

# Diagnositics in asthma

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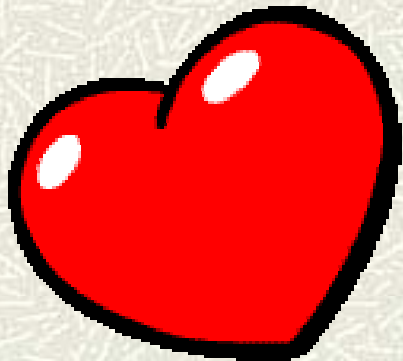
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*Zagreb*

*Croatia*

# Asthma is like love...

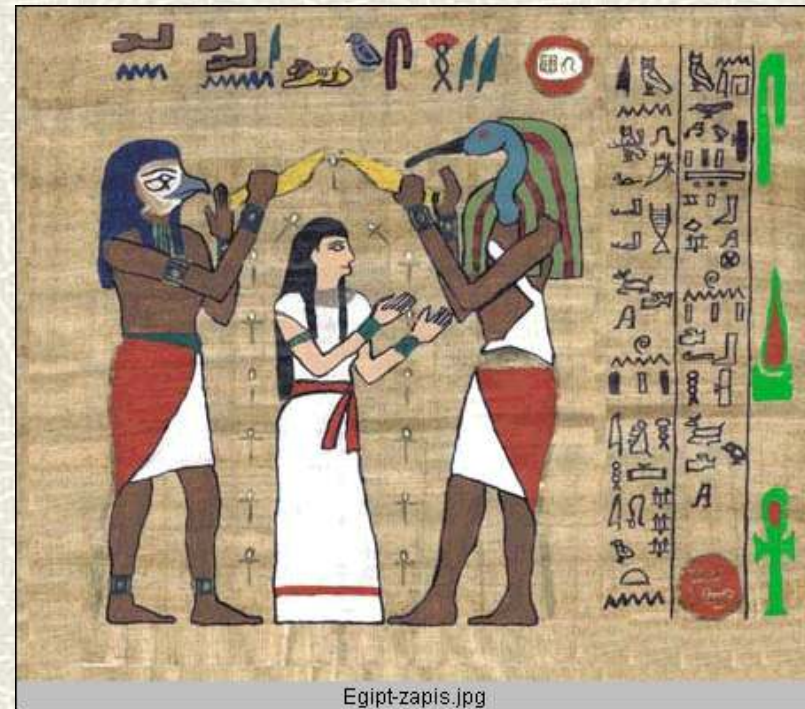
- ◆ Everybody knows what it is, but no one could define it completely



# Interest for asthma from an ancient time...

- Written documents about asthma in 3500 B.C. from Egyptian Empire.

