

MEDICAL MICROBIOLOGY SHORT ANSWER QUESTIONS
(General Medicine – English Program)

These basic questions will be included in the mid-semester tests (in addition to simple-choice and multiple-choice questions) and in the written entry test of the Final Examination in the Department of Medical Microbiology. We would like to emphasize some important aspects about these questions and answers.

It is important to note that learning these questions alone does not give sufficient knowledge for the tests and examinations. These questions are not to be used to start learning, rather for measuring your knowledge. However, after learning the specific topics, students may use this material for self-testing, and also for identifying weak parts of their knowledge.

Teachers correcting the tests can give 1 point for each answer. As these are basic questions, only completely good answers will be accepted. However, after careful consideration, the teacher may give a point for an answer which is 75-80 % good. On the other hand, if the student writes bad answer(s) in addition to good answers for a question, the teacher may refuse to give the point, depending on the severity of the mistake.

If you find any mistakes in the questions or answers, or you think that there may be additional good answers given to a question, please write me, preferably in e-mail (Dr. Veress György: veregy@med.unideb.hu). We cannot accept any complaints regarding these questions during or after the tests/exams.

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GENERAL MICROBIOLOGY

1. Describe the colour (in a Gram stained smear) of Gram positive and Gram negative bacteria, respectively!
Gram positives: dark blue/purple
Gram negatives: red/pink
2. Describe the 3 important parts of the bacterial lipopolysaccharide!
lipid A + core polysaccharide + O-specific (polysaccharide) side chain
3. Which 2 roles are attributed to bacterial pili (fimbriae)?
adhesion; conjugation (sex fimbriae)
4. Mention a bacterium and its virulence factor that is encoded by a lysogenic bacteriophage!
Corynebacterium diphtheriae – diphtheria toxin
Streptococcus pyogenes – erythrogenic toxin
5. List the possible shapes of bacteria. Write one example for each category!
coccus (spherical): Staphylococcus, Streptococcus
rod: Clostridium, Corynebacterium, Gram negative rods
curved rod: Vibrio
helical: Spirochetes (Treponema, Borrelia, Leptospira)
6. What are the essential components of bacterial cells? Specify at least 3!
cytoplasm, nucleoid (genome), cell membrane, (cell wall)
7. Which part of the bacterial cell carries the endotoxin?
Outer membrane of Gram negative bacteria
8. What role is attributed to the bacterial capsule in the infectious process?
antiphagocytic effect, adhesion
9. Describe the definition for obligate anaerobic bacteria!
They are able to **replicate only in the absence of oxygen (under anaerobic conditions)**. Some of them are quickly killed by oxygen, some are able to survive but do not grow while oxygen is present.
10. Describe the definition for facultative anaerobic bacteria!
They are able to **replicate both in the presence and in the absence of oxygen**. In aerobic conditions, they perform respiration, in anaerobic condition, they perform fermentation.
11. What does sterilisation mean?
Sterilisation means the **killing or removal of all microorganisms** (including bacterial spores).

12. Mention 3 reliable methods of sterilization!
autoclaving, hot air oven, gamma-radiation, filtration (fluids), **gas sterilisation**
(not acceptable: boiling, pasteurisation, UV!)
13. Specify an exact set of parameters (temperature and time) necessary for effective sterilization by **autoclaving!**
121 °C for 20 min. (at 1 bar overpressure)
14. Specify an exact set of parameters (temperature and time) necessary for effective sterilization using a **hot air oven** (with circulation)!
160 °C for 60 min. (dry heat)
15. What does disinfection mean?
The purpose of disinfection is the **killing of pathogenic microbes**. Resistant microbes and spores may survive, so disinfection does not the kill all microbes.
16. Mention 5 groups of disinfectants!
alcohols, phenol derivatives, detergents, chlorine, iodine, aldehydes
17. Mention 2 groups of disinfectants acting on the microbial membrane structures!
a., (cationic) detergents (quaternary ammonium compounds)
b., phenol compounds (cresol, hexachlorophene, chlorohexidine)
c., alcohols (ethanol, isopropanol)
18. What does active immunisation mean?
It means the **transfer of microbes or microbial products (vaccines)** to the human body to induce **long-lasting immunity** against a specific infectious disease
19. What does passive immunisation mean?
It means the **administration of preformed antibody (immune globulins** produced in animals or humans) to the human body resulting in **short-term protection** against a specific infectious disease
20. Mention 2 bacterial infectious diseases that can be prevented or treated by passive immunisation!
prevention: **tetanus**
treatment: **diphtheria, botulism, tetanus**
21. Describe precisely what toxoid means!
Inactivated bacterial exotoxin that is not toxic but immunogenic
22. What do the vaccine(s) against diphtheria and tetanus contain?
Diphtheria and tetanus **toxoid**
23. What does the vaccine against pertussis contain?
Previously: **killed** bacteria
Currently: **acellular** vaccine (toxoid + other purified proteins)

