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Clinical Microbiology



Lectures - dentistry studies 2016

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Agents of respiratory diseases

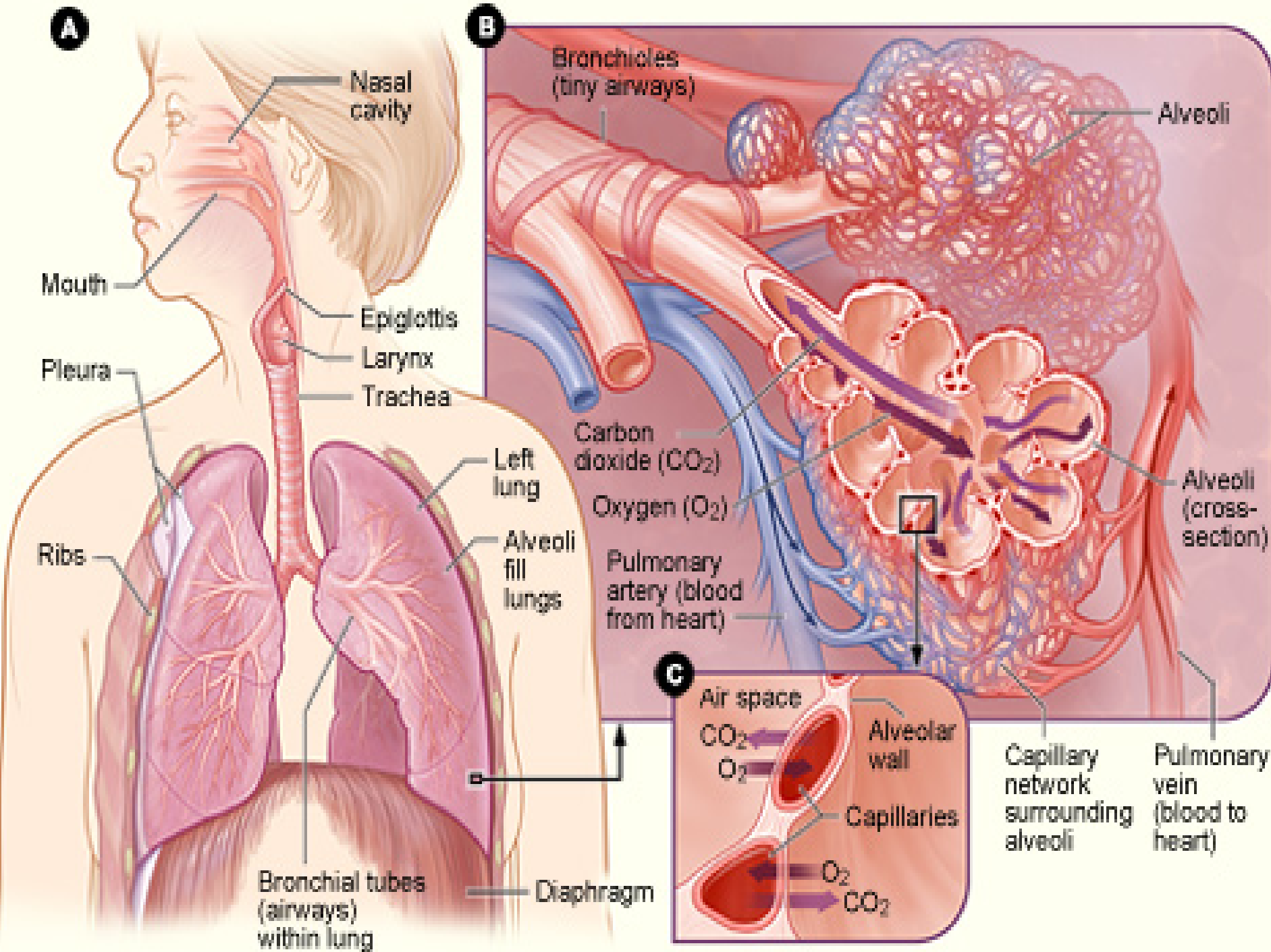
Part One

Importance of respiratory infections

- **The most important/frequent infections in GP's office (respiratory tract = an ideal incubator)**
- **Big economic impact on the economics in general and on the health care in particular**
- **Often produce outbreaks and epidemics**
- **75 % (and even more in children) are caused by viruses**

Where is RTI localized?

- **clinical symptomatology + specific agents**
- **It is necessary to distinguish:**
 - **upper respiratory tract (URT) infections (+ adjacent organs infections)**
 - **lower respiratory tract (LRT) infections (infections of lower respiratory ways + pneumonias)**



URT infections and infections of adjacent organs

- infections of nose a nasopharynx
- infections of oropharynx incl. tonsillae
- infections of paranasal sinuses
- otitis media
- conjunctivitis

LRT infections and lung infections

Infections of LRT

- infection of epiglottitis
 - infection of larynx and trachea
 - infection of bronchi
 - infection of bronchioli
- infections of lungs

Common flora in respiratory ways

- i.e. bacteria typically found in respiratory tract of a healthy person
- **Nasal cavity:** usually *Staph. epidermidis*, less often sterile, coryneform rods, *Staph. aureus*, pneumococci
- **Pharynx:** always neisseriae and streptococci (viridans group), usually haemophili, rarely pneumococci, meningococci, enterobacteriae, yeasts
- **LRW:** sterile, clinical materials from these sites are often contaminated by URW flora

Rhinitis/nasopharyngitis - ETIOLOGY

- **Viruses** – the most common - „common cold“:
 - more than 50 % rhinoviruses
 - coronaviruses
 - other respiratory viruses (NOT flu!)
- **Bacteria:**
 - **Acute** infections: usually secondary
 - *Staph. aureus*, *Haem. influenzae*, *Strep. pneumoniae*, *Moraxella catarrhalis*
 - **Chronic** infections:
 - *Klebsiella ozaenae*, *Kl. rhinoscleromatis*

Rhinitis/nasopharyngitis - TREATMENT

- **Viral etiology - does NOT need antibiotic treatment and bacteriological examination**
- **If necessary (pus full of polymorphonuclears, high CRP levels → markers of bacterial infection) treatment based on the result of bacteriological examination**
- **Topical treatment - carriers of epidemiologically important pathogens - e.g. MRSA – mupirocin (Bactroban)**