- \*Asthma is a Greek word, means gasping



Egipt-zapis.jpg

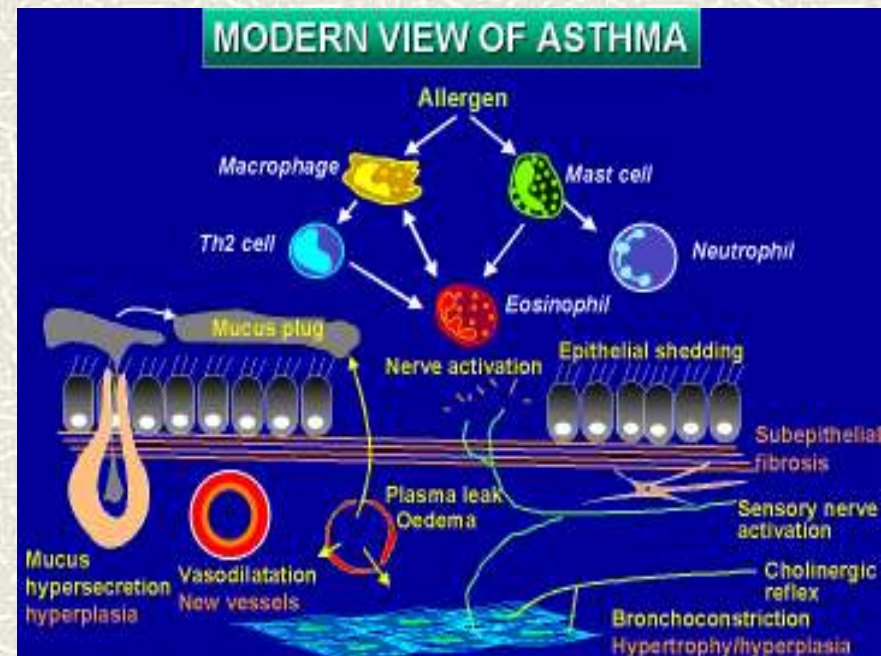
# Asthma today



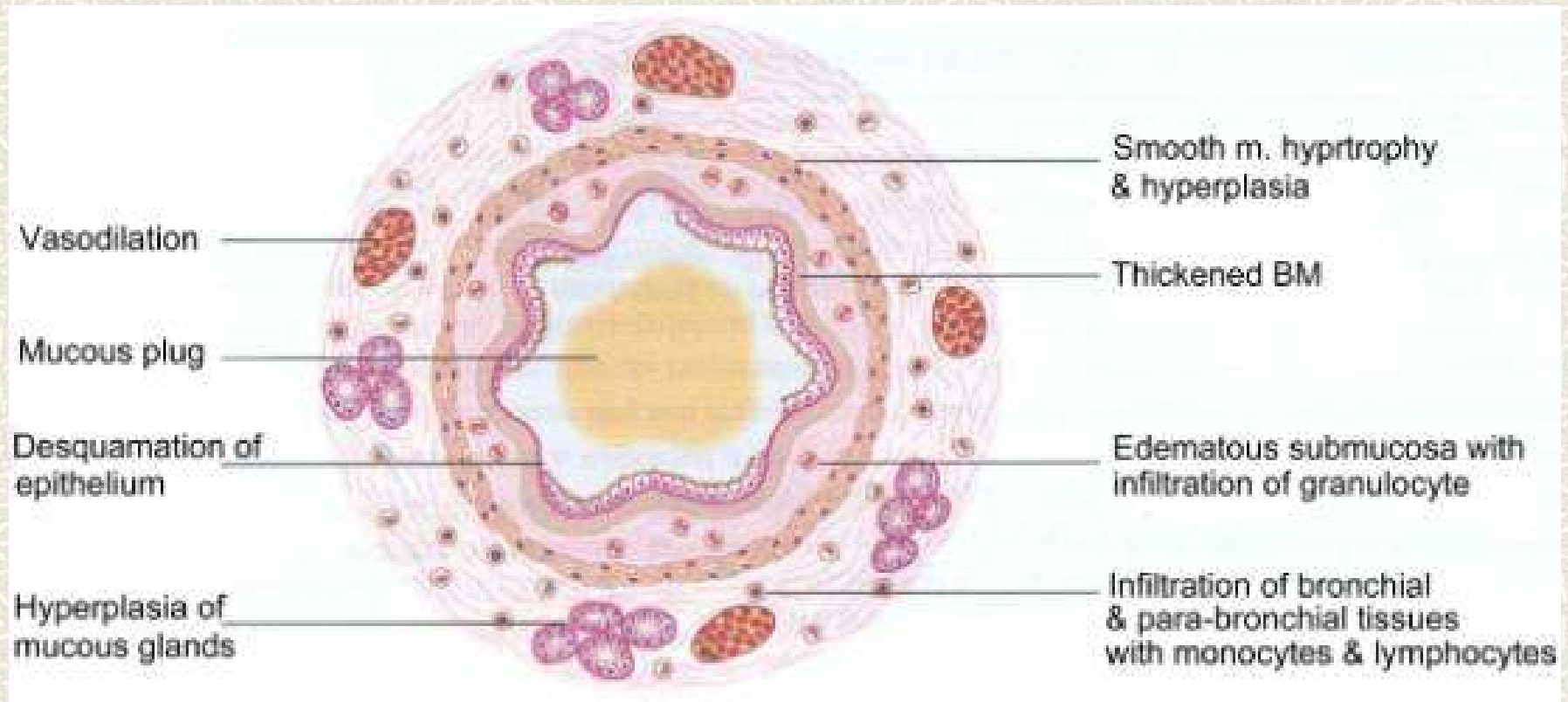
- # 300 million people with asthma in the world
- # Prevalence of asthma is 50% bigger each decade
- # If the trend in asthma prevalence sustains untill 2050. it will be more 100 million new asthma patients
- # Mortality in asthma 5/100.000

# Damage of epithelial cell (by allergens, viruses, drugs, irritants...) activates secretion of cytokines, chemokines

- A chronic **inflammatory** disorder of the airways
- Many **cells and cellular elements** play a role
- Chronic inflammation is associated with airway **hyperresponsiveness** that leads to recurrent episodes of wheezing, breathlessness, chest tightness, and coughing
- Widespread, variable, and often **reversible** airflow limitation



# Damage in all bronchial levels



# Asthma definition

## KEY POINTS:

Asthma is a chronic inflammatory disorder of the airways characterized by variable and recurring symptoms, triggered by a variety of factors and episodes of wheezing, breathlessness, chest tightness and coughing, particularly at night and/or in the early morning. These symptoms are usually recurrent, often severe, and associated with widespread and persistent airflow limitation that is not fully reversible. The airflow limitation is usually not fixed and is not permanent, and is not fully reversible either spontaneously or with treatment.

