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## Inference of Gene Expression in Asthma – A Future Vision

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### ABSTRACT

Asthma is the common chronic inflammatory disease of the airways characterized by variable and recurring symptoms, reversible airflow obstruction, and bronchospasm. An attack may be triggered if a susceptible individual is exposed to an allergen or irritants. Allergies are inappropriate responses by the body's immune system to a substance that is not normally harmful. Thus, the allergic response becomes a disease in itself. Adhatoda Vasica leaves have been used extensively in Ayurvedic Medicine primarily for respiratory disorders. From the study on asthma and allergy 5 Genes were selected on the basis of sudden increased of IgE level, asthma attack and the gene which plays major role in inheritance and pathogenesis of asthma: FCER1A, CHI3L1, ADAM33, PHF11, and IL4R. The result of the study will provide the Chromosomal number of the gene, gene expression, signalling gene which is transferred from parent to offspring (inheritance), and the gene used in the treatment for asthma from Adathoda Vasica using various Bioinformatics tools. The future aspect of this study is to develop a Peak Expiratory Flow Calculator (Lung function Calculator) using .NET language, which estimates the asthma content in every individual according to the value predicted by the calculator.

**Keywords:** Asthma, Bronchospasm, Allergies, Adhatoda Vasica, Respiratory disorders.

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## INTRODUCTION

Asthma is a disorder that causes the airways of the lungs to swell and narrow, leading to wheezing, shortness of breath, chest tightness, and coughing. Asthma is caused by inflammation in the airways. Many people with asthma have a personal or family history of allergies, such as hay fever (allergic rhinitis) or eczema. Others have no history of allergies[2].

Asthma attack is a series of things happening in your lungs and airways that all contribute to the symptoms of an asthma attack. The cells that line your airways create and excrete more mucus than they normally do. This creates an excess that clogs the airways and makes breathing more difficult. This mucus can also settle in the lungs creating breathing problems by filling the air pockets that would normally hold the air you breathe. The muscles in your airways tighten. These muscles are wrapped around the airways and when they tighten they constrict the airways and cause them to narrow[9]. The activated T-lymphocytes also direct the release of inflammatory mediators from eosinophils, mast cells, and lymphocytes[6].

In asthma, there is infiltration of mast cells, basophils, eosinophils, lymphocytes, macrophages etc. into the bronchial mucosa and these cells along with the cells of the respiratory tracts such as epithelial cells, endothelium, smooth muscles etc. bring about airway inflammation and airway remodelling. Airway remodelling refers to the structural changes of the surface of the airway that lead to its narrowing and constriction[1]., Vascular endothelial growth factor (VEGF) is a potent inducer of endothelial cells, which may contribute to chronic inflammation and angiogenesis[5].

Asthma, like several common diseases such as diabetes and atherosclerosis, occurs in families and thus probably has a complex polygenic basis, in which environmental factors also play a role[8]. The maternal inheritance of the allergies may be due to the mother's influence on the child's immunity as it is developing in the womb - via antibodies she produces, or substances in the food she eats. After birth, breast milk contains a high proportion of the mother's antibodies, white blood cells and substances from her diet. These factors could cause subtle changes in the infant's immunity and alter the risk of developing allergies in adult life [7].

If gene therapy for asthmatics were to be developed - years from now - doctors claim it would only be suitable for people with very severe asthma that is unresponsive to all other treatments [4].

Adhatoda vasica is a well-known plant drug in Ayurvedic and Unani medicine. Adhatoda leaves have been used extensively in Ayurvedic Medicine primarily for respiratory disorders. The medicinal properties of Adhatoda vasica, called Vasa or Vasaka in Sanskrit have been known in India and several other countries for thousands of years [3, 10].

Asthma diagnosis is usually based on the pattern of symptoms, response to therapy over time, and spirometry. It is clinically classified according to the frequency of symptoms, forced expiratory volume in one second (FEV1), and peak expiratory flow rate. In medical

Peak flow meters (instrument) is used to measure the peak expiratory flow rate, important in both monitoring and diagnosing asthma.

