

# Biochemistry of Lungs



Lecture # 35

Lecturer: Alexander Koval

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# Introduction

- Biochemistry of lungs
  - Overview of substances produced (surfactant, mucus, collagen), inactivated (ROS, kinins, serotonin, catecholamines) and activated (angiotensine) in the lungs.
  - Strategy of antioxidant defence (enzymatic, nonenzymatic). Surfactant production and its control.
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No smoking!



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# Lung - dictionary

*(World Book Encyclopedia)*

- - one of the pair of organs for breathing, found in the chest of most animals that breathe air and have backbones. The lungs absorb oxygen from the air and give the blood the oxygen it needs, and relieve it of carbon dioxide. A lung is composed of masses of spongy tissue containing many millions of tiny air sacs or alveoli, each with its own network of capillaries.
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# Blood Circulation in Lungs

- Blood reaches the lung through two routes.
    - Almost all of the blood comes through the pulmonary circulation. This blood has already circulated through the body tissues, where it has given up oxygen and picked up carbon dioxide.
    - A small amount of blood reaches the lungs through the bronchial circulation. This blood is rich in the oxygen and nutrients that the airway tissues – like all other body tissues – need.
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No smoking!



**NO SMOKING**

**IT IS AGAINST THE  
LAW TO SMOKE IN  
THESE PREMISES**

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# Lung diseases

- Lung diseases are usually grouped by how they affect lung functions:
  - Obstructive lung diseases, such as emphysema, asthma, and chronic bronchitis, cause the airways to become partly blocked or narrower, making it more difficult for air to move through them.
    - Cigarette smoking and air pollution are major causes of these diseases.
  - Restrictive lung diseases make it harder for the respiratory system to expand. They can cause a stiffening of the lung or chest wall or make the respiratory muscles unable to respond to nerve signals from the brain.
    - Breathing substances such as asbestos, silica, and coal dust can cause some types of restrictive disease.
  - Pulmonary vascular diseases affect the circulation of blood in the lungs.
    - For example, in pulmonary hypertension, the small blood vessels of the lung become narrower, making it difficult for the right side of the heart to pump blood.



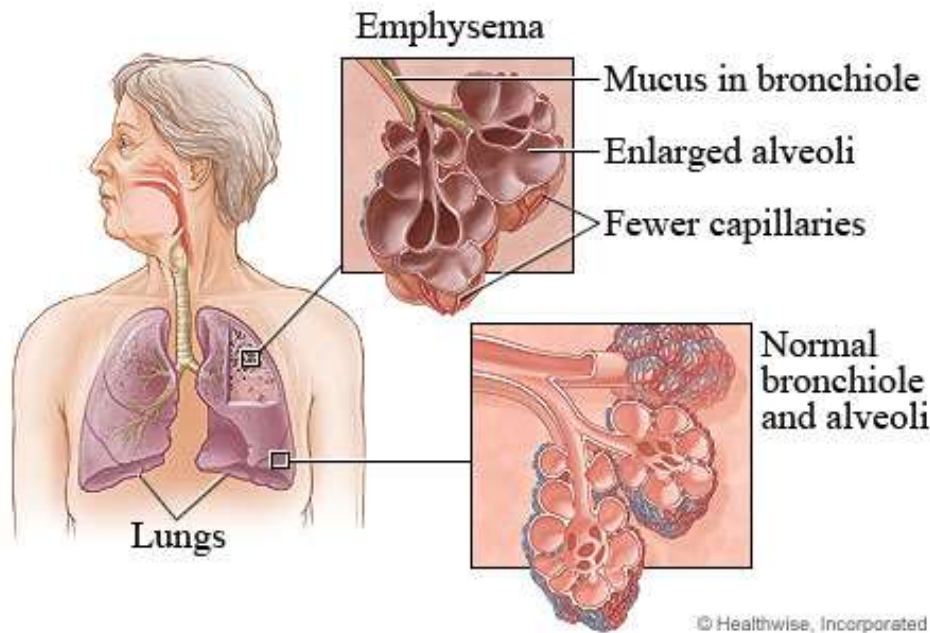
# No smoking!



- Some diseases are difficult to categorize because they can harm the lungs in a number of ways.
- Some pollutants--particularly cigarette smoke--affect the cilia, causing the upward movement of mucus to slow or stop.
- Smoking cigarettes is also a major cause of **lung cancer**. Infectious lung diseases, such as tuberculosis and pneumonia, are caused by bacteria, viruses, or other organisms.
- These diseases are serious health concerns in all parts of the world.



