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# **MICROBIOLOGY AND MEDICINE**

**The 1st lecture for the 2nd-year students**

**February 16, 2015**

# What is the Medical Microbiology?

**Medical microbiology = a complex of sciences dealing with microorganisms (= microbes) important in the medicine**

**Objects of medical microbiology:**

- a) Pathogenic microbes (causing diseases of human beings or animals)**
- b) Normal microflora (microbes commonly present in healthy persons or animals)**
- c) Mutual relationship between microbes and their hosts (even we need the microbes)**
- d) Relationship between microbes and the environment (including methods how to eradicate the microbes)**

# “Other” microbiologies

- 1) There are two branches of the medical microbiology:  
**human and veterinary**

Here we are going to regard **medical microbiology** as the science about microbes important in human medicine only

**Clinical microbiology** = a segment of the medical microbiology dealing with the etiology, pathogenesis and laboratory diagnostics of diseases caused by microbes

- 2) Other types of microbiology:

**environmental microbiology** (m. of soil, water etc.)

**phytopathological m.** (m. of plant diseases)

**food microbiology** (m. of milk, meat, wine, beer etc.)

**other industrial microbiologies**

# Different objects and sections of microbiology

- **bacteria** **bacteriology**
- **micromycetes (moulds & yeasts)** **mycology**
- **(algae)** **(algology)**
- **parasites** **parasitology**
  - **protozoa** **protozoology**
  - **helminths** **helminthology**
  - **arthropods** **entomology**
- **viruses** **virology**

**General microbiology**

**special microbiology**

# **“Must-knows” about each microbe –**



## **1. Classification, morphology, structure**

**Is it a bacterium, yeast, mold or protozoan?**

**If a bacterium: is it Gram-positive, Gram-negative, or does it stain in yet another way?**

**Is it a coccus, rod, filament, spiral?**

**How are the cells relatively arranged? In pairs, clumps, chains, tetrads?**

**Do they produce spores, capsules, granules?**

## **2. Physiology, biochemistry, genetics, tenacity**

**Is it a strict anaerobe (does the oxygen kill it)?**

**Has it any important biochemical property?**

**Or genetical one?**

**Is it resistant (robust), or delicate?**

# **“Must-knows” about each microbe –**

## **II**

### **3. Antigenic structure**

**Does it exist in one antigenic type or in several ones?**

### **4. Pathogenicity**

**Which diseases or syndromes does it cause?**

**How are they called in Latin?**

### **5. Pathogenesis**

**Portal of entry, spread through the body, elimination?**

**How do the symptoms develop?**

**Which factors of pathogenicity (virulence) has it?**

### **6. Immunity**

**Does it actually develop after the contact with the microbe?**

**Is it short-lasting, or life-long; humoral, or cellular one?**

# **“Must-knows” about each microbe – III**

## **7. Epidemiology**

**What is the source of infection: man, animal or environment?**

**How is the agent transmitted?**

## **8. Prevention, if necessary prophylaxis**

**Does a vaccination exist, or passive immunization?**

**What type of vaccine is in the use?**

## **9. Treatment**

**What is the treatment of choice?**

**If it is an antibiotics, which one?**

# “Must-knows” about each microbe – IV

## 10. Laboratory diagnostics

**Direct demonstration** (= detection of the agent in question – microscopy, culture, detection of antigens, nucleic acid), or

**indirect one** (= detection of antibodies)?

If **direct** one, what is sampled from the patient?

In which way is the specimen examined?

If by the culture, is a special medium required?

How is the isolated strain identified?

If **indirect** one, is a special serologic reaction required?

What is considered as a positive result?



# “Must-knows” about microbiology of different infectious diseases and syndromes

- A) Which microbe is the etiological agent of the infectious disease in question?
- B) Which microbes (bacteriae, yeasts, moulds, viruses or parasites) are the most important causes of the syndrome in question?
- Do they differ according to e.g. the age of the patient?