## MATERIALS AND METHODS

### Databases Used

**NCBI:** NATIONAL CENTER FOR BIOTECHNOLOGICAL INFORMATION.

**UNIPROT:** Universal Protein Resource.

### Tools Used

**AlgPred:** prediction of allergenic proteins and mapping of IgE epitopes.

**DisEMBI:** Intrinsic Protein Disorder Prediction.

**GeneBuilder:** Gene structure Prediction System.

**SpliceView:** Splicing signals prediction.

**APOLLO:** Apollo is a genomic annotation viewer and editor. It was originally developed as a collaboration between the Berkeley Drosophila Genome Project.

**Microsoft.NET, Visual Studio 2008 Command Prompt.**

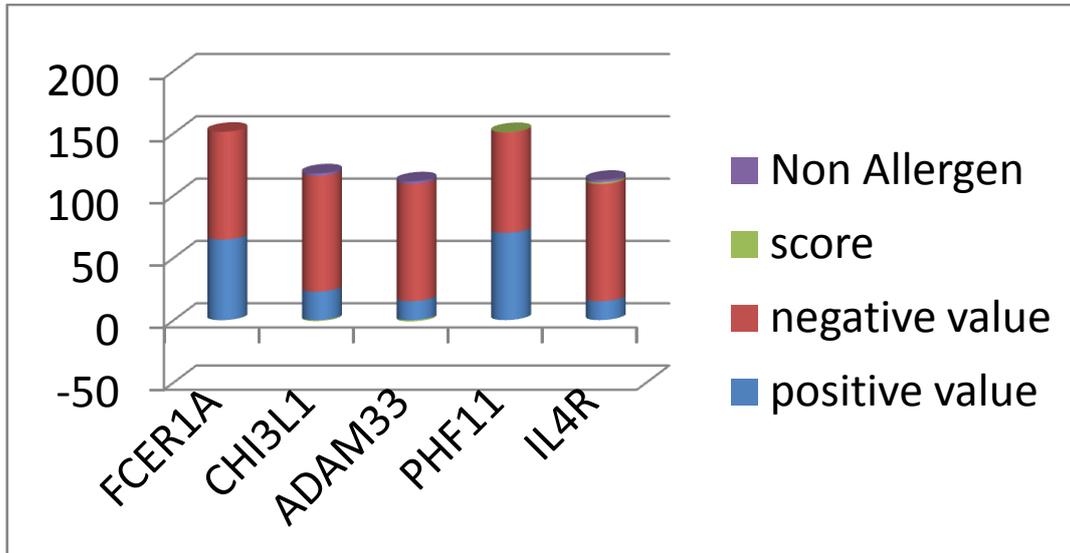
## METHODS

- **Step1:** Study of all the genes which are responsible for asthma with the help of Uniprot.
- **Step2:** Select 5 important genes On the basis of Genes which are responsible for sudden increased of IgE level and sudden asthma attack and gene which plays major role in inheritance and pathogenesis of asthma.
- **Step3:** Predict and differentiate the allergic and non-allergic protein with the help of AlgPred online tool.
- **Step4:** Developing a graphical representation of the predicted values obtained from AlgPred.
- **Step5:** Predicting the disorder allergic protein using DisEMBL Tool.
- **Step6:** Develop the Gene model of allergic protein using Gene Builder Tool.
- **Step7:** Predict the Signalling sequence of non-allergic protein using SpliceView Tool, and identify the Chromosomal location of the gene.
- **Step8:** Annotation of Adhatoda Vasika which is used for the treatment of Asthma by Apollo Offline Tool.

- **Step9:** Execute the .Net language program by using Microsoft .Net Framework and Visual Studio2008, command Promt.