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Asthma is a chronic inflammatory disorder of the airways characterized by variable and recurring symptoms, triggered by a variety of factors and episodes of wheezing, breathlessness, chest tightness and coughing, particularly at night and/or in the early morning. These symptoms are usually recurrent, often severe, and associated with widespread and persistent airflow limitation that is not fully reversible. The airflow limitation is usually not fixed and is not permanent, and is not fully reversible either spontaneously or with treatment.

# First part of the asthma definition- inflammation

- # “Asthma is a chronic inflammatory disorder of the airways in which many cells and cellular elements play a role”
- # **Objectivisation of inflammation proces in bronchi:**
  1. **FeNO**: Increased concentration of NO in exhaled airflow
  2. **Eosinophiles** in sputum and peripheral blood smear
  3. Increased level of **ECP** in serum
  4. Lowered **pH** in exhaled air



# Second part of the asthma definition – clinical presentation

- # “The chronic inflammation is associated with bronchial hyperresponsiveness that leads to recurrent episodes of wheezing, breathlessness, chest tightness, particularly at night and early in the morning.”
- # Anamnesis also:
- # cough more than 10 days without fever
- # Symptoms of rhinitis (“*United airways*”), rhinitis could be early stage of asthma
- # In each patient with rhinitis, we should search for asthma, because asthma is 3x more often in rhinitic patients



# Clinical difference of asthma and COPD

■ <b>ASTHMA</b>	■ <b>COPD</b>
■ <i>Beginning of disease</i> : < 30y	■ > 40 years
■ <i>Breathing problems</i> sudden and variable beginnng	■ Progressive and progredient
■ <i>Smoking habbit</i> rarely	■ Practicly always
■ <i>Cough</i> mostly at night	■ Coughing out in the morning
■ <i>FEV<sub>1</sub> (PEF)</i> variable	■ Always lowered
■ <i>Bronchobstruction</i> reversible ( increase of FEV <sub>1</sub> >15%)	■ irreversible

# Bronchial hyperresponsiveness

## # INDICATION:

### # Each patient with:

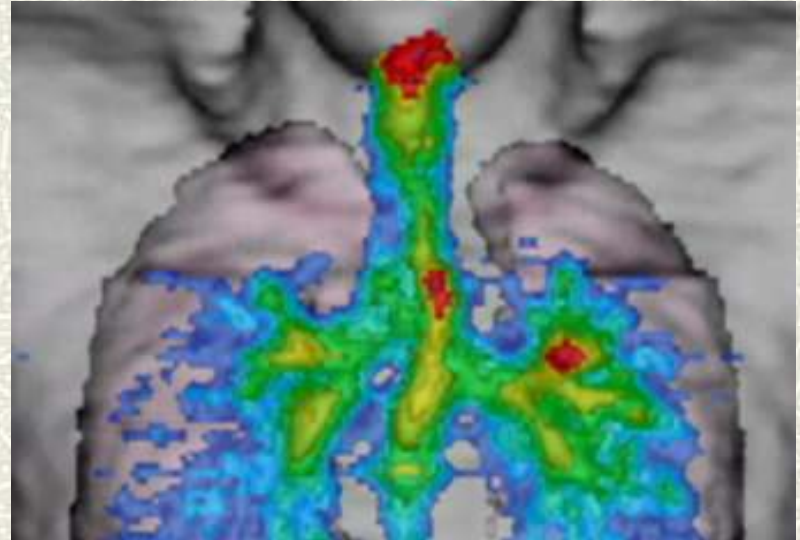
- asthma symptoms, but
- **NORMAL** lung function, and
- **NEGATIVE** bronchodilator test to SABA