24. What does the vaccine against tuberculosis (BCG) contain?
live attenuated *Mycobacterium bovis* (Bacille Calmette-Guerin)
25. What is the nature of antigen in the vaccines used to prevent infections by *Streptococcus pneumoniae*, *Haemophilus influenzae* and *Neisseria meningitidis*?
capsular polysaccharide (either alone or conjugated to a carrier protein)
26. Specify the 4 groups of **bacterial** vaccines according to the nature of the antigen!
a., live, attenuated vaccines
b., killed bacterial vaccines
c., toxoid vaccines
d., subunit vaccines (capsular polysaccharide or purified protein)
27. What are the main advantages and disadvantages of live attenuated vaccines as compared to killed vaccines?
Advantages: induce not only serum antibodies but also **cellular immunity and local IgA** antibodies. Some may be applied orally. Usually **fewer doses** are needed.
Disadvantages: Attenuated strains may **revert to virulent** in rare cases. They may cause **disease in immunosuppressed** patients. Live attenuated microbes are usually heat sensitive and must be refrigerated.
28. Mention 2 bacterial exotoxins that act by ADP ribosylation!
Diphtheria toxin, cholera toxin, pertussis toxin
29. Mention 2 bacterial exotoxins that are neurotoxic!
tetanus toxin, botulinum toxin
30. What is the mechanism of action of diphtheria toxin?
Inhibition of protein synthesis in eukaryotic cells by **ADP-ribosylation of ribosomal EF-2** (elongation factor-2)
31. What is the mechanism of action of tetanus toxin?
It causes **spastic paralysis** by **blocking the release of inhibitory neurotransmitters** (glycine and GABA) in synapses
32. Mention at least three of the physiological effects of septic shock (characterized by the presence of large amount of bacterial endotoxin in the blood)!
fever, hypotension, disseminated intravascular coagulation (DIC), complement activation, impaired organ perfusion, hypoglycaemia
33. Mention 2 non-essential bacterial organelles that enhance bacterial virulence! Describe how their function contributes to pathogenicity!
Capsule: antiphagocytic effect, adhesion to tissues
Fimbriae: binding to tissues
Flagellae: spreading the bacteria
34. Mention 4 extracellular enzymes of bacterial origin functioning as virulence factors!
coagulase, streptokinase (fibrinolysine), streptodornase (DNase), hyaluronidase, IgA protease, collagenase, elastase, urease

35. What is a vector? Write an example!

Vector is an **arthropod** that **transmits infection** from human to human, or from animal to human

examples. tick – Lyme disease; louse – epidemic typhus; mosquito – malaria

36. Mention 2 infectious diseases that are transmitted to humans by tick bites!

tick-borne encephalitis; Lyme-disease; tularemia; Rocky-Mountain spotted fever; etc.

37. What is a reservoir? Write an example!

The **normal host** of a pathogen (human or animal) serving as a continuous **source of infection** to other hosts (such as humans).

Salmonella typhi – human; *Yersinia pestis* - rodents

38. Mention at least 5 possible transmission ways of infections!

respiratory droplets (infectious aerosol)

faecal-oral

direct contact (such as sexual)

fomites (inanimate objects)

blood

vectors (blood-sucking arthropods)

39. What is the difference between prevalence and incidence of an infectious disease?

It can be differentiated in **chronic diseases**. **Prevalence: total number** of diseases (per 100,000 people). **Incidence: number of new cases** in a year (per 100,000 people).

40. What is the difference between mortality and lethality of a disease?

Mortality: total **number of deaths** caused by the disease in a population (usually 100,000 people). Lethality: **rate of death** (in percent) among patients suffering from the disease.

41. Describe the rules of collecting native urine for culturing bacteria! Describe also the conditions for keeping the specimen before sending it to the laboratory!

A midstream specimen, taken preferably in the morning, after thorough cleaning of the external genital area. Keep it up to 1 h at room temperature or up to 24 h at +4 °C.

42. Describe the rules of collecting hemoculture specimens!

It is recommended to obtain **3 specimens** (with at least 30 min. between the specimens).

The specimens should be preferably taken **before fever spikes (during rising fever), from fresh peripheral venipuncture sites**. If possible, **both aerobic and anaerobic** bottles should be used (3 x 2 bottles altogether). The site of **venipuncture** and the **plug of the bottle** containing the medium must be properly **disinfected**. The amount of blood injected to the bottle should be about 10 % of the liquid medium. The specimen should be taken before giving antibiotics to the patient.

43. Mention two clinical specimens that are heavily contaminated with bacteria belonging to the normal body flora!

throat and nasal secretions, faeces, vaginal secretions.

44. Explain the purpose for using beta-lactamase inhibitors in antibacterial therapy!
Combination of beta-lactamase inhibitors (such as **clavulanic acid or sulbactam**) with beta-lactamase sensitive penicillins (such as **amoxicillin or ampicillin**) **can overcome resistance mediated by many but not all beta-lactamases.**
45. Mention a **group** of antimicrobial drugs that acts on the bacterial ribosome and usually has bactericidal effect!
aminoglycosides
46. Mention 2 broad-spectrum (effective against both Gram positive and Gram negative bacteria) penicillin derivatives.
ampicillin, amoxicillin, piperacillin, azlocillin, mezlocillin
47. Mention an antifungal and an antibacterial drug that alter the function of the cell membrane!
antifungal: Amphotericin B, azoles; antibacterial: polymyxins
48. What are the possible mechanisms of acquired penicillin resistance of bacteria? Mention at least 3 mechanisms!
1. **beta-lactamase** production
2. **PBP (target) alteration**
3. **reduced permeability**
4. **active efflux**
49. Mention a drug belonging to macrolides!
erythromycin, spiramycin, roxithromycin, clarithromycin, azithromycin
50. Mention 2 drugs belonging to aminoglycosides!
streptomycin, gentamycin, tobramycin, amikacin...
51. Mention 2 groups of antimicrobial drugs that act on the 30 S subunit of the bacterial ribosome!
aminoglycosides, tetracyclines, glycyliclines
52. Mention 3 antimicrobial drugs that act on the 50 S subunit of the bacterial ribosome!
chloramphenicol, erythromycin (and other macrolides), clindamycin, linezolid, streptogramins
53. Mention 3 **groups** of antibacterial drugs inhibiting bacterial cell wall synthesis!
penicillins, cephalosporins, carbapenems, monobactams, glycopeptides
54. Mention 4 groups of antibiotics which have bactericidal effects!
penicillins, cephalosporins, aminoglycosides, fluoroquinolons etc.
55. Which antibiotics inhibit bacterial DNA gyrase enzyme?
nalidixic acids, fluoroquinolons

