politano AD, Riccio LM, Lake DE, Rusin CG, Guin LE, Josef CS, Clark MT, Sawyer RG, **Moorman JR**, Calland JF. Predicting the need for urgent intubation in a surgical/trauma intensive care unit. *Surgery*. 2013; 154: 1110-1116. PMID: 24075272

### **Selected publications on predictive monitoring in infants:**

- Fairchild KD, Lake DE, Kattwinkel J, **Moorman JR**, Bateman DA, Grieve PG, Isler JR, Sahni R. Vital signs and their cross-correlation in sepsis and NEC: a study of 1,065 very-low-birth-weight infants in two NICUs. *Pediatr Res*. 2017. Epub 2016 Nov 3. PMID:28001143
- Lake DE, Fairchild KD, **Moorman JR**. Complex signals bioinformatics: evaluation of heart rate characteristics monitoring as a novel risk marker. *Journal of Clinical Monitoring and Computing* 2014. 28: 329-39. PMID 2424844.
- Fairchild KD, Schelonka RL, Kaufman DA, Carlo WA, Kattwinkel J, Porcelli PJ, Navarrete CT, Bancalari E, Aschner JL, Walker MW, Perez JA, Palmer C, Lake DE, O'Shea TM, **Moorman JR**. Septicemia mortality reduction in a heart rate characteristics monitoring trial. *Pediatric Research* 2013. 74: 570-5. PMID: 2394255
- Clark MT, Vergales BD, Paget-Brown AO, Smoot TJ, Lake DE, Hudson JL, Delos JB, Kattwinkel J, **Moorman JR**. Predictive monitoring for respiratory decompensation leading to urgent unplanned intubation in the Neonatal Intensive Care Unit. *Pediatric Research*. 2013 73:104-10. PMID: 23138402
- Moorman JR**, Rusin CG, Lee H, Guin LE, Clark MT, Delos JB, Kattwinkel J, Lake DE. Predictive monitoring for early detection of subacute potentially catastrophic illnesses in critical care. *Conf Proc IEEE Eng Med Biol Soc*. 2011;2011:5515-8
- Moorman JR**, Carlo WA, Kattwinkel J, Schelonka RL, Porcelli PJ, Navarrete CT, Bancalari E, Aschner JL, Walker MW, Perez JA, Palmer C, Wagner DP, Stukenborg GJ, Lake DE, O'Shea TM. Mortality reduction by heart rate characteristic monitoring in very low birth weight neonates: a randomized trial. *Journal of Pediatrics*. 159: 900-906, 2011. PMID 21864846

### **Selected editorials and letters:**

- Moorman JR**, Lake DE, Moss TJ. Computers in white coats: how to devise useful clinical decision support software. *Crit Care Med*. 2016;44:1449-50. PMID:27309173
- Moorman JR**, Lake DE, Ivanov PCh. Early detection of sepsis--a role for network physiology? *Crit Care Med*. 2016;44:e312-3. PMID:27083036

### **U.S. PATENTS**

- 1 9,962,101 Analysis of cardiac rhythm using RR interval characterization
- 2 9,839,364 Ventricular activation (RR) entropy change as a predictor of sudden cardiac death in cardiac resynchronization therapy patients
- 3 8,983,584 Method, system and computer program product for non-invasive classification of cardiac rhythm
- 4 8,588,908 System, method and computer program product for detection of changes in health status and risk of imminent illness
- 5 7,774,050 Method and apparatus for the early diagnosis of subacute, potentially catastrophic illness
- 6 7,519,417 Quantitative fetal heart rate and cardiocotographic monitoring system and related method thereof
- 7 6,923,763 Method and apparatus for predicting the risk of hypoglycemia
- 8 6,856,831 Method for the early diagnosis of subacute, potentially catastrophic illness
- 9 6,804,551 Method and apparatus for the early diagnosis of subacute, potentially catastrophic illness
- 10 6,330,469 Method and apparatus for the early diagnosis of subacute, potentially catastrophic illness
- 11 6,216,032 Method and apparatus for the early diagnosis of subacute, potentially catastrophic illness