### # should perform inhalation challenge test with methacholine to confirm asthma diagnosis

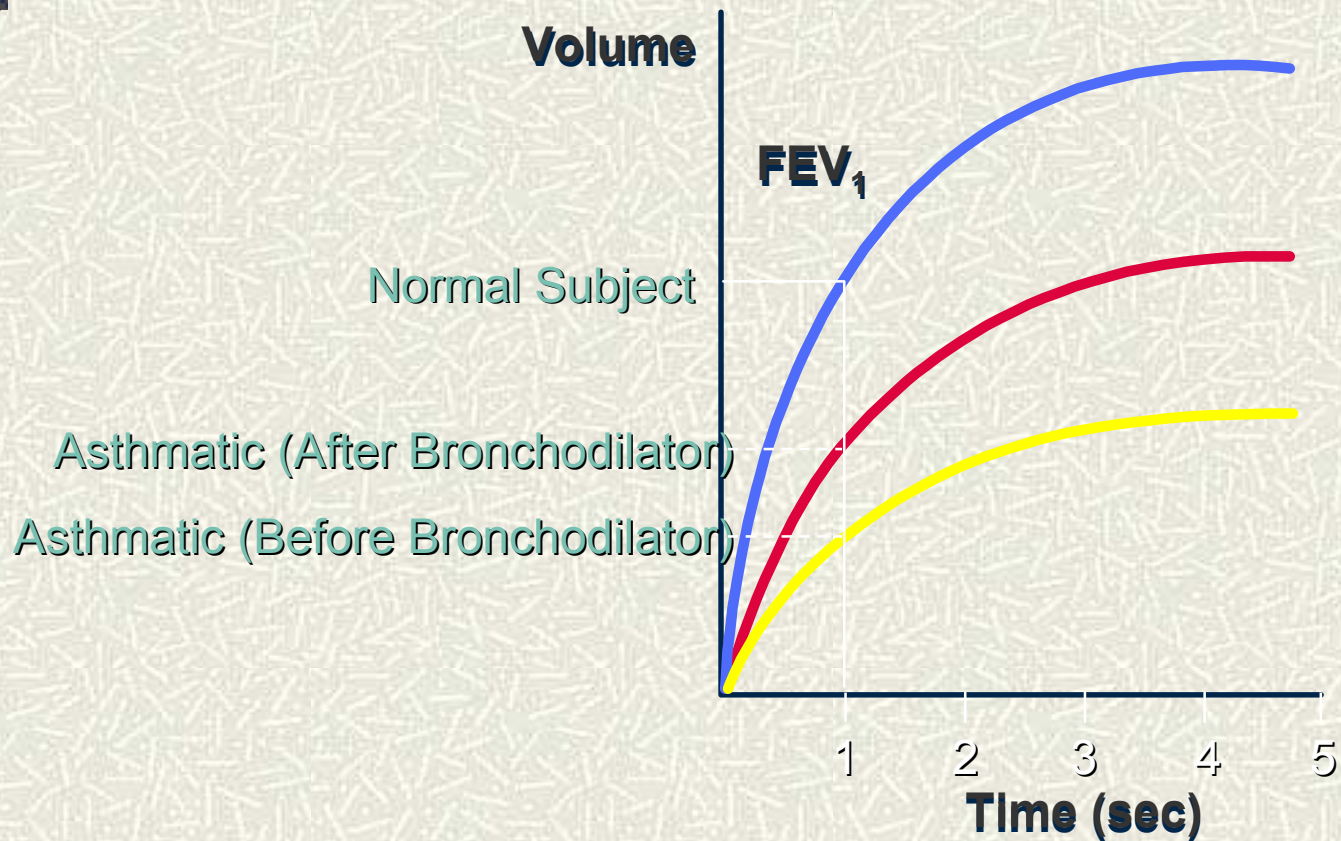


# Third part of the asthma definition – lung function

- # “These episodes are usually associated with widespread, but variable, airflow obstruction within the lungs, which is often reversible either spontaneously or with treatment.”
- # Measurement of airflow obstruction (ventilation):
  - Spirometry
- # Variable obstruction:
  - PEF monitoring
- # Reversibility:
  - Bronchodilator test with short-acting  $\beta_2$ -agonist (SABA)