# Lung Emphysema

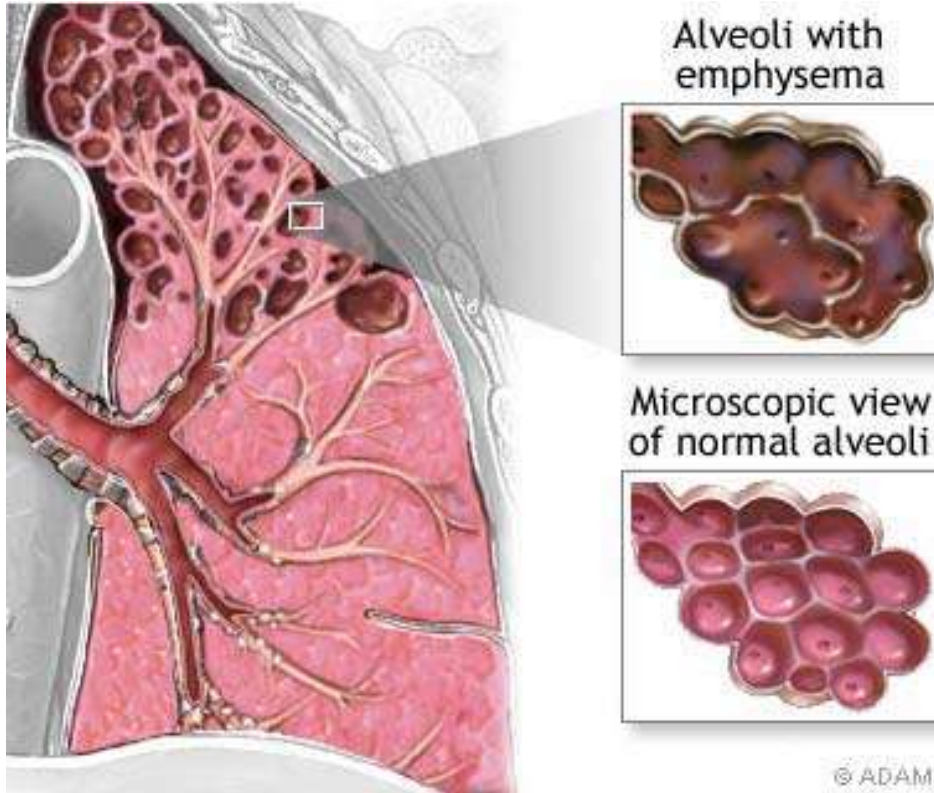


- Is a lung disease in which victims have difficulty breathing, especially when they exhale.
  - Emphysema is one of the two main forms of **chronic obstructive pulmonary diseases (COPD)**.
  - The other is chronic bronchitis.
- Chronic obstructive pulmonary diseases are characterized by progressive narrowing of the airways.

Picture source: US Food and Drug Administration

[http://64.143.176.9/library/healthguide/en-us/images/media/medical/hw/h9991437\\_001.jpg](http://64.143.176.9/library/healthguide/en-us/images/media/medical/hw/h9991437_001.jpg)

# How Emphysema Affects Breathing



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- Fresh air is carried through the airways to alveoli, contain a network of pulmonary capillaries. The gas exchange occurs.
- Emphysema destroys the walls of alveoli, including the pulmonary capillaries. The lung begins to lose elasticity and becomes overinflated as more air is inhaled and trapped in the air spaces.
- Thus, emphysema disrupts the flow of carbon dioxide from the body and deprives body tissues of needed oxygen.

Picture source: The New York Times

<http://graphics8.nytimes.com/images/2007/08/01/health/adam/17055.jpg>

# Symptoms of Emphysema

- difficulty in breathing, especially during exhalation;
- shortness of breath;
- an enlarged chest;
- bluish skin color
  - resulting from a less than normal amount of oxygen in the blood.
- Emphysema victims often suffer from frequent colds and lung infections. Some also develop serious heart disease.



# Causes and Treatment of Emphysema

## ■ Causes:

- ❑ cigarette smoking;
- ❑ air pollution;
- ❑ environmental or occupational hazards;
- ❑ repeated infections;
- ❑ genetic factors;
- ❑  $\alpha$ 1-antitrypsine deficiency.
  - Macrophagal proteases can destroy the alveolar walls in emphysema victims.  $\alpha$ 1-antitrypsine control these enzymes.

## ■ Treatment.

- ❑ Emphysema cannot be cured, but treatment may help reduce further lung damage.
- ❑ Victims of emphysema should
  - avoid cigarette smoking and air pollution.
  - promptly treat recurrent colds and infections.
- ❑ Many victims are helped by drugs, physical therapy, special breathing techniques, and by breathing oxygen-enriched air.