56. What is the mode of action of the antibiotics sulfonamides and trimethoprim, respectively?
They inhibit the synthesis of **folic acid**. Sulfonamides: inhibit the synthesis of dihydrofolate (they are PABA analogues). Trimethoprim: inhibition of dihydrofolate-reductase.
57. What is the mode of action of the antibiotic vancomycin?
Inhibits cell wall synthesis in Gram positive bacteria by **blocking transpeptidation**.
58. Mention 4 groups of antibiotics inhibiting protein synthesis of bacteria!
Aminoglycosides, tetracyclines, chloramphenicol, macrolides, lincosamides
59. Regarding the joint effects of 2 antibiotics, what does synergism mean?
The effect of the two drugs together is significantly higher than the sum of the effects of the two drugs acting separately.
60. Regarding the joint effects of 2 antibiotics, what does antagonism mean?
The effect of the two drugs together is significantly lower than the effect of the more effective drug alone.
61. What does selective toxicity mean?
Selective inhibition of the growth of the microorganism without damage to the host.
In other words: the drug is highly toxic to the bacteria, but not toxic (or have very low toxicity) to the human host.
62. What is the mechanism of action of lysozyme? Where is lysozyme found in the host?
It destroys bacterial cell wall peptidoglycan by hydrolysing the glycosyl bonds between NAM (N-acetylmuramic acid) and NAG (N-acetylglucosamine). It occurs in tear, saliva, respiratory secretions.
63. What roles can be attributed to specific antibodies in antibacterial immunity? Specify at least 3!
a. **neutralisation of exotoxins and enzymes**
b. complement-dependent **bacteriolysis** (Gram-negatives)
c. **opsonisation** (helping phagocytosis)
d. **interfering with attachment** of bacteria to mucosal surfaces
64. Which type of hypersensitivity is involved in the tuberculin test?
late type (type IV)
65. Which Gram negative organelles or structures are associated with the O, H and K antigens, respectively?
O- LPS, H-flagella, K-capsule
66. How can one identify the different surface antigens of Gram negative bacteria?
with slide agglutination tests using antibodies of known specificity

67. Starting from a fixed smear, specify the main steps of Gram stain in the appropriate order!
1. Crystal violet
 2. Lugol solution (iodine)
 3. Differentiation: ethanol wash
 4. Counterstaining: safranin or fuchsin
(wash with tap water after each step)
68. Starting from a fixed smear, specify the main steps of the acid-fast stain (Ziehl-Neelsen) in the appropriate order!
1. Stain with carbol-fuchsin (with heating)
 2. Differentiation: wash with acid-ethanol
 3. Counterstaining with methylene-blue
(wash with tap water after each step)
69. Describe the principle of acid fast staining procedures!
Mycobacteria contain a high amount of special lipids called **mycolic acids**. They can be stained by hot carbol-fuchsin, but they **resist decolourisation with acid-alcohol**, so they remain red. All other cells are stained blue by the counter stain (methylene blue).
70. What is the difference between agglutination and precipitation?
Both are serological reactions where specific binding of the antigen with the antibody directly results in a reaction visible by the naked eye. The difference is in the nature of the antigen. **Agglutination: particulate antigen** (RBC, bacteria, latex particles).
Precipitation: antigen is in solution before the reaction.
71. What does titer mean in serological tests?
The **highest dilution** of the serum sample that gives a **positive** reaction in the test.
72. How can one differentiate between past and current infections in serological tests?
Current infections are indicated by: either **IgM class** specific antibodies or, in the case of paired serum specimens (taken from the same patient at least 7-10 days apart), a **significant (at least 4-fold) rise in the titer** of specific antibodies.
73. Specify the main steps of an ELISA test in which we detect antibodies from patients' serum samples using known antigens!
1. **Binding antigen** to plastic surface (in wells of a 96-well plate)
 2. Adding **diluted serum sample** (specific antibodies bind to the antigen)
 3. Adding **conjugate** (secondary antibody conjugated with an enzyme)
 4. Adding the **substrate** of the enzyme, reading the **colour reaction**.
(wash with buffer after steps 1-3.)
74. How can one determine the minimal inhibitory concentration of an antibiotic to a bacterial isolate?
Inoculate the bacterial isolate into a series of test tubes containing 2-fold dilution series of the drug (prepared in appropriate liquid culture medium). After overnight incubation, the **lowest concentration of drug that prevents visible growth** of the organism is the MIC.

75. Describe the principle of the Kirby-Bauer (disk diffusion) method used to determine antibiotic sensitivity!

Disks impregnated with different antibiotics are placed on the surface of appropriate agar media that has been inoculated with the bacterium isolated from the patient. After overnight incubation, the **antibiotics diffusing from the discs** may cause zones of inhibition around the discs. The **size of the zone** should be compared to standards to determine antibiotic sensitivity.

