36th Annual International Conference of the
IEEE Engineering in Medicine and Biology Society

"Discovering, Innovating, and Engineering Future Biomedicine"

Sheraton Chicago Hotel and Towers
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EMBC 2014

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EMBC'14 Pre-Conference Workshop
August 26, 2014 (8:30 AM – 5:30 PM)

"Computational modeling and dynamic imaging in pediatric upper airway disorders"

Abstract

While abnormalities in upper airway structure and function affect only 3 percent of the general pediatric population, upper airway dysfunction is present in up to 50% in children with congenital syndromes. The congenital conditions of Pierre Robin syndrome and subglottic stenosis involve, respectively, jaw and soft tissue malformations. The dramatic increase of overweight and obesity in children over the past two decades has led to the high prevalence of Sleep Related Breathing Disorders amongst children. Obstructive Sleep Apnea occurs in 50-100% of patients with Down's syndrome and significantly cause and exacerbate medical problems in these patients. With rapidly advancing computer technology, powerful bioengineering tools are now available for investigating physiological dynamics in the respiratory tract. Airway geometries may be derived from a variety of 3D medical imaging modalities such as optical coherence tomography, magnetic resonance imaging and computed tomography. Computational methods are being developed that incorporate the effects of structure fluid interactions to account for soft tissue deformations and critical phenomena such as airway collapse. Furthermore, the computed geometry can be virtually modified in a manner reflecting medical intervention, surgical techniques, and normal growth and development, to predict changes in airway geometry, in airflow and pressure distribution. This workshop showcases the efforts taken by 5 NHLBI-funded centers to apply a multidisciplinary approach that combines state-of-the-art computational modeling, dynamic imaging and physiological measurements with the ultimate goals of improving diagnostic precision and providing more objective assessments of alternative therapeutic modalities.

Organizer & Workshop Chair

Michael C.K. Khoo, Professor of Biomedical Engineering and Pediatrics at the University of Southern California at Los Angeles.

List of Speakers and Titles of Presentations

- **Krishna Nayak & Yoon-Chul Kim (USC):**
  Dynamic MR imaging of the pediatric upper airway during sleep onset

- **Zhongping Chen & Brian Wong (UCI):**
  Reconstruction of upper airway structure from OCT images

- **David Wootton (Cooper Union):**
  Computational Modeling of the upper airway in adolescent girls with polycystic ovarian syndrome based on dynamic MR imaging

- **Ephraim Gutmark (U Cincinnatti):**
  Dynamic computational modeling of obstructive sleep apnea in down syndrome

- **Sorin Mitran & Richard Superfine (UNC):**
  Predictive modeling for treatment of upper airway obstruction in young children

- **Said Elghobashi (UCI):**
  Direct numerical simulation of the flow in the pediatric upper airway

- **Michael Khoo & Leonardo Nava-Guerra (USC):**
  Factors not involving the upper airway that lead to ventilatory instability in pediatric sleep-disordered breathing – effects of state and chemoreflex control

- **Brad Davis (Kitware, Inc):**
  Development of a pediatric upper airway atlas for the assessment of normal growth and subglottic stenosis

- **Robert Fleck & Sally Shott (U Cincinnatti):**
  The current state of diagnosis and treatment of obstructive sleep apnea

- **PANEL DISCUSSION:**
  "The role of computational modeling in improving outcomes for children with upper airway disorders – impact of work to date, limitations, future research priorities", Raouff Amin (U Cincinnatti), Stephanie Davis (Indiana U), Brian Wong (UCI), Sally D. Ward (USC)