Infectious rhinitis VS. allergic/vasomotor rhinitis

<http://www.drgrgreen.org/body.cfm?xyzpdqabc=0&id=21&action=detail&ref=1285>

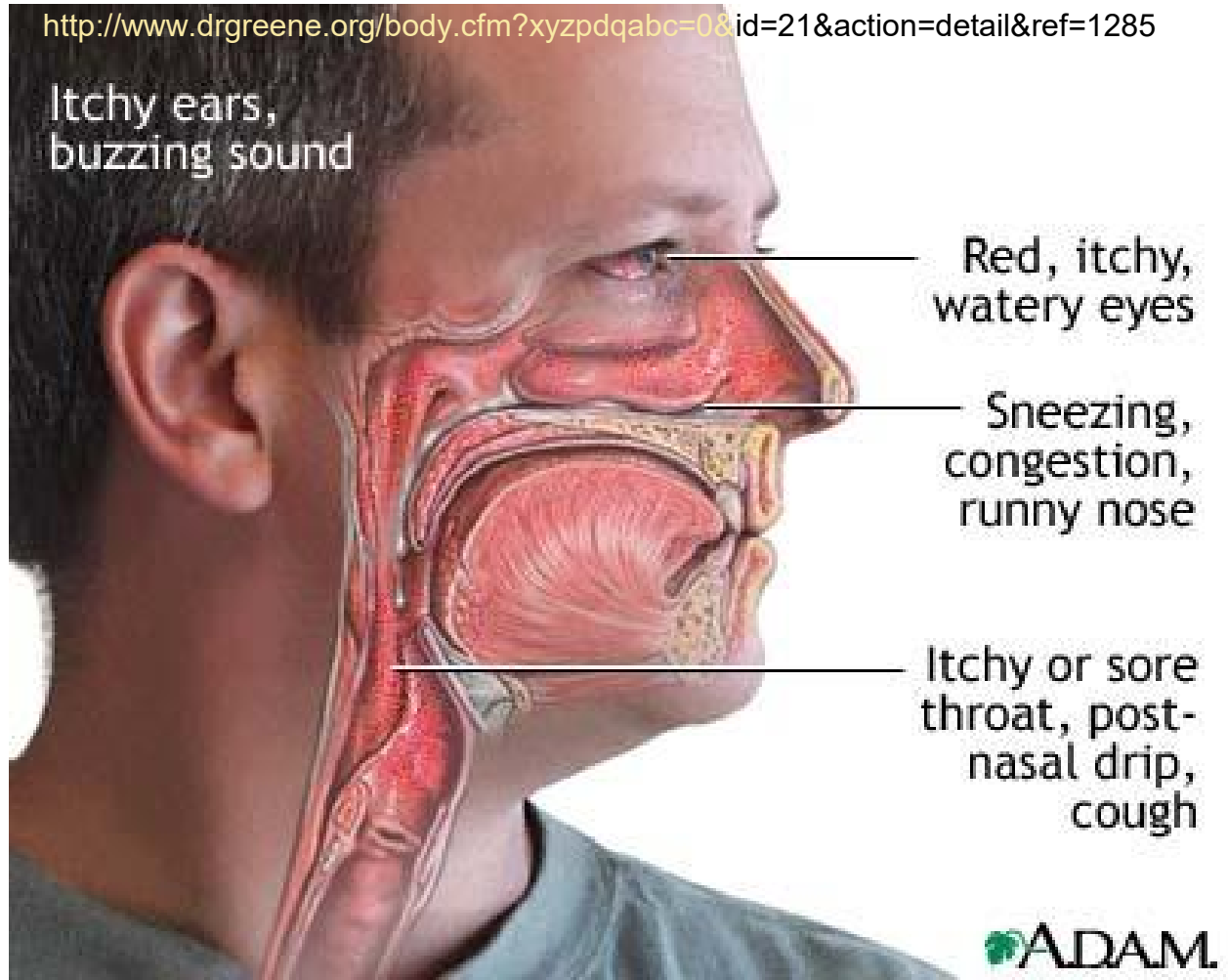
Itchy ears,
buzzing sound

Red, itchy,
watery eyes

Sneezing,
congestion,
runny nose

Itchy or sore
throat, post-
nasal drip,
cough

http://www.bupa.co.uk/health_information/asp/direct_news/general_health/rhinitis_240706.asp



Sinusitis/otitis media – ETIOLOGY I

- **Acute sinusitis and otitis usually started by respiratory viruses, *M. pneumoniae* (myringitis)**
- **Secondary pyogenic inflammations:**
***S. pneumoniae*, *H. influenzae* type b, *Moraxella catarrhalis*, *Staph. aureus*, Str. group A, OR even anaerobes (genus *Bacteroides*, *Prevotella*, *Porphyromonas*...)**

Complications: mastoiditis, purulent meningitis

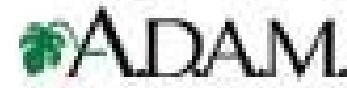
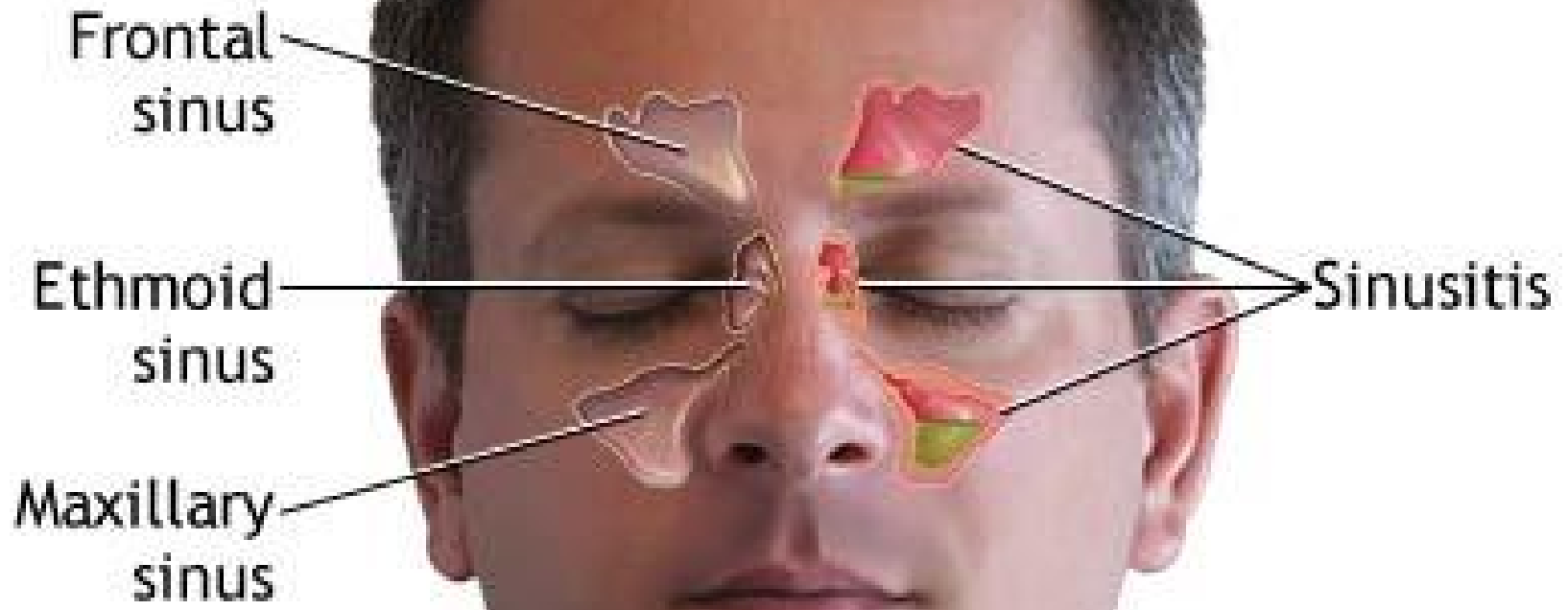
Sinusitis/otitis media – ETIOLOGY II

- **Sinusitis maxillaris chronica, sinusitis frontalis chronica: *Staph. aureus*, genus *Peptostreptococcus***
- **Otitis media chronica: *Pseudomonas aeruginosa*, *Proteus mirabilis***