### EXPERIMENTAL

Fig:1 GRAFICAL REPRESENTATION OF ALL THE ALLERGIC GENE PREDICTION USING ALGPRED:



### RESULTS AND DISCUSSION

Fig:2 Gene model of FCER1A

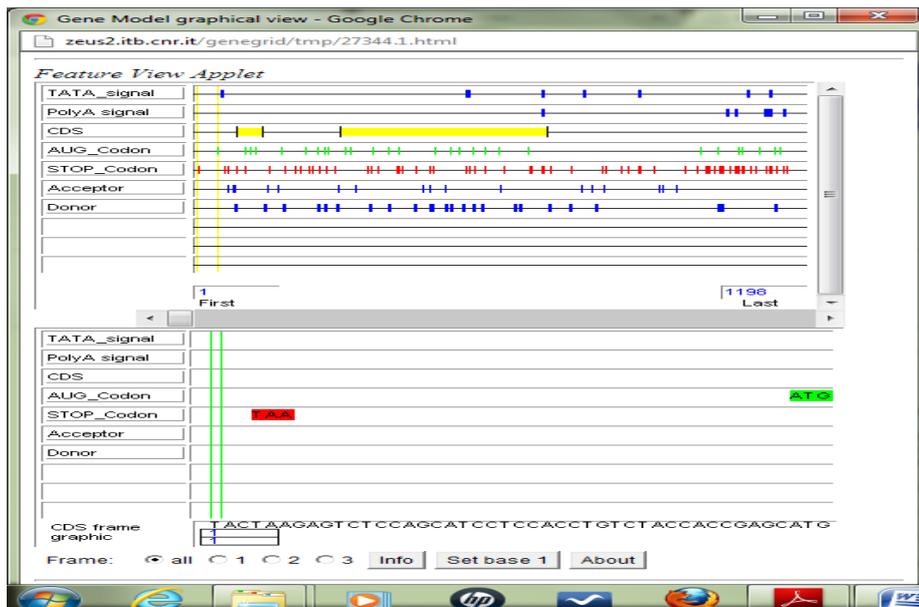


Fig:3 Gene model of PHF11

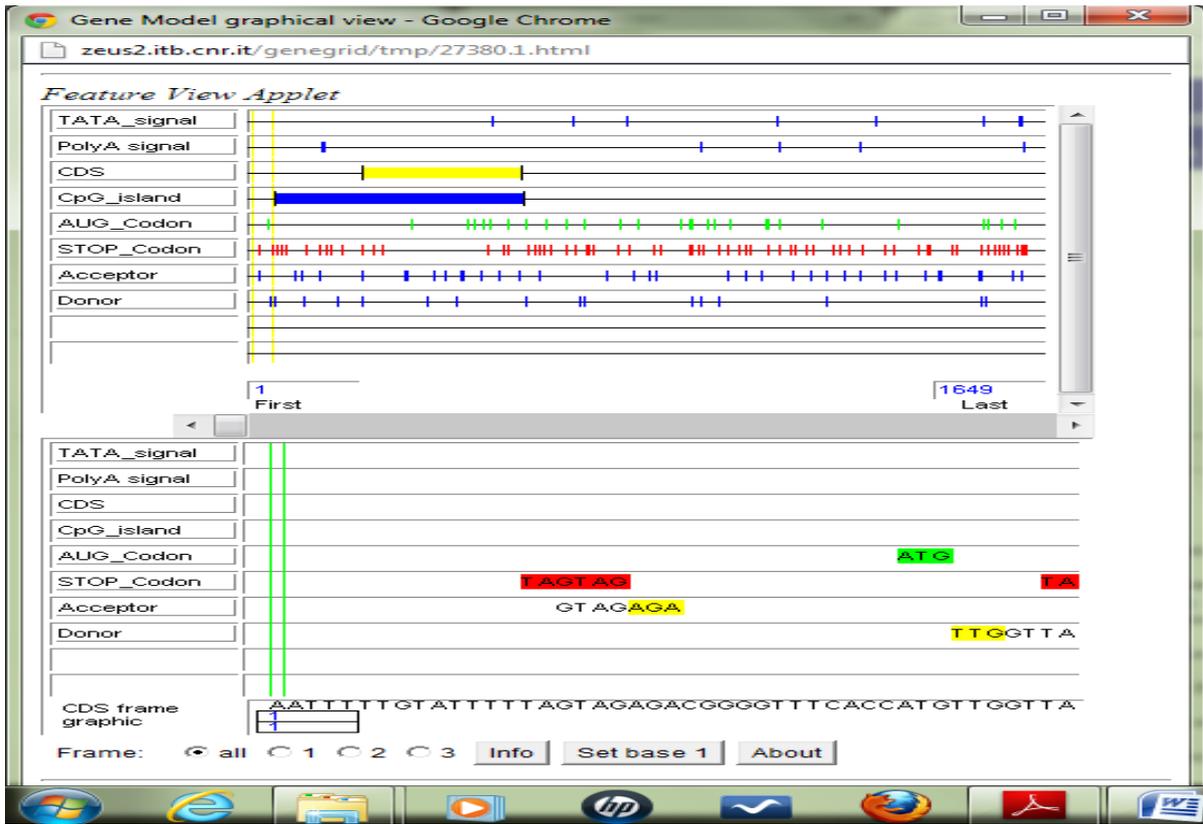


Fig:4 Annotation result of Adhatoda Vasika

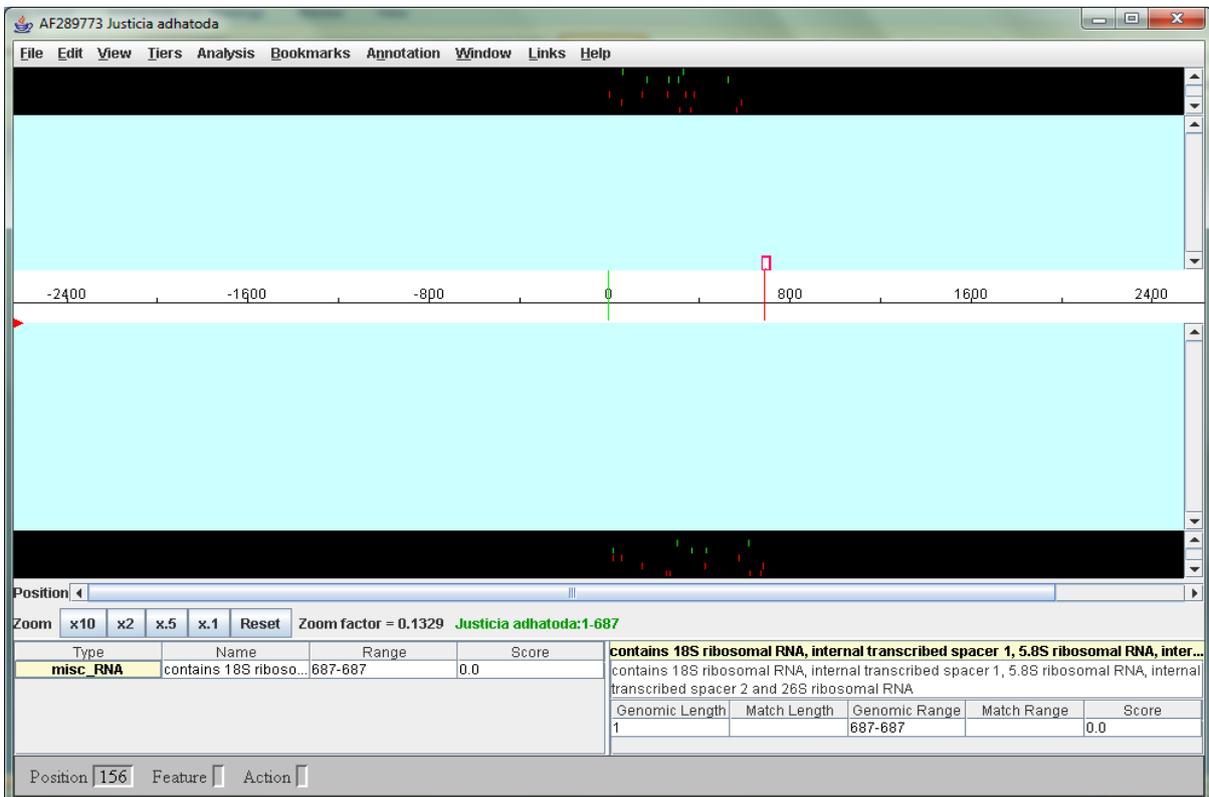
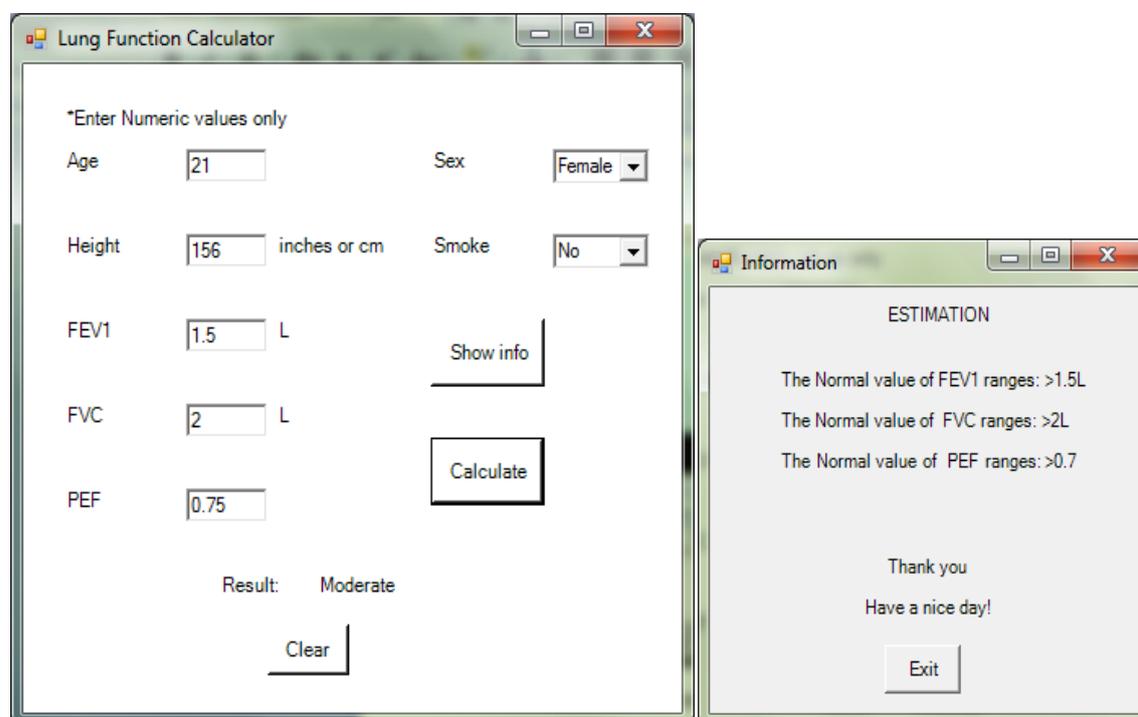


Fig:5 .NET Language (Lung Function Calculator)



### CONCLUSION

- ✓ Cytokine production by the mother/placenta/fetus at critical times during the development of the fetal-infant immune system could alter the final outcome in terms of whether the response to a particular antigen is of a Th1 or Th2 phenotype.
- ✓ FCER1A & PHF11 genes are linked to asthma and atopy, or related phenotypes like elevated IgE levels, wheezing, and bronchial hyperresponsiveness. (Th1 gene expression).
- ✓ A promoter SNP in the *CHI3L1* gene that encodes the chitinase-like YKL-40 plays major role in increasing proliferation, migration of bronchial smooth muscle cells and inflammation in pathogenesis of asthma.
- ✓ ADAM33 gene plays a major role in airway remodelling and their expression with asthma during pathogenesis.
- ✓ IL4R responses are involved in regulating IgE production and, chemokine and mucus production at sites of allergic inflammation.
- ✓ N-oxides of vasicine – Vasicinone (Quinazoline Alkaloids) found in *Adhatoda vasica* have the capability to treat Asthma.
- ✓ The Lung Function Calculator will predict the asthma level in the individual.



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