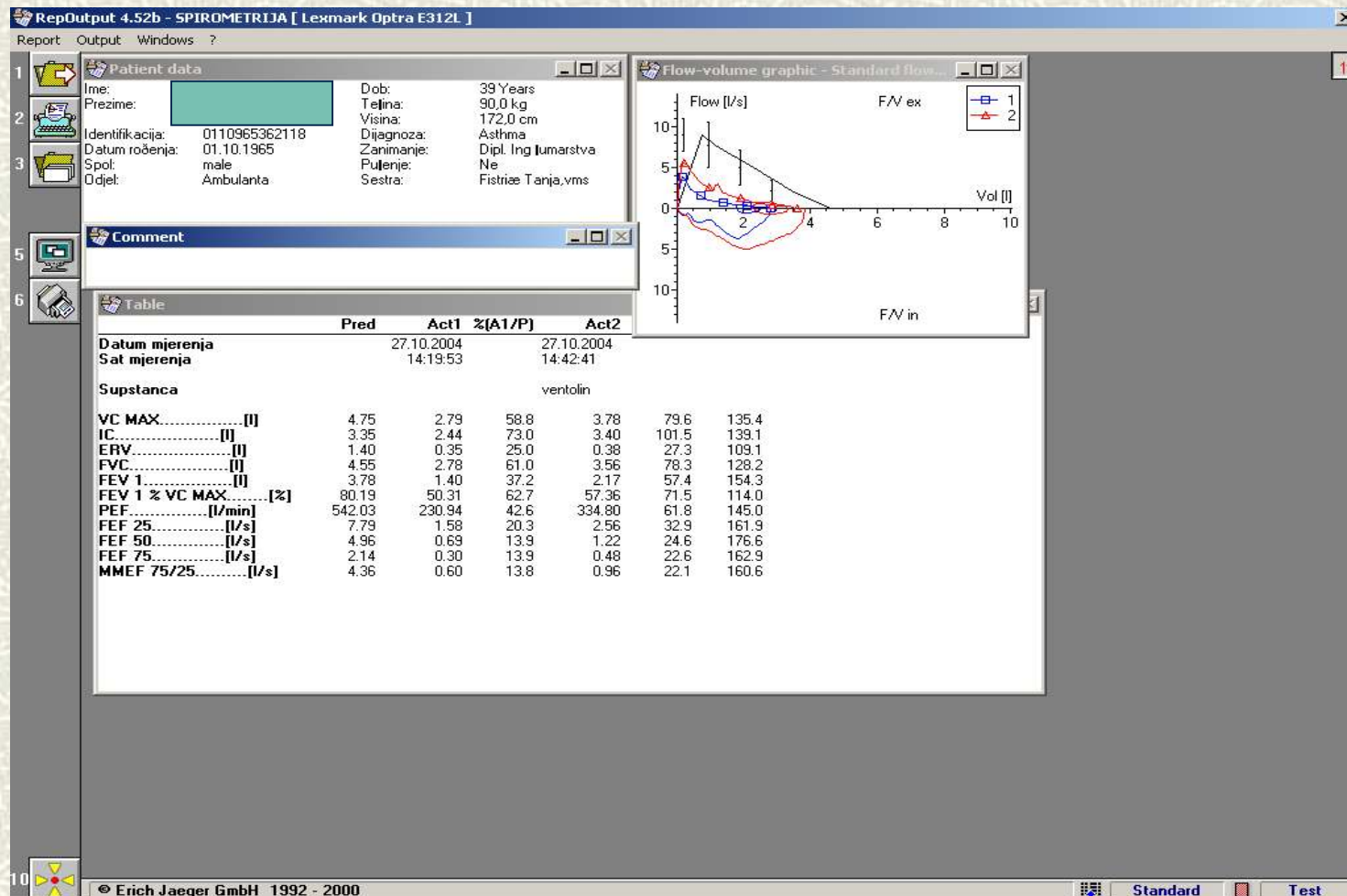


# Measuring bronchial obstruction - Typical Spirometric (FEV<sub>1</sub>) Tracings

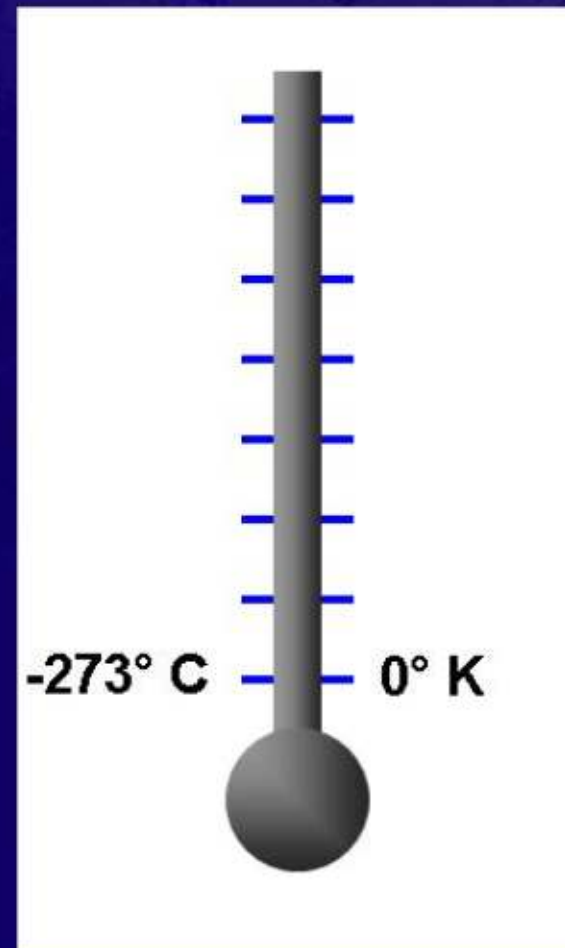


Note: Each FEV<sub>1</sub> curve represents the highest of three repeated measurements

# Example of positive bronchodilator test in asthmatic (FEV<sub>1</sub> + 54%, PEF + 45%, measured 21 minutes after salbutamol application)