Sinusitis/otitis media - EXAMINATION + TREATMENT

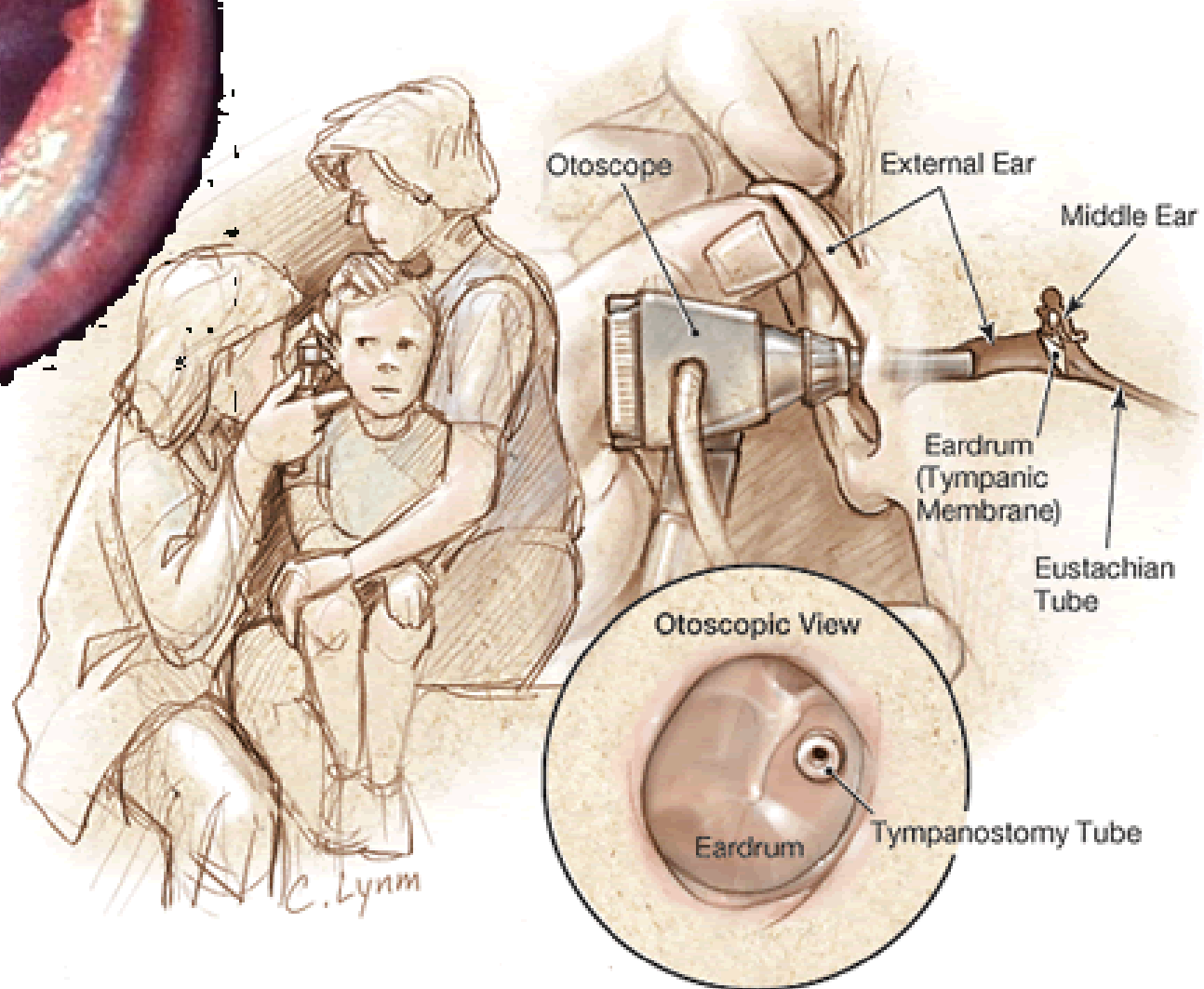
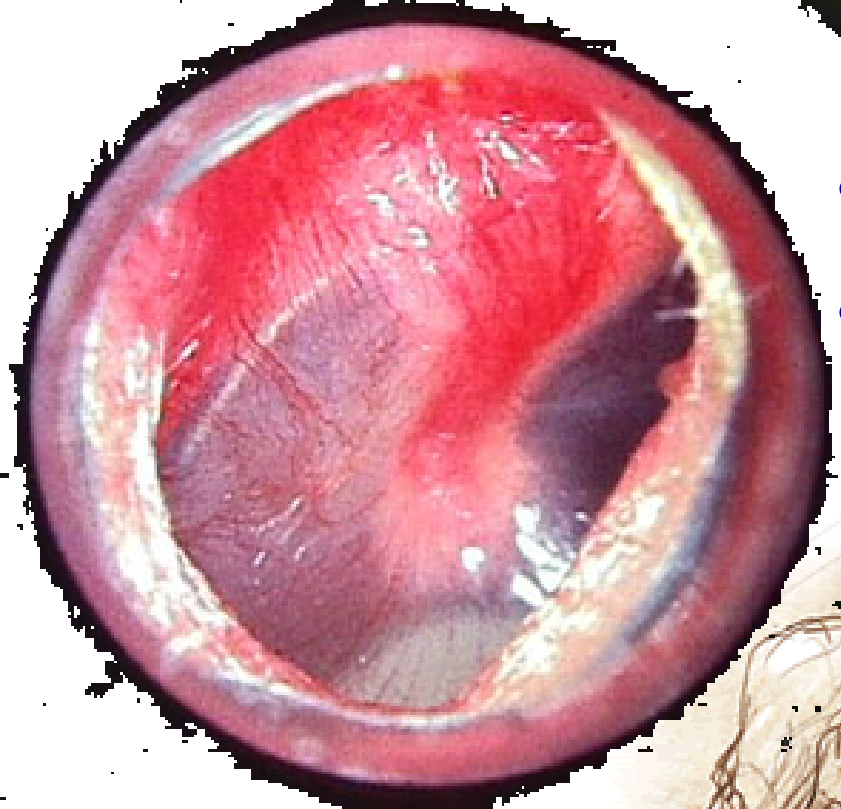
- **Relevant specimen** – only a **punctate** from the middle ear or paranasal sinus; **NOT** nasal, ear swabs (contaminants)
- **Sinusitis ATB treatment ONLY** in **painful sinusitis**, with teathache, headache, fever, lasting at least a weak, eventually neuralgia of N. Trigemini
- **Otitis media ATB** when inflammation (pain, red colour, fever) and anti-inflammatory treatment not sufficient
- **e.g. Aminopenicillin or 1st gen. cephalosporin**

sitis



Otitis media

- Causative agents
- as in sinusitis



<http://www.otol.uic.edu/research/microto/Microtscopy/acute1.htm>

http://www.medem.com/Me dLB/article_detailb.cfm? article_ID=ZZZPMV6D1AC &sub_cat=544

Conjunctivitis - ETIOLOGY

- Usually **viral**, accompanies acute URT infections/
adenovirus, enterovirus - hemorrhagic conjunctivitis, **HSV** -
herpetic keratoconjunctivitis
- **Bacterial**
 - a. **Acute:**
suppurative conjunctivitis: *S. pneumoniae*, *S. aureus*
inclusion conjunct.: *C. trachomatis* D – K
 - b. **Chronic:** *S. aureus*, *C. trachomatis* A – C (trachoma)
- **Allergic, mechanic** (allien body)
- Usually **topical** treatment

Oropharyngeal infections - ETIOLOGY

- **Acute tonsillitis and pharyngitis:**

usually **viral** (rhinoviruses, coronaviruses, adenoviruses, EBV – inf. mononucleosis, coxsackieviruses – herpangina)

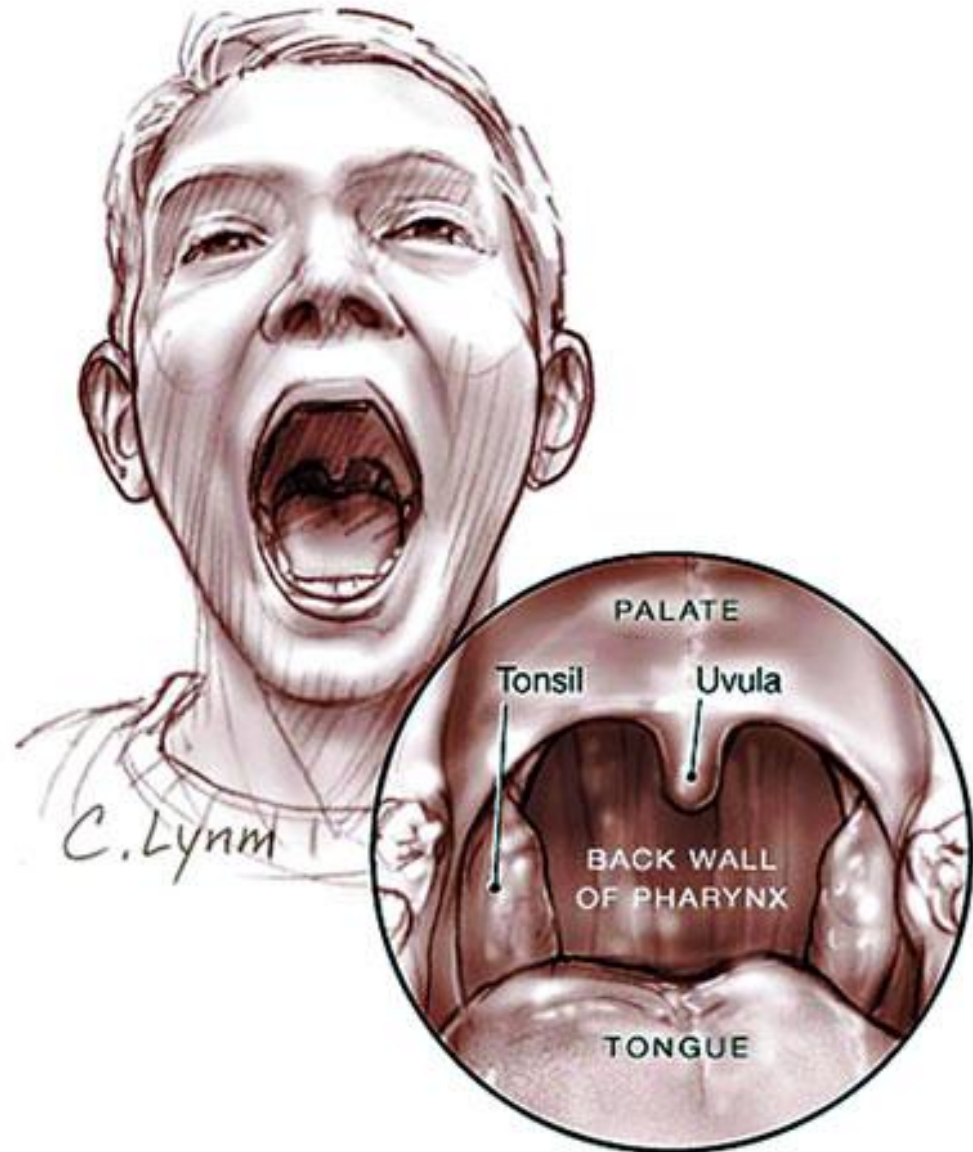
Most important bacterial: *S. pyogenes* (= β -haemol. streptococcus **group A**)