CLINICAL BACTERIOLOGY

1. Mention 5 diseases that are frequently caused by *Staphylococcus aureus*!
Impetigo, furunculus, pneumonia, osteomyelitis, food poisoning etc.
2. Mention 2 toxin-mediated staphylococcal diseases!
toxic shock syndrome (TSS), scalded skin syndrome, food poisoning
3. Mention 3 toxic products produced by *Staphylococcus aureus*!
TSST (toxic shock syndrome toxin), enterotoxin, exfoliatin, leukocidins, hemolysins
4. Which is the most virulent species of *Staphylococcus*?
S. aureus
5. Which enzymatic virulence factor is characteristic exclusively for *Staphylococcus aureus*?
coagulase
6. How can we identify the source of infection in a staphylococcal food poisoning?
by phage typing
7. Which antibacterial drug is the first choice in serious infections caused by methicillin sensitive *Staphylococcus aureus* (MSSA) strains?
oxacillin (cloxacillin, flucloxacillin)
8. Which antibacterial drug is the first choice in serious infections caused by methicillin resistant *Staphylococcus aureus* (MRSA) strains?
glycopeptides (vancomycin, teicoplanin)
9. In which disease is *Staphylococcus saprophyticus* considered an obligate pathogen?
cystitis in young women
10. Which cell constituents determine the group-specific, and the type specific antigens of *Streptococcus pyogenes*, respectively?
group specific: C- polysaccharide
type specific: M protein
11. Mention 3 enzymes produced by *Streptococcus pyogenes* that enhance the spread of the bacterial infection in the body!
Streptokinase (fibrinolysin), hyaluronidase, streptodornase (DNase)
12. List 3 diseases caused by *Streptococcus pyogenes* in the skin or in subcutaneous tissues!
impetigo (pyoderma), cellulitis, erysipelas, fasciitis, myositis
13. Mention a toxin-mediated streptococcal disease, specify the name of the toxin and its mechanism of action!
Scarlet fever - erythrogenic toxin – superantigen causing capillary destruction

14. Mention 2 poststreptococcal diseases!
Glomerulonephritis, rheumatic fever, erythema nodosum, chorea minor.
15. Which product of *Streptococcus pyogenes* has a major pathogenic role in poststreptococcal diseases?
M protein: may induce hypersensitivity reactions
16. How long does immunity against scarlet fever exist? Which immune effector mechanism is involved?
Life-long immunity. Antitoxic antibodies are involved.
17. What is the drug of first choice in *Streptococcus pyogenes* infection?
Penicillin-G
18. What is the pathomechanism of post-streptococcal rheumatic fever?
type II hypersensitivity (cytotoxic antibodies)
19. What is the pathomechanism of post-streptococcal glomerulonephritis?
type III hypersensitivity (immune complexes)
20. Which *Streptococcus* species plays major role in the meningitis of newborn babies?
Group B Streptococcus (*S. agalactiae*)
21. What is (are) the major causative agent(s) for subacute bacterial endocarditis?
Viridans streptococci
22. What are the characteristics of Enterococci that can be used in their identification?
D group polysaccharide antigen; tolerance to bile and hydrolysis of esculin (BEA medium: bile esculin agar); growth in the presence of 6,5 % NaCl
23. What are the specific morphologic features of *Streptococcus pneumoniae*?
Gram positive diplococcus, lancet shape, capsule.
24. Mention 3 diseases that are frequently caused by *Streptococcus pneumoniae*!
Pneumonia, meningitis, sinusitis, otitis media, sepsis, (ulcus serpens corneae)
25. What fast diagnostic procedure can be used in acute *Neisseria gonorrhoeae* infection?
Demonstration of bacteria (intracellular in PMNs) from urethral discharge by Gram or methylene blue stain; PCR amplification of bacterial DNA
26. What kind of immunity develops after *Neisseria gonorrhoeae* infection?
Partial immunity of short duration; no protection from reinfection
27. Specify at least 2 of the most important manifestations of disseminated gonorrhoeal infections!
arthritis, skin lesions, (endocarditis, meningitis)

28. What is the major manifestation of *Neisseria gonorrhoeae* infection in newborns?
How can it be prevented?
Blenorrhoea (ophthalmia) neonatorum, silver acetate eye drops or erythromycin ointment
29. Mention at least 3 major virulence factors of *Neisseria gonorrhoeae*!
pilus, outer membrane proteins, LOS (lipooligosaccharide), IgA protease
30. Mention at least 2 major virulence factors of *Neisseria meningitidis*!
polysaccharide capsule, LPS, IgA protease
31. What is the site of entry of *Neisseria meningitidis* infection? Which diseases are caused by this bacterium?
The site of entry is the **nasopharynx** (transmitted by airborne droplets).
Meningococemia (characterized by skin lesions), and acute (purulent) bacterial **meningitis**.
32. What kinds of prophylactic measurements are available against *Neisseria meningitidis* infections?
Chemoprophylaxis: rifampin or ciprofloxacin.
Vaccination: capsular polysaccharide (types A, C, Y and W135). No vaccine against type B!
33. Which rapid diagnostic methods can be used in the presumptive diagnosis of purulent bacterial meningitis?
Gram or methylene blue stain of CSF sediment
Demonstration of bacterial capsular antigens by latex agglutination (from CSF)
34. Which capsular serotype is included in the vaccine against *Haemophilus influenzae*?
type b
35. Which are the portals of entry of *Bacillus anthracis*?
Skin, lungs, gastrointestinal tract
36. Mention 3 important bacteria involved in nosocomial (hospital-acquired) infections!
Staphylococcus aureus*, *Enterococcus faecalis*, *Pseudomonas aeruginosa*, *Escherichia coli
37. Mention four *E. coli* pathogenetic groups involved in enteric diseases!
Enteropathogenic *E. coli* (EPEC)
Enterotoxigenic *E. coli* (ETEC)
Enteroinvasive *E. coli* (EIEC)
Enterohemorrhagic *E. coli* (EHEC)
Enterocytotoxic *E. coli* (EAggEC)
38. What are the most important extraintestinal infections caused by *E. coli*? Mention at least 3 of them!
urinary tract infections, neonatal meningitis, nosocomial wound infections