# Smoking is Shameful!



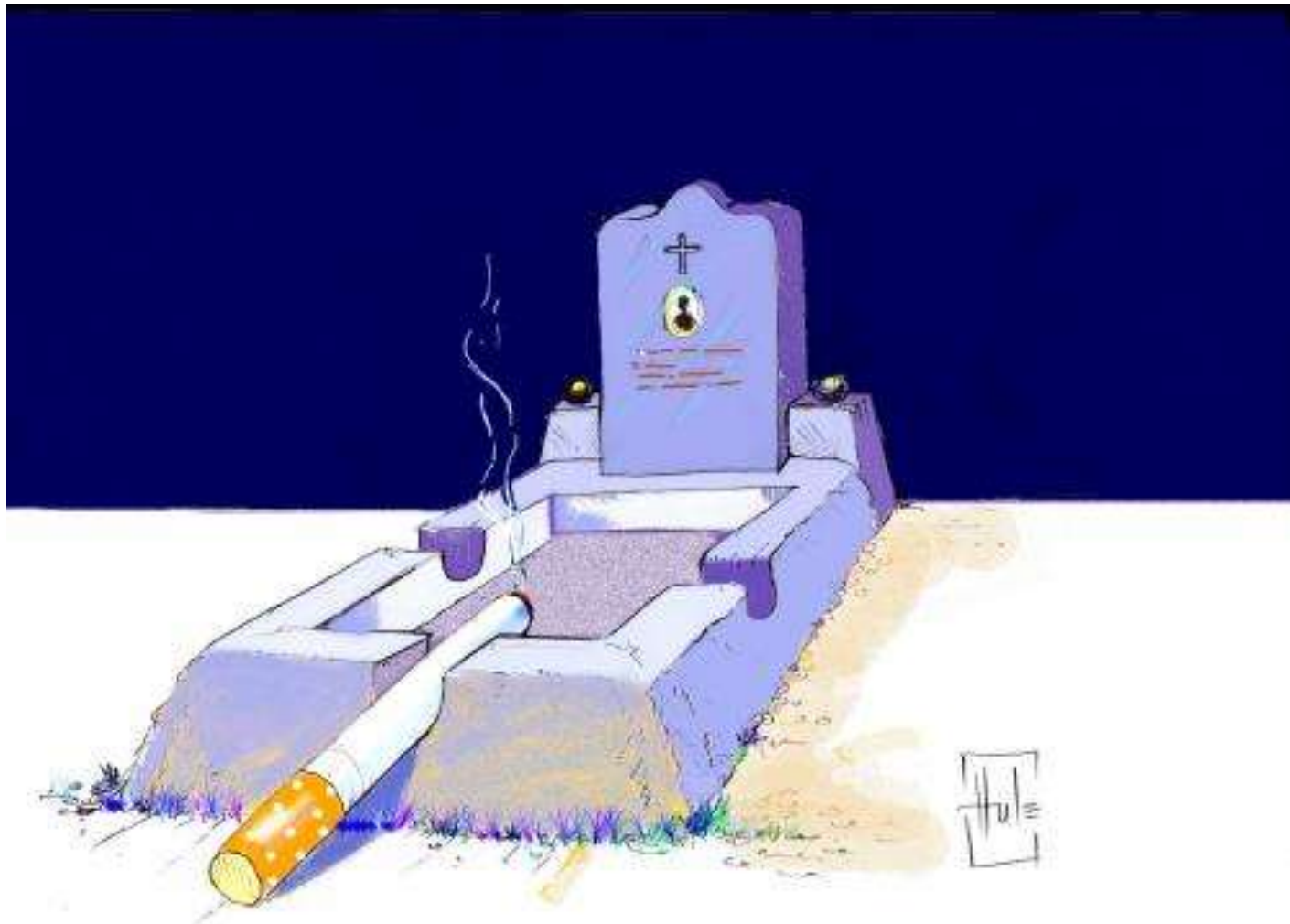
Smoking is  
Lucky Shot!



Stop Smoking!



# Smoking Kills!





# Smoking Kills!



No smoking!



**THANK YOU FOR  
OBSERVING OUR  
NO SMOKING  
POLICY**

# No smoking!



傷害你 自己

傷害你 身邊的人

5.31

World No-Tobacco Day

無烟青少年 熱情公益歡迎傳播，請勿用於商業用途©2008 www.jojohot.com



...to smoke or not to smoke?



# Smoking Causes Cancer!



Smoking  
shortens  
your  
days!



Smoking makes  
your look fool!



Cigarette Smoking is not a crime.  
But it guarantees punishment!