- **Other bacterial:** streptococci group C, F, G, pneumococci, *H. influenzae?*, *N. meningitidis?*,
- **Rare, but important:** *Corynebacterium diphtheriae*, *Neisseria gonorrhoeae*

Oropharyngeal infections -TREATMENT

- **Throat swab recommended in all cases, incl. „typical tonsillitis“**
- ***Streptococcus pyogenes* - penicillin still the best!**
- **Macrolides, e.g. clarithromycin in allergic patients only (resistance, worse effect)**
- **determination of CRP level (marker of a bacterial infection)**

Tonsilopharyngitis



<http://medicine.ucsd.edu/Clinicalimg/Head-Pharyngitis.htm>

<http://www.newagebd.com/2005/sep/12/img2.html>

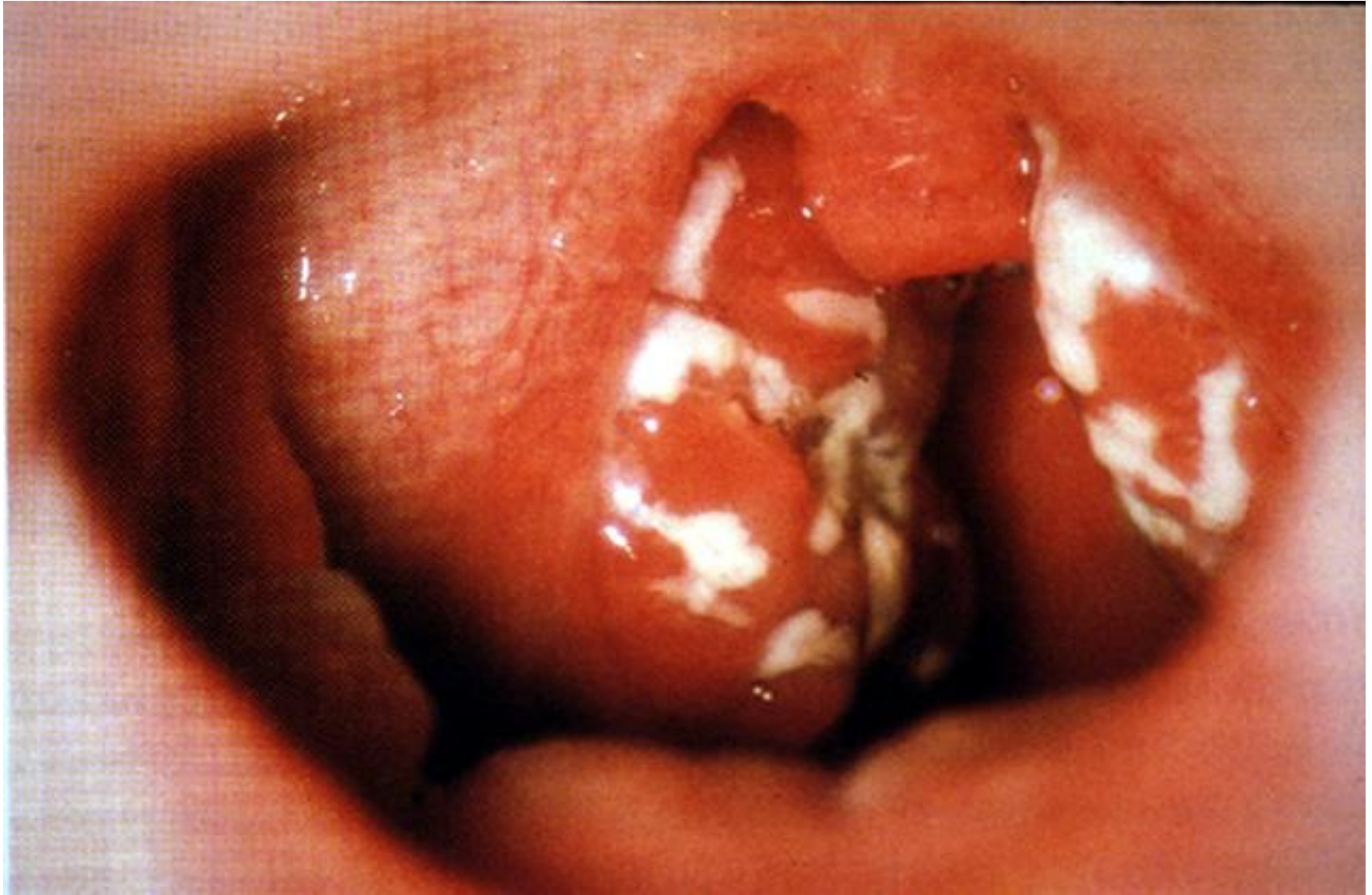
Viral tonsilopharyngitis



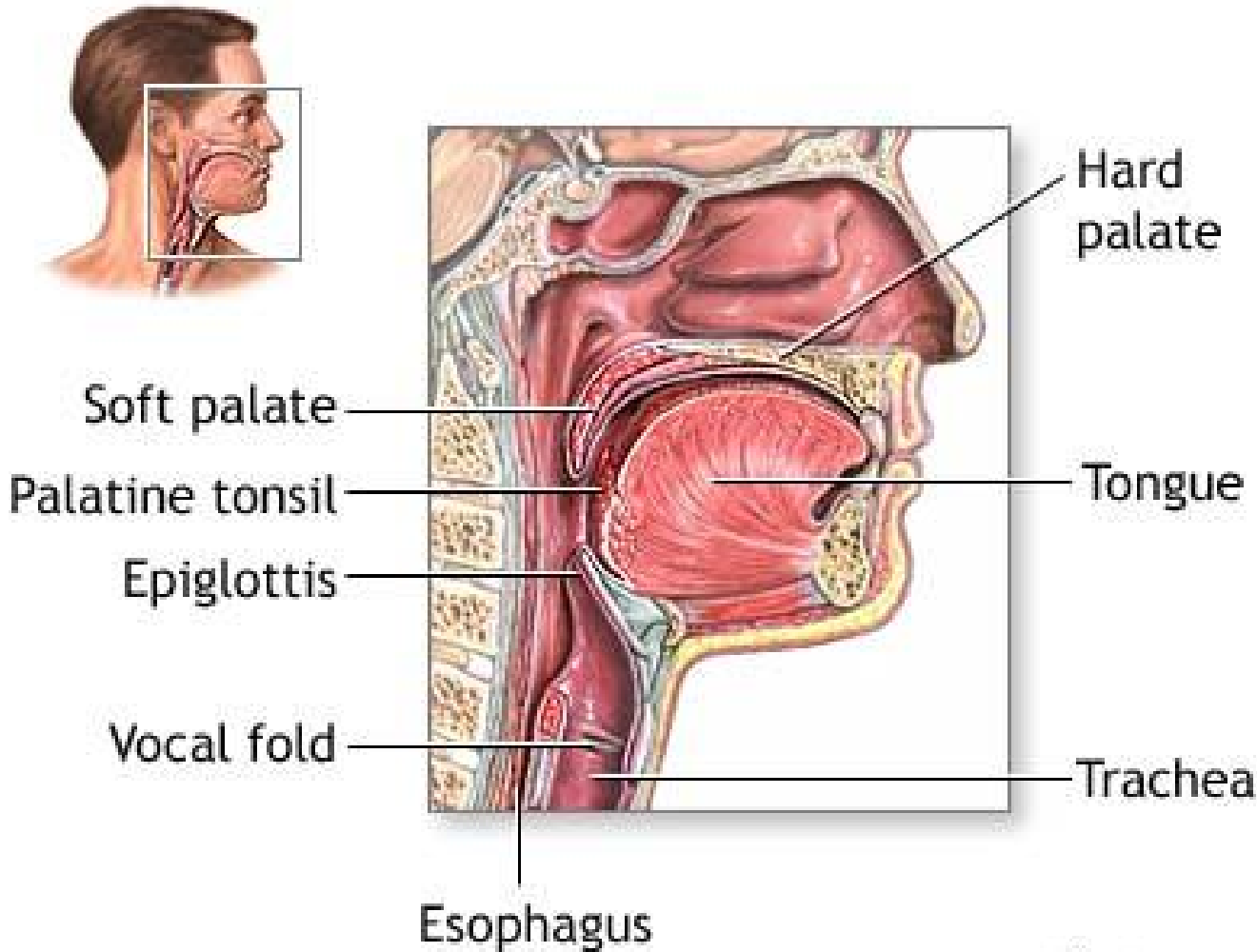
<http://upload.wikimedia.org/wikipedia/commons/thumb/b/b1/Pharyngitis.jpg/250px-Pharyngitis.jpg>