# Anniversaries in 2015 – I

- 265** 1750 John Pringle was the first to use the term **antiseptic**
- 180** 1835 Agostino Bassi introduced the idea of **microbes as disease agents**, with mould *Beauveria bassiana* in silkworms
- 165** 1850 Casimir Davaine observed the **agent of anthrax** in blood
- 160** 1855 \* Josef Hlava, a forgotten discoverer of *Entamoeba histolytica*
- 150** 1865 † Ignaz Semmelweis, who attempted to introduce disinfecting obstetricians' hands in order to prevent puerperal fever (childbed fever)
- 140** 1875 \* Stanislav Prowazek, the discoverer of the agents of **trachoma** and **typhus**
- 135** 1880 Fanny Hesse inspired her husband to solidify cultivation media by means of **agar**
- 130** 1885 Louis Pasteur started **vaccinating against rabies**

# Anniversaries in 2015 – II

- 125 1890** Emil von Behring and Kitasato discovered diphtheria antitoxin
- 120 1895** Richard Pfeiffer described bacteriolysis, dissolving of bacteria with fresh blood of immune individuals  
† Louis Pasteur, the discoverer of vaccination against rabies, pasteurization, anaerobes and spore-forming microbes
- 115 1900** Paul Ehrlich elaborated the theory of functioning of antibodies  
William Leishman described the agent of kala-azar, the protozoan *Leishmania donovani*
- 110 1905** Fritz Schaudin and Hoffmann discovered the agent of syphilis, the spirochete *Treponema pallidum*
- 105 1910** † Robert Koch, the discoverer of the agents of tuberculosis and cholera, cultivation on gelatine and microbe staining

# Anniversaries in 2015 – III

- 100 1915 Paul Ehrlich and Hata created salvarsan, the first effective remedy for syphilis**  
**Twort & d Hérelle discovered bacteriophages**
- 75 1940 Florey & Chain prepared and tested pure penicillin**
- 55 1960 Woodward synthesized tetracycline**  
**Tyrrell et al. isolated common cold viruses**  
**Enders et al. prepared the vaccine against measles**  
**Burnet & Medawar: Nobel price for the discovery of acquired immunologic tolerance**

# Anniversaries in 2015 – IV

- 50 1965 Nobel price: Jacob & Monod for the discovery of regulation in bacteriae, Lwoff for explaining of lysogeny**
- 40 1975 Nobel price: Dulbecco, Temin & Baltimore: the relationship between tumor viruses and cellular genome**
- 10 2005 Nobel price: Warren & Marshall – the discovery of the role of *Helicobacter pylori* in gastric and duodenal inflammations and ulcers**

# **Preliminary Curriculum of lectures, 2014/15, spring term**

- 1. Microbiology and medicine**
- 2. Morphology and structure of bacteria**
- 3. Bacterial growth, growth curve**
- 4. Tenacity of microbes (their resistance to the environment)**
- 5. Microbial biofilm**
- 6. – 8. Antimicrobial therapy**
- 9. – 10. Pathogenicity and virulence**
- 11. – 12. Pathogenesis of infection**
- 13. – 14. Course and forms of infection**
- 15. Active and passive immunization**

# Recommended textbook

Greenwood, D., Slack, R., Barer, M., Irving, W.:  
**Medical Microbiology, 18th Ed., Churchill  
Livingstone, 2012, 800 pp.**

You may use also

Murray, P.R., et al.: **Medical Microbiology, 7th Ed., Mosby,  
2009, 947 pp.**

Goering, R., et al.: Mims' **Medical Microbiology, 5th Ed.,  
Saunders, 2012, 580 pp.**

# Recommended textbook II

Gladwin, M., Trattlen, B.: **Clinical Microbiology  
Made Ridiculously Simple, 25th Printing,  
MedMaster, Inc., 2012, Miami, Fl., approx.  
400 pp.**



# Further recommended literature

**Paul de Kruif: Microbe Hunters**

**Attention! If you are not going to become a microbiologist as I did  
please read the book with the extreme caution!**

# Other examples and questions

Examples of other works of fiction connected with the medicine in general and the microbiology in particular as well as possible questions please send to

[mvotava@med.muni.cz](mailto:mvotava@med.muni.cz)

# How to get to the text of the lecture

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**Student**

**Study Materials**

**Subject: ZLLM0421p**

**Learning Materials**

**Lectures in English**

**Thank you for your attention**