39. The most frequent causative agent of urinary tract infections is:
Escherichia coli
40. Which 2 diseases are caused by *E. coli* O157:H7?
hemorrhagic colitis +/- HUS (hemolytic uraemic syndrome)
41. What is the reservoir of *Salmonella typhi*?
humans (with disease, or healthy carriers)
42. Which bacteria cause most frequently typhoid fever and enteric fever, respectively?
***Salmonella typhi* (typhoid)
Salmonella paratyphi A, B, C (enteric fever)**
43. When typhoid fever is suspected, what kinds of clinical samples should be used to isolate the causative agent in the first 2 weeks of the disease?
Blood, (bone marrow)
44. What is the route of infection in Salmonella gastroenteritis?
Ingestion of contaminated food (such as eggs, cream, mayonnaise, creamed foods, etc.) containing a sufficient number of *Salmonella*.
45. Which antibacterial drugs should be administered in gastroenteritis caused by Salmonella?
Antibiotics are not usually necessary unless the infection is generalised. In case of extraintestinal infection (very young, very old or immunosuppressed patients): ampicillin, gentamicin, trimethoprim/sulfamethoxazole, or ciprofloxacin.
46. List the 4 Shigella species causing human disease!
Shigella dysenteriae*, *S. flexneri*, *S. boydii*, *S. sonnei
47. Mention 2 bacterial species belonging to different genera that cause bacillary dysentery
***Shigella dysenteriae*, (*Shigella flexneri*, *Shigella boydii*, *Shigella sonnei*), *enteroinvasive E. coli* (EIEC)**
48. Mention 3 bacterial species belonging to different genera that cause enteritis or enterocolitis!
Campylobacter jejuni*, *Escherichia coli*, *Salmonella enteritidis*, *Shigella*, *Yersinia enterocolitica
49. Mention 2 bacteria causing intestinal infections which have animal reservoirs!
***Salmonella* (not Typhi and Paratyphi!), *Campylobacter jejuni*, *Yersinia enterocolitica*, *Listeria monocytogenes*, *E. coli* O157**
50. What are the modes of transmission for the 2 different epidemiologic forms of plague?
- **Bubonic plague** is transmitted by the bite of infected rat fleas from rats to humans.
- **Primary pneumonic plague** spreads directly from human to human via respiratory droplets.
51. What are the possible portals of entry of *Francisella tularensis*? Specify at least 4!
tick bite, mucous membranes, skin abrasions, resp. tract, gastroint. tract

52. How do humans acquire brucellosis? Where do the bacteria replicate in the human body?
**Via contaminated milk products or through skin abrasions (contact with animals).
Organisms spread to the mononuclear phagocytes of the reticuloendothelial system
(lymph nodes, liver, spleen, bone marrow).**
53. What are the reservoirs of the different *Brucella* species, respectively?
***B. abortus*: cattle
B. melitensis: goat, sheep
B. suis: swine**
54. What is the mechanism of action of cholera toxin?
Cholera toxin activates the adenylate cyclase enzyme in cells of the intestinal mucosa leading to **increased levels of intracellular cAMP**, and the **secretion of large amount of water, Na⁺, K⁺, Cl⁻, and HCO₃⁻ into the lumen** of the small intestine.
55. What is the principle of the treatment for cholera?
Rapid intravenous or oral **replacement of the lost fluid and ions**. (Administration of isotonic maintenance solution should continue until the diarrhea ceases.) In severe cases: administration of tetracycline (in addition to rehydration).
56. Mention 4 diseases caused by *Haemophilus influenzae*!
**purulent meningitis
epiglottitis (obstructive laryngitis)
otitis media and sinusitis
pneumonia
(cellulitis, arthritis)**
57. Which disease is caused by *Haemophilus ducreyi*?
Chancroid (soft chancre or ulcus molle), which is an STD (sexually transmitted disease)
58. What can serve as source of infections caused by *Pseudomonas aeruginosa*?
Pseudomonas species are normally present in the **environment** and can be isolated from the **skin, throat, and stool** of some healthy persons. They often colonize hospital food, sinks, taps, mops, and respiratory equipment.
59. Mention 4 diseases that are frequently caused by *Pseudomonas aeruginosa*!
**urinary tract infections
wound infections (burns)
pneumonia, sepsis (immunosuppression)
otitis externa**
60. Mention at least 3 drugs which may be effective to treat infections caused by *Pseudomonas aeruginosa*!
certain penicillins: **piperacillin/tazobactam combination**
a 3rd generation cephalosporin: **ceftazidim**
a 4th generation cephalosporin: **cefepime**
certain aminoglycosides: gentamycin, **amikacin**
carbapenems: **imipenem, meropenem**