Purulent bacterial tonsillitis

<http://www.meddean.luc.edu/lumen/MedEd/medicine/PULMONAR/diseases/pul43b.htm>

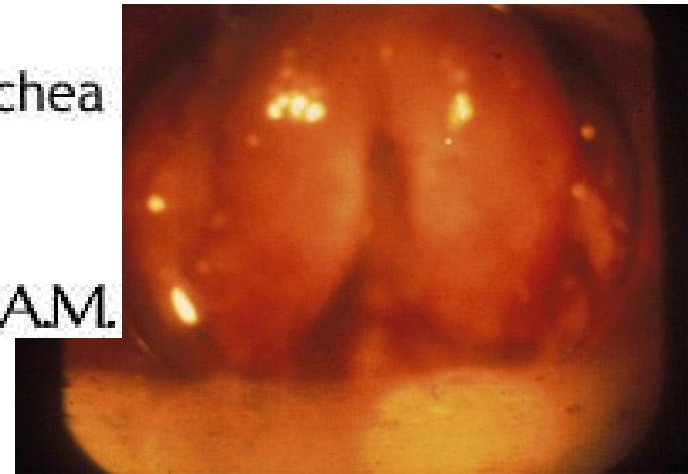


Epiglottitis



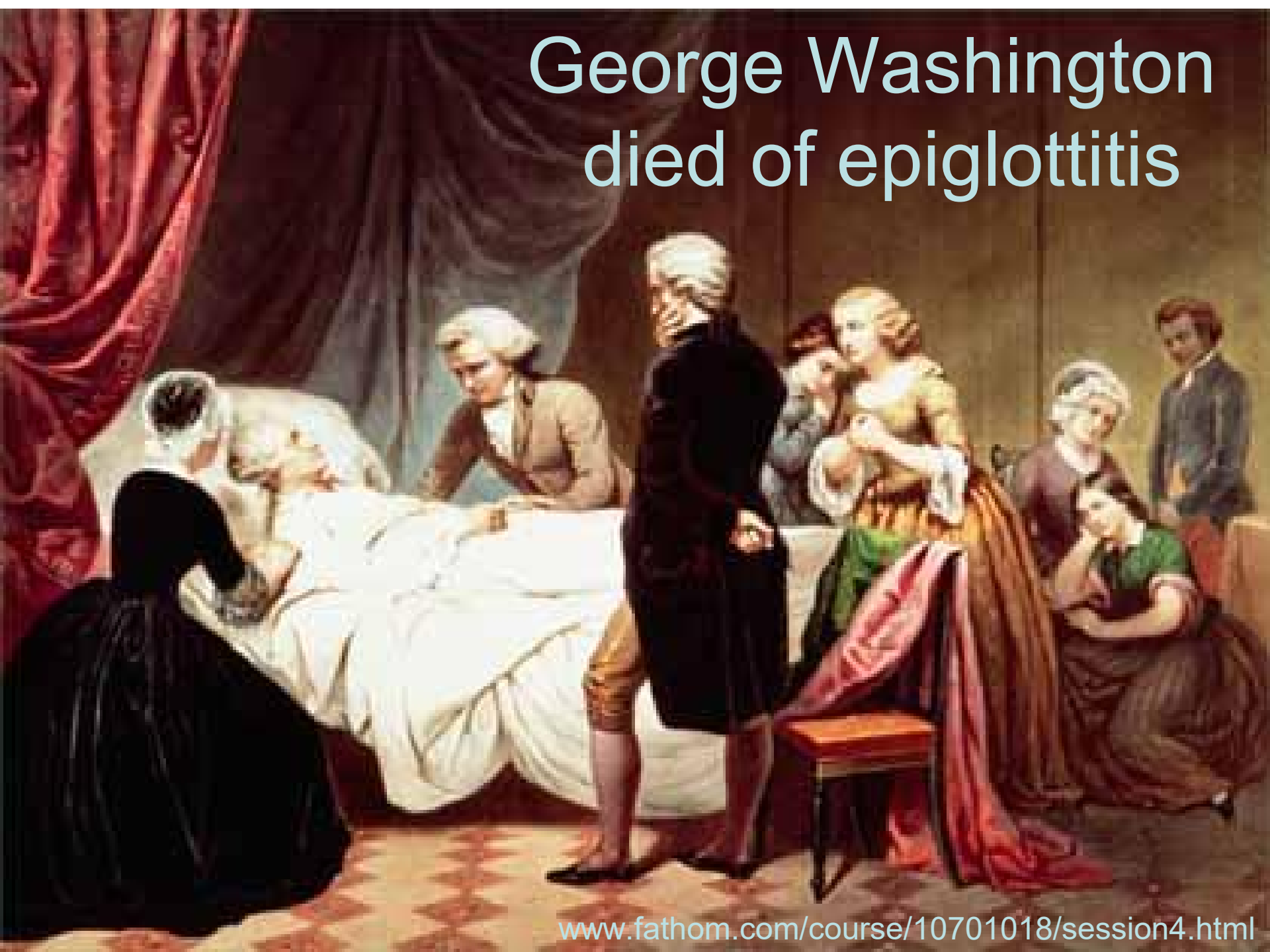
de.wikipedia.org/wiki/Epiglottitis

ADAM.



<http://health.allrefer.com/health/epiglottitis-throat-anatomy.html>

George Washington died of epiglottitis



Epiglottitis

- **Serious disease – medical emergency**

The child could suffocate!

- ***Haemophilus influenzae* type b („Hib“)**
- vaccination



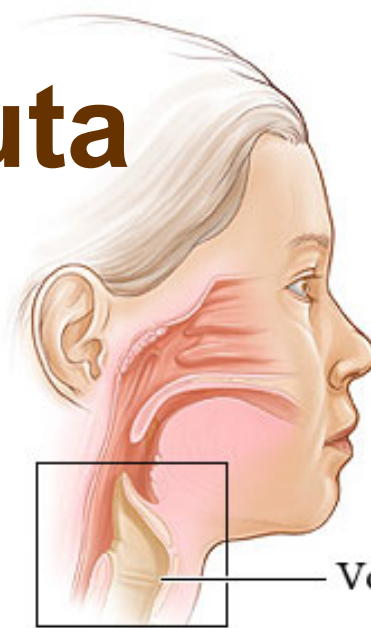
Laryngitis and tracheitis

- **Respiratory viruses (other than in nasopharyngitis):**
parainfluenza/influenza A viruses & RSV

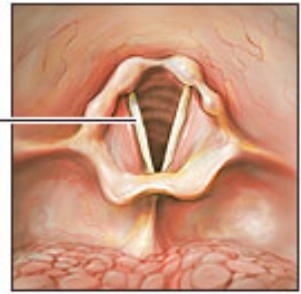
Treatment symptomatic - antibiotics NOT recommended

- **Bacterial:** *Chlamydophila pneumoniae*, *Mycoplasma pneumoniae*, secondary: *S. aureus* and *Haemophilus influenzae*, laryngotracheitis pseudomembranosa (croup): *Corynebacterium diphtheriae*
- **Throat swab is useless, except for chronic situations.**

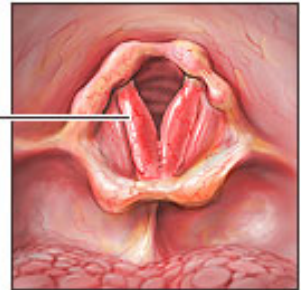
Laryngitis acuta



Normal
vocal cords



Inflamed
vocal cords



Vocal cords

© Healthwise, Incorporated





IAN BAKER...