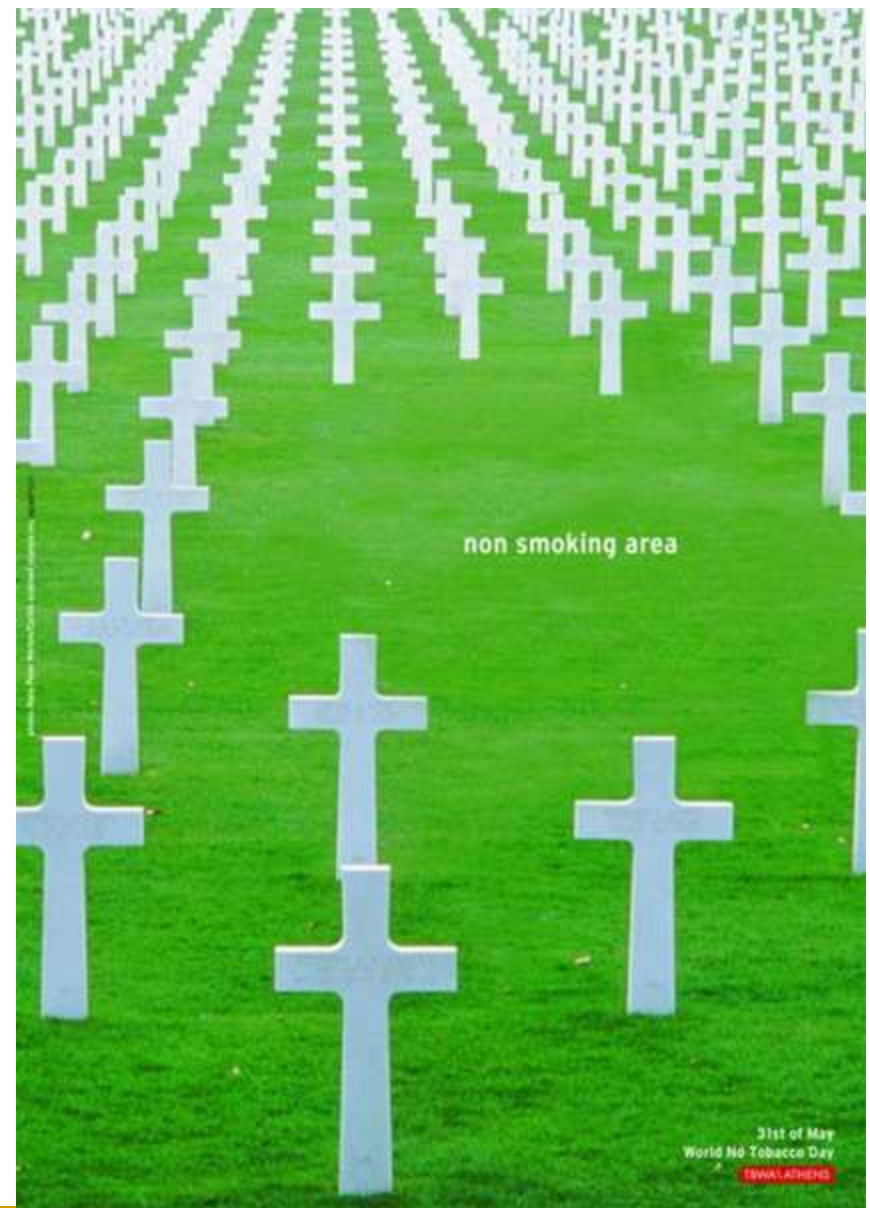


Smoking is  
dangerous!





# Smoking kills!



# Smoking = Lung Cancer

for more  
information  
on lung cancer,  
keep smoking.

— *the lung association british colombia*

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Smoking steals your days!



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# Smoking Kills!