61. What are the frequent sources of infection for *Legionella pneumophila*?
air conditioners, water taps, showers, evaporators, etc.
62. Which 2 diseases are caused by *Legionella pneumophila*?
- **legionellosis, legionnaires' disease** (atypical pneumonia)
- **Pontiac fever** (mild, flu like illness without pneumonia)
63. List 3 important virulence factors of *Bordetella pertussis*!
filamentous hemagglutinin, pertussis toxin, adenylate-cyclase toxin, tracheal cytotoxin
64. What is the precise definition of bacterial food poisoning?
Acute disease, usually with vomiting and diarrhea, caused by **preformed toxins produced by bacteria contaminating the food**. The period between consumption of food and the appearance of symptoms is short (< 4-6 hours).
65. Mention 3 bacterium species causing food poisoning!
Staphylococcus aureus*, *Bacillus cereus*, *Clostridium perfringens*, *Clostridium botulinum*, *Vibrio parahaemolyticus, (Salmonella serotypes causing enterocolitis)
66. Which bacterium has the highest germ number in the colon?
Bacteroides fragilis
67. Mention 4 bacterial genera that are obligate anaerobes!
Clostridium*, *Bacteroides*, *Prevotella*, *Porphyromonas*, *Fusobacterium*, *Actinomyces*, *Bifidobacterium*, *Peptostreptococcus*, *Propionibacterium
68. Which is the most important gas gangrene *Clostridium*? What is its main virulence factor?
Clostridium perfringens
alpha-toxin (lecithinase)
69. Mention 3 *Clostridium* species causing gas gangrene! How are they acquired?
Clostridium perfringens*, *C. novyi*, *C. septicum*, *C. histolyticum*, *C. tertium*, *C. bifermentans*, *C. sporogenes
The site of infection is usually a wound that comes into contact with *Clostridium* spores that germinate in an **anaerobic environment**.
70. How can be tetanus prevented in patients who have wounds possibly contaminated with *C. tetani* spores?
Wound should be **cleaned and debrided; tetanus toxoid booster injection given; tetanus immunoglobulin (TETIG)** in previously unvaccinated patients and in case of heavy contamination of wound; penicillin may be added prophylactically
71. What are the main symptoms of tetanus infection? Specify at least 3!
Spastic paralysis: muscle spasms; **lockjaw(trismus), risus sardonicus (grimace of the face), opisthotonus (spasm of the back); respiratory paralysis**
72. What is the mechanism of action of the botulinus toxin?
Blocks release of acetylcholine in peripheral nerve synapses;

73. What are the main symptoms of botulism? Specify at least 3!
flaccid paralysis: diplopia (double vision), dysphagia (difficulty to swallow), dysphonia (hoarseness), respiratory paralysis.
74. What kind of therapy is used to treat botulism?
Treatment: respiratory support + **trivalent antitoxin**
75. Explain whether or not antibiotic treatment is useful in botulism!
Not, because antibiotics are not effective against **preformed toxins.**
76. What diseases may be associated with *Helicobacter pylori*? Specify at least 3!
Gastritis, peptic and duodenal ulcers, gastric carcinoma, MALT lymphoma
77. What is the most important virulence factor of *Corynebacterium diphtheriae*?
Diphtheria toxin
78. What is the mechanism of action of the diphtheria toxin?
Inhibits protein synthesis. Inhibits peptide elongation in eukaryotic ribosomes by ADP ribosylation of EF-2 (elongation factor-2)
79. How long does immunity against diphtheria exist? Which immune effector mechanism is involved?
long lasting immunity; antitoxic antibodies
80. Which assays should be done in the lab in order to prove diphtheria?
Smears of the **throat swab should be stained with methylene blue or Neisser stain;** bacteria are **cultured on Löffler's or tellurite (Clauberg) medium; toxin production** must be demonstrated by **agar precipitation (ELEK-test)**
81. What feature of Mycobacteria make them acid fast?
The cell envelope contains a **high amount (60 – 70 %) of complex lipids:** mycolic acid, cord factor. Once the cells are stained (by carbol-fuchsin) they **resist decolorisation by acid-ethanol.**
82. Mention 2 atypical Mycobacterium species!
***M. kansasii*, *M. marinum*, *M. avium-intracellulare* complex, *M. fortuitum-chelonae* complex**
83. How can one demonstrate the presence of Mycobacterium tuberculosis in clinical samples?
Acid-fast staining (Ziehl-Neelsen)
Culture on selective media (Löwenstein-Jensen agar, liquid BACTEC medium)
PCR amplification of bacterial DNA
84. Why is multi-drug therapy used for tuberculosis?
To prevent the overgrowth of drug-resistant mutants during the long treatment period (if bacteria resistant to one drug emerge, they are most probably inhibited by the other drugs).

85. What is the main immune defense mechanism against *Mycobacterium tuberculosis*?
activated macrophages
86. Mention 3 antituberculous drugs that are of first choice against *Mycobacterium tuberculosis*!
isoniazid (INH), pyrazinamid, rifampin, (ethambutol, streptomycin)
87. What disease is caused by *Mycobacterium avium-intracellulare*? What patients are characteristically susceptible to infection?
It causes TB, especially in immunosuppressed patients (such as AIDS patients).
88. What is the reservoir of *Mycobacterium tuberculosis*?
human
89. What is the reservoir of atypical *Mycobacteria*?
environment (soil, water)
90. What are the 2 distinct forms of leprosy?
Tuberculoid, lepromatous forms
91. Mention 3 Gram-negative bacteria belonging to different genera causing zoonosis!
Brucella, Francisella tularensis, Yersinia pestis, Pasteurella
92. Mention 2 Gram-positive bacteria belonging to different genera causing zoonosis!
Listeria monocytogenes, Bacillus anthracis, Erysipelothrix rhusiopathiae
93. Mention 3 bacterial species belonging to different genera that are frequent causes of urinary tract infections!
E. coli, Klebsiella, Proteus, Pseudomonas aeruginosa, Enterococcus faecalis
94. Mention one aerobic and one anaerobic bacterium of the normal flora of the skin!
aerobic: ***Staphylococcus epidermidis***
anaerobic: ***Propionibacterium acnes***
95. Give two genera for each category of bacteria!
Gram positive aerobic: ***Staphylococcus, Streptococcus, Bacillus, Corynebacterium***
Gram positive anaerobic: ***Clostridium, Actinomyces, Propionibacterium, Lactobacillus***
96. Give two genera for each category of bacteria!
Gram negative aerobic: ***Vibrio, Neisseria, Haemophilus***
Gram negative anaerobic: ***Bacteroides, Prevotella, Porphyromonas, Veillonella***
97. Give 2 genera for each category of bacteria!
Gram positive coccus: ***Staphylococcus, Streptococcus***
Gram negative coccus: ***Neisseria, Veillonella***
Gram positive rod: ***Clostridium, Bacillus***