Bronchitis - ETIOLOGY

- **Acute bronchitis:**

influenza, parainfluenza, adenoviruses, RSV

Bacterial - secondary: pneumococci, haemofili, stafylococci, moraxellae

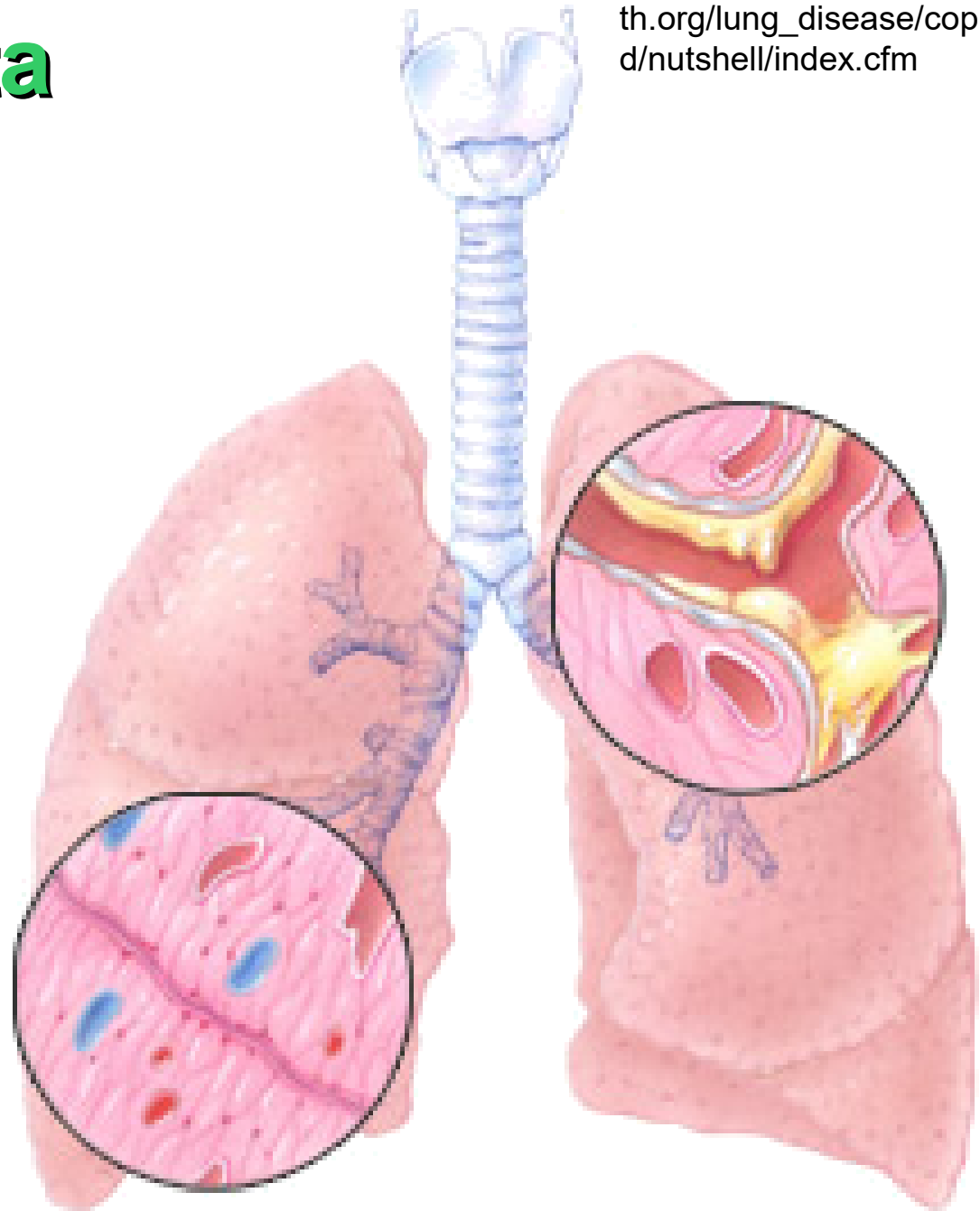
Bacterial - primary: *Mycoplasma pneumoniae*, *Chlamydophila pneumoniae*, *Bordetella pertussis*

- **Chronic bronchitis (cystic fibrosis):**

Pseudomonas aeruginosa*, *Burholderia cepacia

Bronchitis acuta

http://www.yourlunghealth.org/lung_disease/copd/nutshell/index.cfm



<http://www.lhsc.on.ca/resptherapy/students/patho/brnchit5.htm>

Bronchiolitis

- **Isolated bronchiolitis in newborns and infants only:**

Pneumovirus (= RSV)

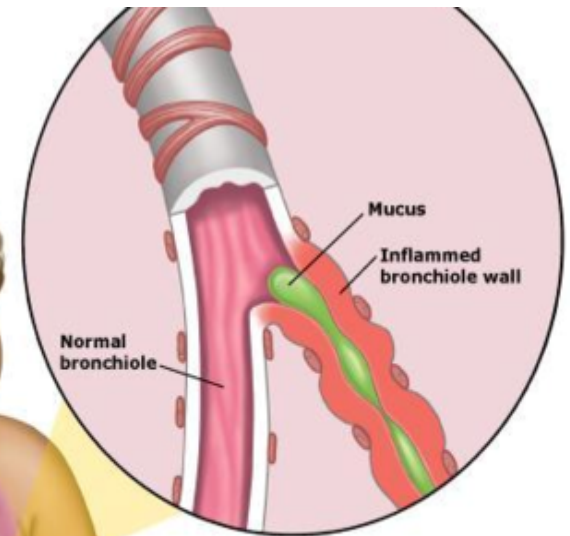
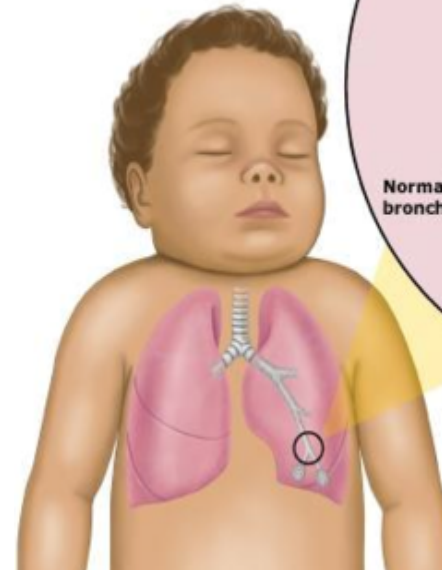
Metapneumovirus