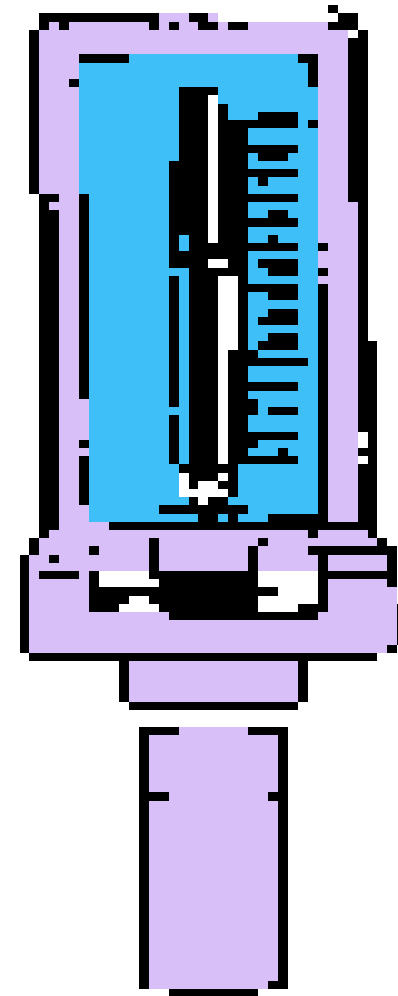
***“If you can not  
measure it,  
you can not  
improve it”***



**Lord Kelvin (1824-1907)**

# Peak expiratory flow (PEF)

- PEF correlates very good with  $FEV_1$  (forced expiratory volume in first second).
- PEF correlates excellent with the degree of clinical worsening and respiratory gases







# Classification of asthma severity

	Intermittent	Persistens		
		Mild	Moderate	Severe
Daily Symptoms	<1x week	<1x day	1x day	Continuously
Night symptoms	<2x month	<1x week	>1x week	Often
FEV <sub>1</sub> (PEF)	>80%	>80%	<u>60-80%</u>	<60%

# PEF indications



## # ***PEF Diagnostics***

- # evaluation about the stage of the disease (GINA classification)
- # bronchodilator reversibility
- # is there variability of PEF values – PEF monitoring)

## # ***PEF Therapy***

- # evaluation of immediately efficiency: is there a growth >15% after emergency treatment
- # long term evaluation of efficiency: trend of PEF thought time)

# Peak flow meter models

- # Most models are mechanical, today there are electronic models with memory
- # Technique for measurements are the same for all models



# Technique for PEF measurement

- # 1. Sign on the scale should be placed on zero
- # 2. Tube should be connected on PEF-meter
- # 3. Maximal inspirium, instrument should be put in mouth, follow by strongly and fast exhalation
- # 4. Display will show PEF value in L/min



# General rules for PEF measurements

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- PEF is measured for 3 times, while the best of those three measurements is recorded as the PEF value
  - This PEF value is correlated with reference value for a healthy average individual of the same age, sex, and height (common for the whole Europe), result in percentage
  - Normal values for healthy woman is above 350 L/min
  - Normal values for healthy man is above 550 L/min
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# Bronhodilator test with salbutamol

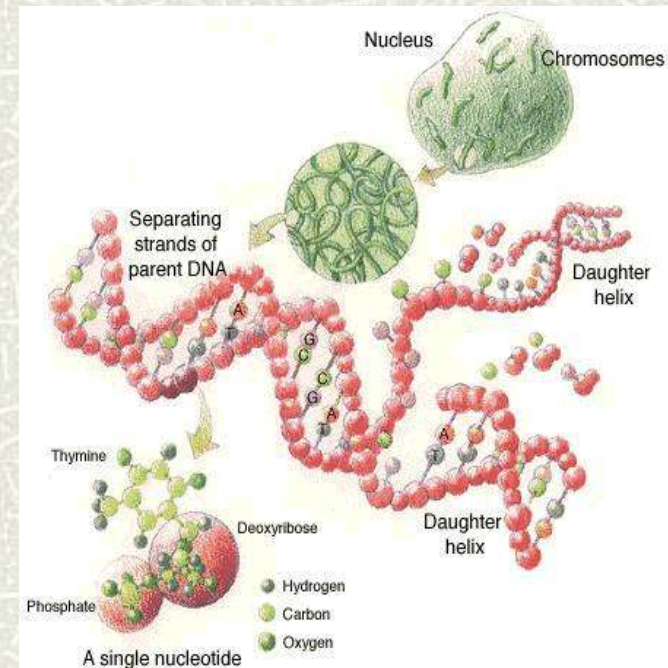
- # Each patient with asthma should have data of salbutamol reversibility in his medical history
- # PEF increase for 15% means reversibility = positive salbutamol test
- # A formula for the reversibility test:

$$\frac{B-A}{A} \times 100$$

- B – value of FEV<sub>1</sub> after 15-30 minutes of inhalation 400 mcg salbutamol
- A – basic FEV<sub>1</sub> measurement, before drug application