98. Give 2 genera for each category of bacteria!
Gram negative rod: *E. coli*, *Salmonella*, *Shigella*
Spirochetes: *Treponema*, *Borrelia*, *Leptospira*
99. Describe the color and the shape of Clostridia in a Gram stained smear of gas gangrene exudate!
Gram positive (dark blue) **rod**
(it usually does not form spores in vivo)
100. Mention 2 antibiotics which can be used in the empirical treatment against Gram negative obligate anaerobic bacteria!
Metronidazol, amoxicillin + clavulanic acid, imipenem
101. Which 3 bacterial species are the most important causative agents of neonatal (< 1 month of age) meningitis?
Streptococcus agalactiae, *E. coli*, *Listeria monocytogenes*
102. Which 3 bacterial species are the most important causative agents of meningitis among babies (> 1 month of age) and children?
Neisseria meningitidis, *Haemophilus influenzae*, *Streptococcus pneumoniae*
103. What is the causative agent of febris undulans (undulant fever)?
Brucellae
104. What are the main symptoms in the different stages of syphilis?
Primary syphilis: nontender **ulcer** (hard chancre)
Secondary lesions: **maculopapular rash** on skin, and **condylomata lata** on mucous membranes
Tertiary stage: granulomas (**gummas**), central nervous system involvement (**tabes dorsalis**, **paralysis progressiva**), cardiovascular lesions (**aortitis**, **aortic aneurysm**)
105. When syphilis is diagnosed in the lab, which antigens are used in the non-treponemal and in the specific treponemal antibody tests, respectively?
Non-treponemal antibody tests: **cardiolipin**
Specific treponemal antibody tests: *Treponema pallidum*
106. Which are the two different kinds of antibodies used in the diagnosis of syphilis? Give examples for tests demonstrating them!
Reagin (nonspecific antibody) – RPR, **VDRL** (flocculation tests)
Immobilisin (specific antibody) – **TPHA (T. pallidum hemagglutination)**, **FTA-ABS (fluorescent treponemal assay – with antibody absorption)**, **TPI (T. pallidum immobilisation test)**,

107. What is the advantage and disadvantage of the FTA-ABS syphilis serologic test compared to the VDRL test?
Specific (treponemal) tests such as FTA-ABS are **more specific**, but they **can not be used to follow the efficacy of treatment** (because the specific antibodies persist even after effective eradication of bacteria)
108. What is the drug of first choice in the treatment of syphilis?
penicillin G
109. What is the reservoir and what is the vector for *Borrelia recurrentis*?
Reservoir: human; vector: louse
110. What is used for the laboratory diagnosis of relapsing fever?
Direct demonstration of bacteria from **peripheral blood smear** by microscopy (**Giemsa** stain or dark field illumination)
111. What is the causative agent of Lyme disease?
Borrelia burgdorferi
112. Mention 2 antibacterial drugs that are of first choice in early stage Lyme disease?
Tetracyclines, amoxicillin, cefuroxim
113. What is the first characteristic manifestation in the early phase of Lyme disease?
Erythema (chronicum) migrans
114. Which manifestations are characteristic for the late phases of Lyme disease?
Arthritis, cardiac manifestations (myocarditis, pericarditis) and neurological involvement (meningitis, peripheral neuropathies)
115. What is the reservoir of *Leptospira interrogans*?
rodents, household animals (dog, swine etc.)
116. Mention 2 obligate intracellular bacterial genuses!
Rickettsia, Chlamydia, (Coxiella, Ehrlichia)
117. Mention 4 bacteria causing atypical pneumonia!
Chlamydia pneumoniae
Chlamydia psittaci
Coxiella burnetii
Mycoplasma pneumoniae
Legionella pneumophila
118. Which two diseases are caused by *Rickettsia prowazekii*?
Louse-borne epidemic typhus
Recurrent form: Brill-Zinsser disease
119. Mention an antibacterial drug active against rickettsial infections!
Tetracycline, chloramphenicol