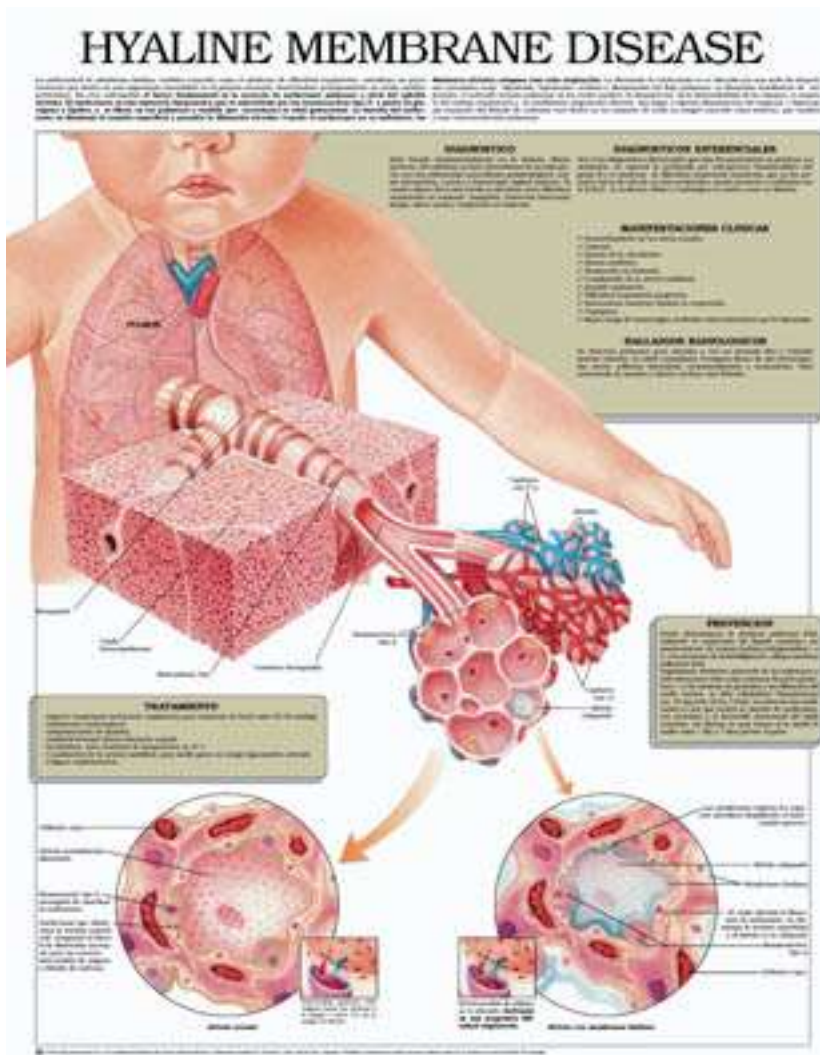


# Hyaline Membrane Disease 1/2



- ...or respiratory distress syndrome, is a lung condition that affects premature babies.
  - ❑ underdevelopment of the lungs of these infants.
  - ❑ The air sacs of the lungs collapse, causing rapid, difficult breathing and, in many cases, death by suffocation.
  - ❑ Hyaline membrane disease ranks as a major cause of death among premature infants.

# Hyaline Membrane Disease 2/2

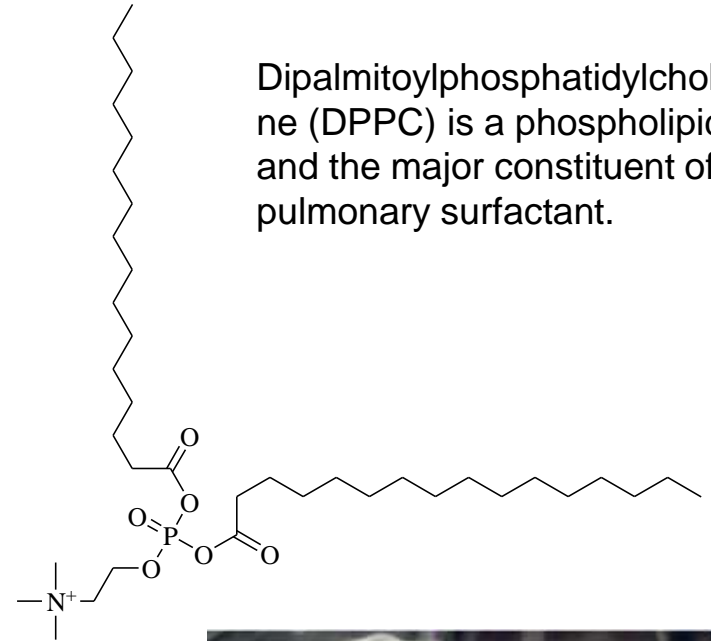


- The term *hyaline membrane* refers to the clear, glassy membranes found in the lungs of babies that die of the disease.
  - Many physicians believe these membranes are produced as a reaction to lung damage caused by the strain of breathing air in an immature lung.

# Surfactant

- Underdeveloped lungs lack pulmonary **surfactant**: prevents the air sacs from collapsing.
  - respirators and high-humidity incubators: 4-5 days of therapy, then lungs produce pulmonary surfactant.
- Artificial surfactants can be given to infants soon after birth to prevent the disease.

Dipalmitoylphosphatidylcholine (DPPC) is a phospholipid and the major constituent of pulmonary surfactant.













Thank you  
for your attention