# Negative salbutamol test

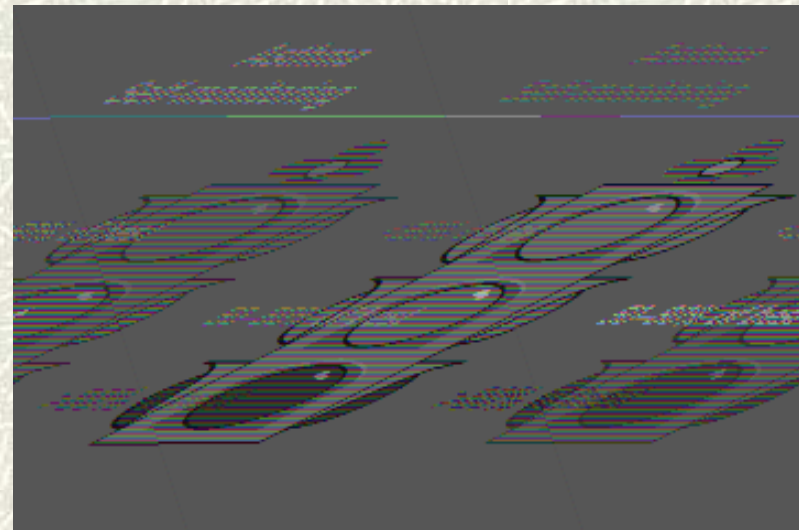
- **A patient with asthma could have negative salbutamol test (almost 20% of patients), because:**
  - test is not performed correctly (low dose of salbutamol, poor inhalation technique, not cooperative patient, didn't understand...)
  - the patient is under asthma medication, including bronchodilator, which is still acting (SABA, LABA, anticholinergics, methylxanthines...)
  - the patient is in acute respiratory infection
  - the patient has gene polymorphism with resistance of  $\beta_2$  agonist receptor
  - etc...



# The best personal PEF

Three different ways:

- 1. The best PEF value during 14 days PEF monitoring during good asthma control.
- 2. The best PEF value during two years recorded by the patient on his own PEF meter.
- 3. Calculated PEF value from spirometry on the control visit to doctor, during good asthma control.





# PEF monitoring

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- # **Measuring PEF value during 10-14 days for PEF variability**
  - # **PEF variability is connected with asthma severity**
  - # **Even normal persons has PEF variability 3-5%, less than 10%**
  - # **Intermittent asthma (GINA I) has PEF variability <20%**
  - # **Mild persistent asthma (GINA II) has PEF variability 20% - 30%**
  - # **Moderate and severe persistent asthma (GINA III and GINA IV) has PEF variability >30%**
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# PEF monitoring formula

- # PEF measurements are two times (2 x) per day, in the morning after awakening (6-11 a.m.) and in the evening before sleeping (18-23 h) (always 3 times, the best effort recorded).
- # Morning PEF in asthmatics is lower than the evening PEF values.

$$\text{PEF} = \frac{\text{evening PEF} - \text{morning PEF}}{(\text{evening PEF} + \text{morning PEF}) / 2} \times 100$$

# PEF in acute asthma attack

- # Evaluation of necessity for hospitalization:
  - 1. PEF <150 L/min
  - 2. If PEF doesn't grow for 15% after therapy
- # ***Therapy of acute attack:***
- # salbutamol inhalation with nebulisator 1 ml Ventolin solution +2 ml F.O.
- # Prednisone or methylprednisolone: 80-125 mg i.v.



## Response to asthma attack therapy is fast !

**1-2 hours after adequate treatment in asthmatic improvement of:**

- **Respiratory gases (decrease of PaCO<sub>2</sub>)**
- **Increase of respiratory mechanics (PEF increase ->50% of predictive, or >200 L/min)**

**If response didn't appear  
hospitalization is indicated.**

# Asthma diagnosis include identification of risk factors and triggers

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- #Respiratory infections
  - #Allergens
  - #Cold air
  - #Exercise
  - #Medication (Aspirin)
  - #GERD
  - #Emotions
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# For successful asthma diagnosis – essential both participants