Bronchial swelling

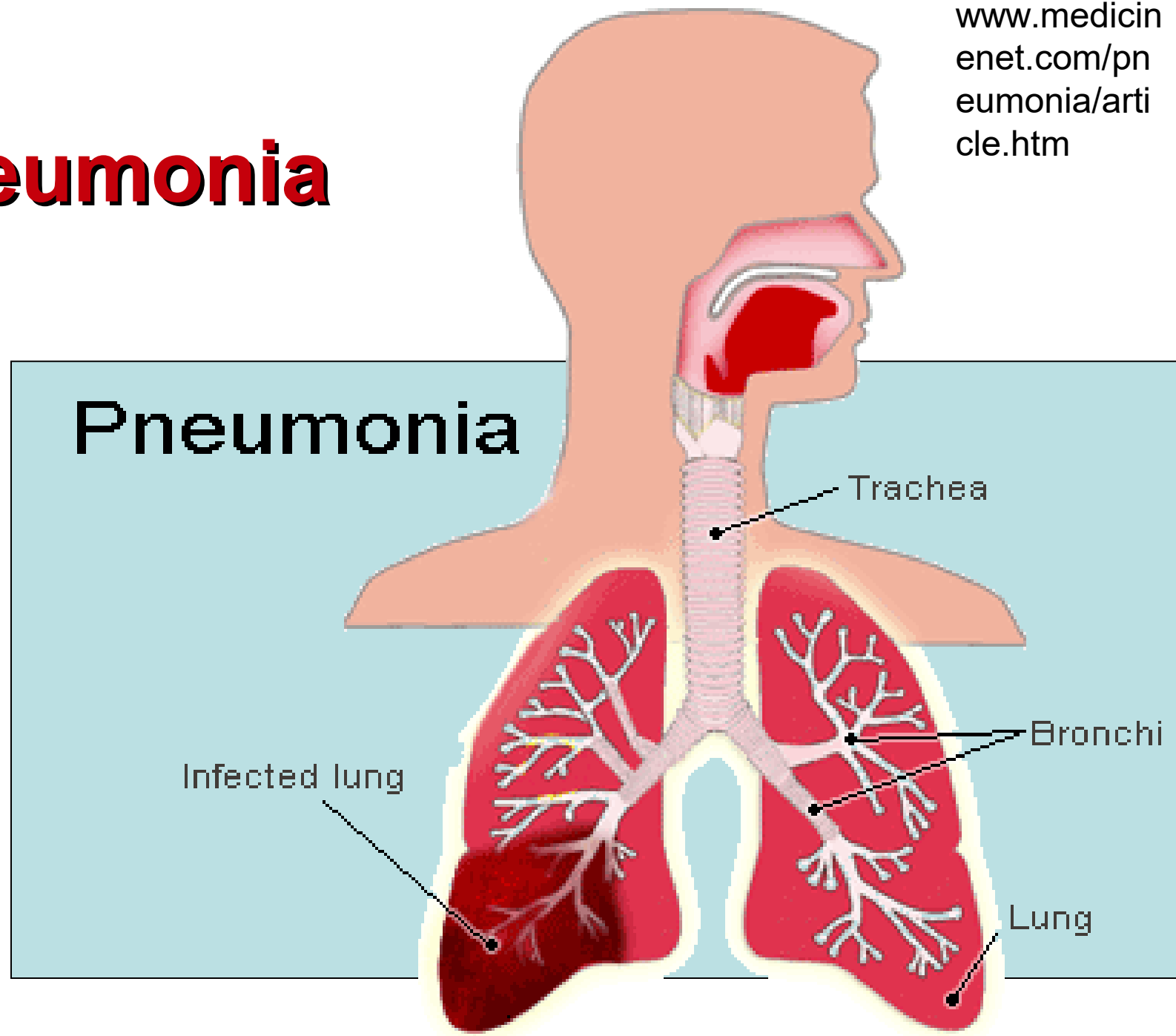


In bronchiolitis, the airway becomes obstructed from swelling of the bronchiole walls



<https://www.nlm.nih.gov>

Pneumonia



Pneumonia

Trachea

Bronchi

Lung

Infected lung

Types of pneumoniae

- **Acute – community-acquired pneumoniae CAP**
 - in originally healthy
 - adults
 - children
 - in debilitated persons
 - after a contact with animals (e.g. *Pasteurella multocida*, *Coxiella burnetii* - Q-fever, *Chlamydophila psittaci* - psittacosis)
- **Acute – nosocomial pneumoniae**
 - ventilator-associated
 - a) early
 - b) late
 - others
- **Subacute and chronic pneumoniae**

Pneumoniae – ETIOLOGY I

Acute, community-acquired, in healthy adults

- **bronchopneumonia and lobar pneumonia:**
 - *Streptococcus pneumoniae*
 - *Staph. aureus*
 - *Haemophilus influenzae* type b
- **atypical pneumonia:**
 - *Mycoplasma pneumoniae*
 - *Chlamydophila pneumoniae*
 - Influenza A virus

Pneumoniae – ETIOLOGY II

- **Acute, community-acquired, in debilitated individuals:**
 - pneumococci, staphylococci, haemofili
 - *Klebsiella pneumoniae* (alcoholics)
 - *Legionella pneumophila*
- **In more serious immunodeficiency:**
 - *Pneumocystis jirovecii*
 - CMV
 - atypical mycobacteria
 - *Nocardia asteroides*
 - aspergilli, candidae

Pneumoniae – ETIOLOGY III

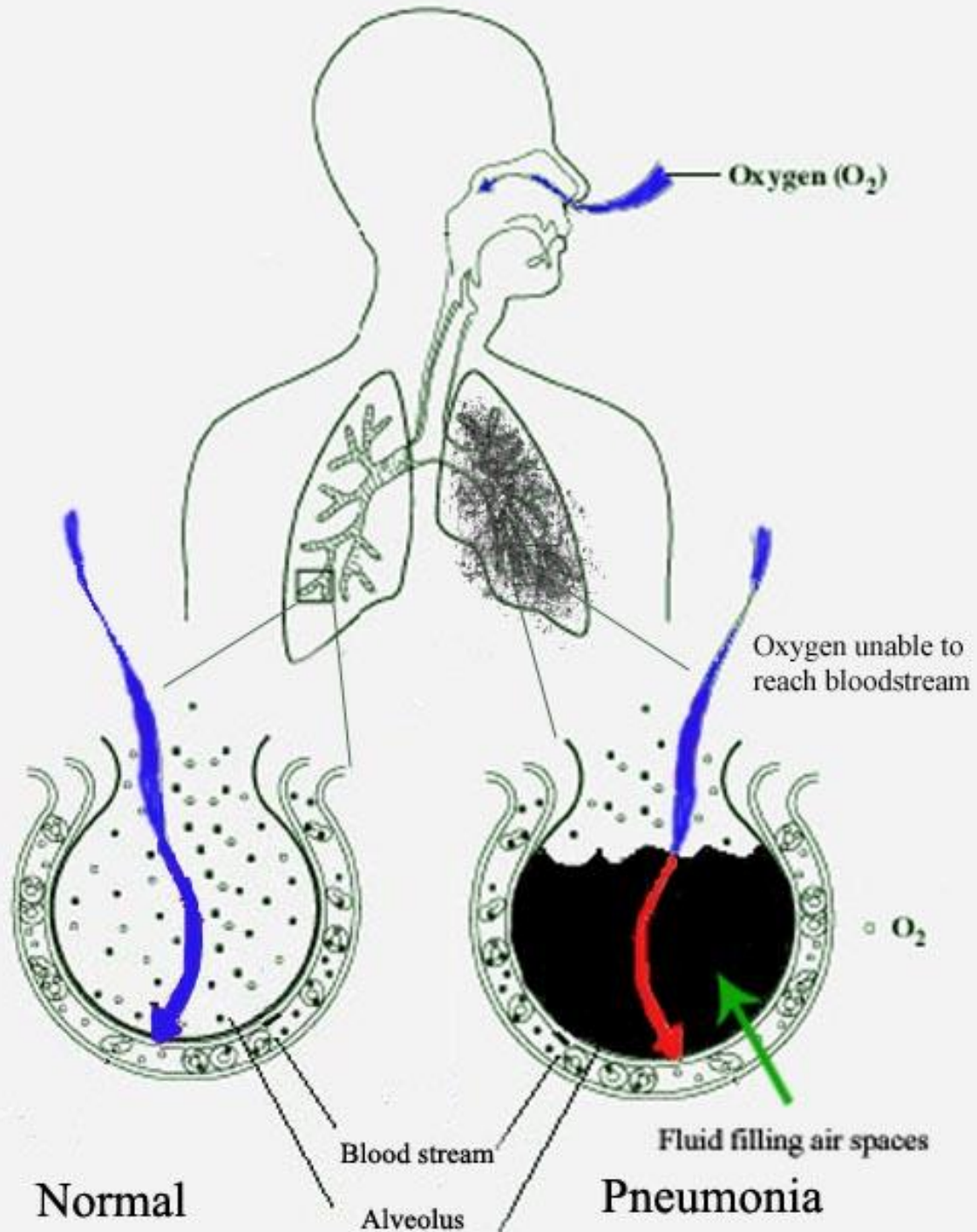
Acute, nosocomial:

- **Ventilator-associated pneumonia - VAP:**
 - **early** (up to the 4th day of hospitalization):
sensitive community strains
 - **late** (from the 5th day):
resistant hospital strains
- **Others**
 - **viruses (RSV, CMV)**
 - **Legionella**

