Mathematical Modeling of Cystic Fibrosis

Cystic fibrosis (CF) is the most common autosomal recessive disease in Caucasians associated with early mortality with a reported incidence of 1 in 3200 live births. Host inflammatory responses result in airway mucus plugging, airway wall edema and eventual destruction of airway wall support structure. Despite very aggressive treatment, the median age of survival is approximately 38 years.

This work is the first attempt to describe CF patients’ spirometric data using a dynamic model of the disease. The parameters in our model were identified using values of forced expiratory volume in one second (FEV1) as a function of age for patients at the University of California San Diego Adult Cystic Fibrosis Center. The model uses the known fractal structure of bronchioles in the lung. In this research, we simulate the lung function of CF patients by using a physiological model of infection in CF lungs. The goal of our research is to use mathematical and statistical modeling techniques to better understand and control Cystic Fibrosis by capturing the complexity of interactions underlying disease activity.

Sara Zarei, Ali Mirtar, Forest Rohwer, Douglas J. Conrad, and Peter Salamon

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