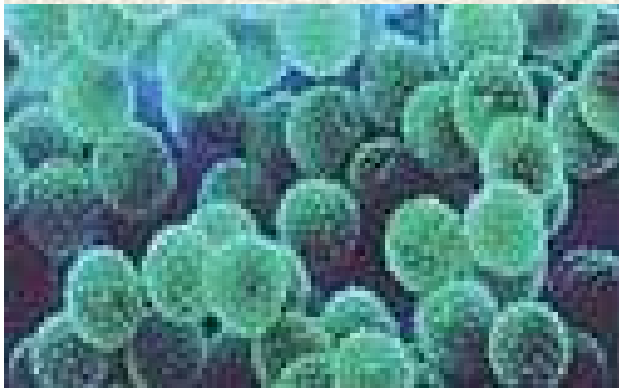
- A PATIENT



- A PHYSICIAN



# Allergens



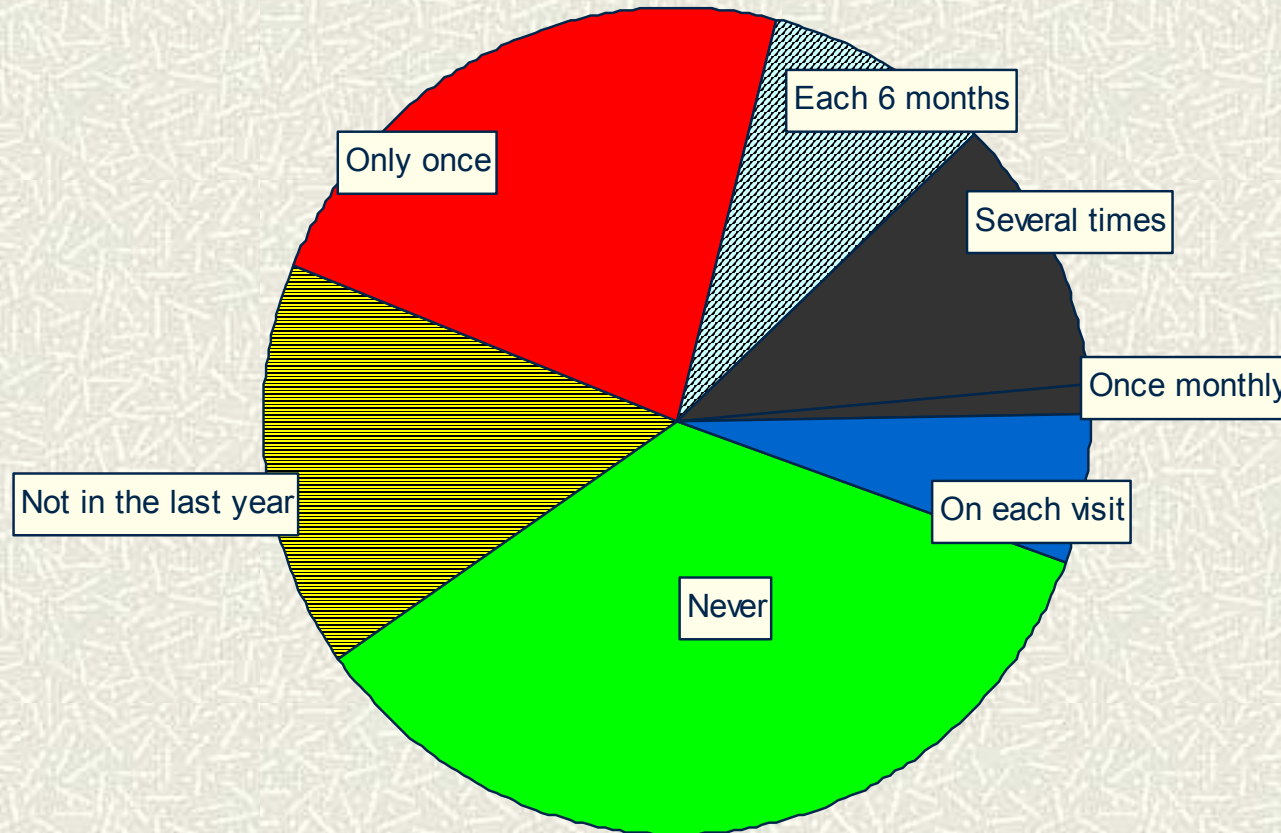
- \*House dust mites  
*Dermatophagoides pteronyssinus*
- \*Tree, grass and weed pollen
- \*Animal dander
- \*Cockroach *Blatella germanica*
- \*Moulds

# ASTHMA INSIGHTS & REALITY IN CENTRAL AND EASTERN EUROPE (AIRCEE,2002)

POPULATION	Sampling Frame	Interview Length	Completed Sample
Interview start and end dates:			
Adults with asthma and parents of children (under 16) with asthma (physician diagnosed and past year medication or asthma attacks)	Telephone screening of a national random digit dialing sample of households	25 Minutes	
COUNTRY			
Bulgaria	3.128		100
Croatia	3.107		101
Czech Republic	5.225		207
Hungary	3.713		204
Latvia	2.453		100
Lithuania	5.576		100
Poland	3.018		300
Romania	3,638		103
Russia	3.390		100
Slovakia	3.228		100
Slovenia	1.939		102
Ukraine	4.326		100



# Frequency of lung function measurement in asthma patients



# Unknown facts in asthma

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- # We have few cornerstones in asthma diagnostics:
    - Anamnesis (typical symptoms)
    - Lung function measurements
  - # But, even today, we have lot of unknown and unpredictable facts in asthma patients
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# Need for new asthma concept

- # Steven Holgate on World Asthma Congress November, 7<sup>th</sup> 2008, Monte Carlo:

***Invitation to all scientists to find new asthma concept, asthma is not just inflammation of airways***

- # Lot of work to do for all involved in asthma