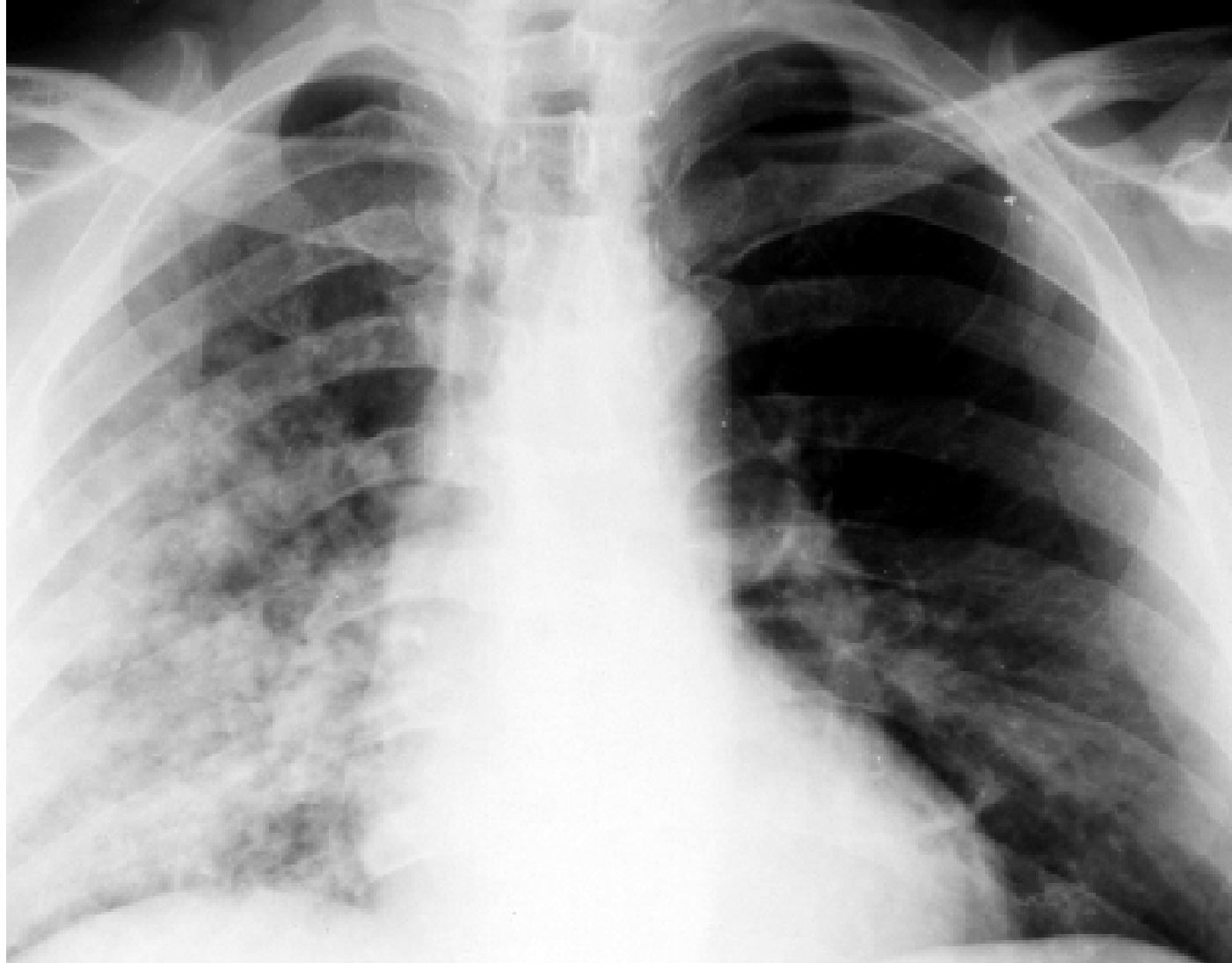
Pneumoniae – ETIOLOGY IV

- **Subacute and chronic:**
 - **aspiration pneumonia and lung abscesses**
 - ***Prevotella melaninogenica***
 - ***Bacteroides fragilis***
 - **peptococci and peptostreptococci**
 - **lung tuberculosis and mycobacterioses**
 - ***Mycobacterium tuberculosis***
 - ***Mycobacterium bovis***
 - **atypical mycobacteria**

Pneumonia



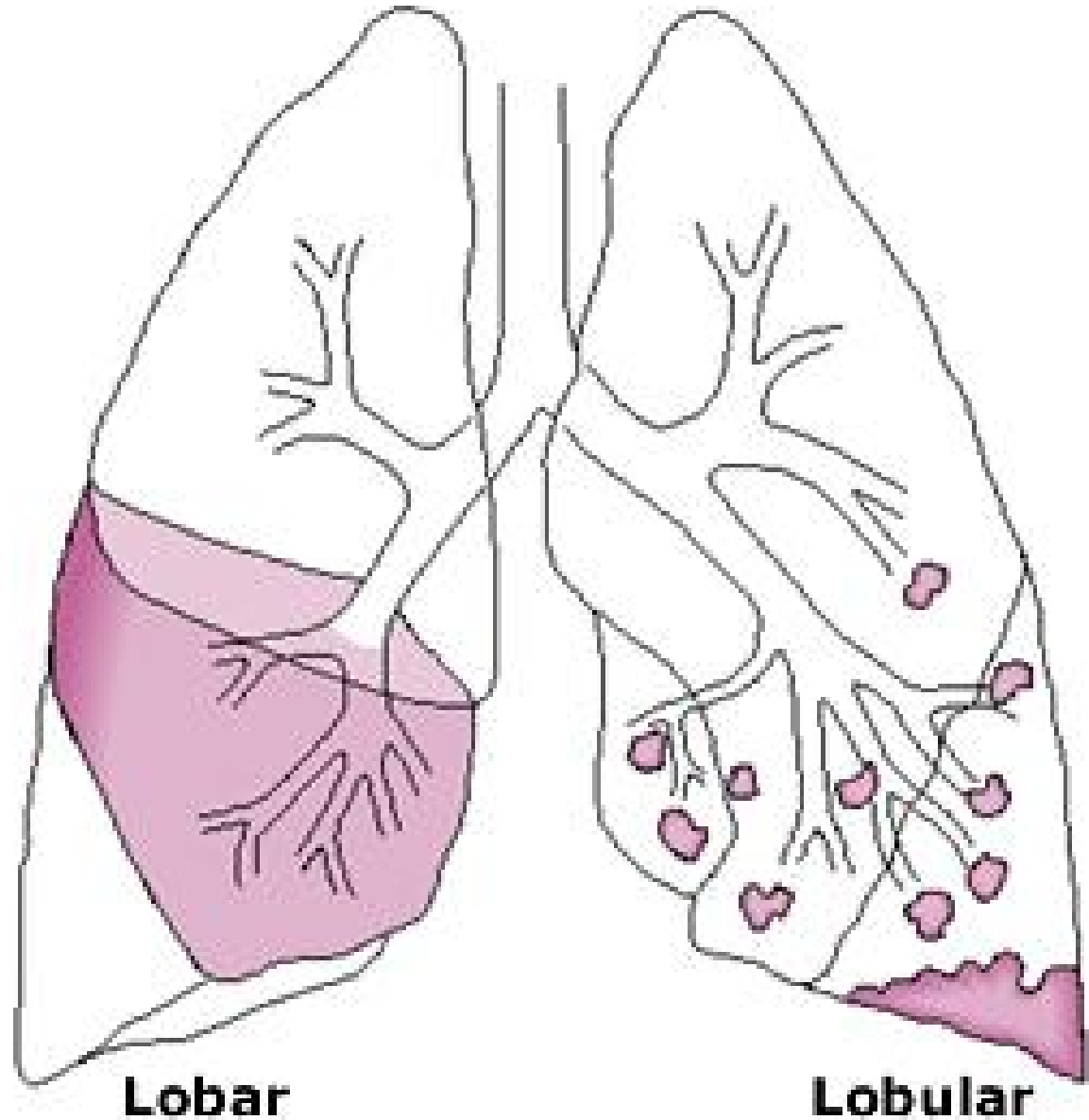
<http://www.uspharmacist.com/index.asp?page=ce/105057/default.htm>



Bronchopneumonia

See the inhomogenous shadow in the lower and middle lobes of the right lung

Lobar and lobular pneumonia



Lobar

Lobular

Lung infections - EXAMINATION

- **Clinical examination and chest X-ray, differentiation classical × atypical pneumonia**
- **Classical pneumoniae - sputum is useful, blood for blood culture, S. pneumoniae Ag in urine**
- **Atypical pneumoniae - serology - mycoplasma and chlamydia (+ „viral screen“).**
- **Hospital pneumoniae also Legionella examination – Ag in urine**

Bronchitis and pneumonia - TREATMENT

- **CAP amoxicilin, (eventually according to a causative agent and antibiotic susceptibility)**
- **Atypical pneumoniae tetracyclins or (esp. in children < 8) macrolides.**
- **Combination therapy**
- **Hospital infections - susceptibility test - resistances!**
- **In TB usually combination of drugs**

Gerrit Dou (1613 - 1675)

The Physician

