

**Institute for Microbiology, Medical Faculty of Masaryk University
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MICROBIOLOGY AND MEDICINE

The 1st lecture for 2nd-year students of Dentistry

February 19, 2014

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 2014 – I

- 340** 1674 **van Leeuwenhoek** first observed protozoa
- 265** 1749 * **Edward Jenner**, who first vaccinated against variola
- 190** 1824 * **Vilem Lambl**, discoverer of *Giardia lamblia*
- 150** 1864 **Louis Pasteur** noticed that microbes spoil wine
- 135** 1879 **Albert Neisser** discovered **gonococci**
- 130** 1884 **Löffler & Klebs** identified the cause of **diphtheria**
Eberth & Gaffky discovered the cause of **typhoid fever**
Élie Metchnikoff described **phagocytosis**
Hans Christian Gram introduced **Gram staining**
Nicolaier found the agent of **tetanus**
- 120** 1894 **Kitasato & Yersin** discovered the agent of **plague**

Anniversaries in 2014 – II

- 110 1909 Howard Ricketts described rickettsiae**
- 95 1919 Jules Bordet was awarded Nobel price for the discovery of BWR, complement and the agent of pertussis (whooping cough)**
- 90 1924 † Josef Hlava, discoverer of the agent of amoebic dysentery**
- 75 1939 Gerhardt Domagk described the effect of sulphonamides on gonococci**
- 70 1944 Selman Waksman discovered streptomycin
Avery et al. described the transformation of pneumococci**
- 65 1949 Enders et al. introduced the cultivation of poliovirus on tissue culture**
- 60 1954 Salk developed inactivated vaccine against polio**

Anniversaries in 2014 – III

45 1969 Delbrück et al. were awarded Nobel price for the description of the multiplication and genetic structure of viruses

25 1989 Bishop & Varmus were awarded Nobel price for the discovery of cellular origin of retroviral oncogenes

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, 2013/14, 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. – 6. Microbial biofilm I and II**
- 7. Antimicrobial therapy**
- 8. Pathogenicity and virulence**
- 9. – 10. Factors of pathogenicity I and II**
- 11. – 12. Pathogenesis of infection I and II**
- 13. – 14. Course and forms of infection I and II**
- 15. Active and passive immunization**

Recommended textbook

**Samaranayke, L.P. : Essential Microbiology
for Dentistry, 4th Ed., Churchill
Livingstone, 2011, 392 pp.**

And as a supplement

**Marsh, P., and Martin, M.V.: Oral Microbiology, 5th Ed.,
Churchill Livingstone, 2009, 232 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

How to get to the text of the lecture

is.muni.cz

Student

Study Materials

Subject: ZLLM0421p

Learning Materials

Lectures in English

Thank you for your attention

Why is microbiology important? How do we know? Microbiology in perspective: to the "golden age" and beyond Light microscopy
Electron microscopy. 2 Biochemical Principles. Atomic structure Acids, bases, and pH Biomacromolecules Test yourself. To the lay person, microbiology means the study of sinister, invisible "bugs" that cause disease. As a subject, it generally only impinges on the popular consciousness in news. 4 microbiology: what, why and how? coverage of the latest "health scare". It may come as something of a surprise therefore to learn that the vast majority of microorganisms coexist alongside us without causing any harm. r medicine. r environmental science. r food and drink production. Microbiology&medicine. 110 likes. An educational blog for the general public, microbiologist and medical student. Facebook is showing information to help you better understand the purpose of a Page. See actions taken by the people who manage and post content. Page created " 21 April 2020. People. Microbiology, in its broadest sense, is the study of the smallest forms of life. As such, it is a fundamental science at the center of the biological stage and, by its scope, relates to many of the other basic sciences and to numerous clinical phenomena including infectious diseases, disorders of the immune system including immune deficiencies and autoimmune phenomenon, and neoplasia. Read More. Despite all of our advances in science and medicine, infectious diseases remain one of the leading causes of death in adults and children world-wide. Each year, infectious diseases kill more than 17 million people, including 9 million children. In addition to suffering and death, infectious diseases impose an enormous financial burden on society.