120. What are the reservoir and vector of *Rickettsia prowazekii* infections?
reservoir: human; vector: louse
121. What are the reservoir and vector of *Rickettsia typhi* infections?
reservoir: rodents; vector: flea
122. What is the causative agent of epidemic typhus?
Rickettsia prowazekii
123. What is the causative agent of endemic typhus?
Rickettsia typhi
124. How can be Chlamydiae and Rickettsiae cultivated?
These are **obligate intracellular** bacteria, can be cultured in **experimental animals, embryonated eggs, and cell culture**
125. Mention an antibacterial drug active against chlamydial infections!
Tetracycline, erythromycin, azithromycin
126. List the serotypes of *Chlamydia trachomatis* and the diseases caused by them!
Types A,B and C: trachoma (chronic conjunctivitis)
Types D-K: genital tract infections (NGU, PID), inclusion conjunctivitis
Types L1-L3: lymphogranuloma venereum (STD)
127. Mention an antibacterial drug effective against *Mycoplasma pneumoniae* infections!
Erythromycin, azythromycin, tetracycline
128. Why are penicillins not effective against *Mycoplasma pneumoniae* infections?
Because of the absence of a cell wall, penicillins are ineffective (penicillins inhibit cell wall synthesis)
129. Mention 4 bacteria frequently causing sexually transmitted diseases (STD)!
***Treponema pallidum*, *Neisseria gonorrhoeae*, *Haemophilus ducreyi*, *Chlamydia trachomatis*, (*Calymmatobacterium granulomatis*)**
130. Which bacterial species can cause hepatitis (jaundice)?
Leptospira interrogans
131. Mention 2 bacteria causing aseptic (serous) meningitis!
Treponema pallidum*, *Leptospira interrogans*, *Borrelia burgdorferi
132. Mention a bacterial pathogen which eludes the host immune response by frequent antigenic changes!
Borrelia recurrentis*, *Neisseria gonorrhoeae
133. What is the causative agent of febris recurrens (recurrent fever)?
Borrelia recurrentis

MYCOLOGY

1. What does fungal dimorphism mean?
The same species is **capable of existing in two morphological forms** (yeast or mold), depending upon environmental conditions (temperature, nutrients).
2. Which are the 4 fungal species causing systemic mycosis?
Coccidioides immitis*, *Histoplasma capsulatum*, *Blastomyces dermatitidis*, *Paracoccidioides brasiliensis
3. Mention 3 species causing opportunistic fungal infections!
Candida albicans*, *Cryptococcus neoformans*, *Aspergillus fumigatus*, *Mucor spp.*, *Rhizopus spp.
4. Mention 3 diseases caused by dermatophytes!
Tinea corporis*, *tinea capitis*, *onychomycosis*, *tinea barbae
5. Mention 3 fungal genera belonging to the dermatophytes!
Trichophyton*, *Microsporum*, *Epidermophyton
6. What is the route of transmission of *Sporothrix schenckii*?
Traumatically introduced under the skin.
7. Mention a *Candida* infection associated with mucosal surfaces!
Soor, vulvovaginitis
8. Which species is the most important causative agent of fungal meningitis?
Cryptococcus neoformans
9. Mention 3 manifestations of *Candida albicans* infections that are characteristic in AIDS patients!
generalised oral candidiasis (GOC), oesophagitis, endocarditis
10. What are the different forms of pulmonary aspergillosis?
 1. **Aspergillus ball** (in preformed cavities)
 2. **invasive aspergillosis** (in immunosuppression)
 3. **allergic bronchopulmonary aspergillosis**
11. What is the usual source of infection in systemic mycoses?
soil
12. What is the usual site of entry of fungi causing systemic mycoses?
respiratory tract (inhalation)
13. Which morphological form of *Coccidioides immitis* can be found in the human body?
spherule
14. Which human pathogenic fungus has a capsule?
Cryptococcus neoformans

PARASITOLOGY

1. Mention 2 protozoa that are susceptible to metronidazol!
Entamoeba histolytica
Giardia lamblia
Trichomonas vaginalis
2. What are the 3 modes of transmission for human *Toxoplasma gondii* infection?
Eating undercooked meat containing tissue cysts,
Contact with cat feces containing oocysts
Transplacental transmission
3. Which 2 protozoa may infect the human foetus transplacentally?
Toxoplasma gondii
Plasmodium species
4. Which species are the causative agents of malaria?
Plasmodium vivax, *P. ovale*, *P. malariae*, *P. falciparum*
5. What is the definitive (ultimate) host of Plasmodium species?
female Anopheles mosquito
6. What is the laboratory diagnosis of malaria?
Giemsa-stained blood smears. **Thick smear** is used to screen for the agent, **thin smear** is used to identify the species.
7. How long is the erythrocytic cycle of *Plasmodium vivax* and *P. ovale*?
48 hours
8. How long is the erythrocytic cycle of *Plasmodium malariae*?
72 hours
9. What is the causative agent of malignant malaria?
Plasmodium falciparum
10. Mention an antimalarial drug active against hypnozoites!
Primaquin
11. How can one diagnose the African sleeping sickness disease?
Giemsa-stained blood smears are used for direct demonstration.
Serology may be helpful
12. What are the causative agents of African sleeping sickness?
Trypanosoma brucei gambiense and *rhodesiense*
13. How can one diagnose amebic dysentery?
Microscopic demonstration of *E. histolytica* cysts and trophozoites from feces

14. How can one diagnose *Trichomonas vaginalis* infection?
Direct demonstration of protozoa in **wet mount or stained smear** of clinical specimens (vaginal, urethral or prostatic secretions).
15. What is the definitive (ultimate) host of *Echinococcus granulosus*?
dog
16. How can one diagnose intestinal taeniasis?
Demonstration of characteristic proglottis and eggs (ova) in faeces.
17. How can one diagnose Hymenolepis infection?
Demonstration of eggs (ova) in faeces
18. Mention a worm species for which *ab ano ad os* auto-reinfection is characteristic in childhood!
Enterobius vermicularis
19. Mention 2 worm species that migrate through the human lungs in the larval stage!
Ascaris lumbricoides
Ancylostoma duodenale
Necator americanus
Strongyloides stercoralis
20. How can one diagnose Ascaris infection?
Demonstration of eggs (ova) in faeces
21. How can one diagnose trichuriasis?
Demonstration of eggs (ova) in faeces
22. How can one diagnose Enterobius infection?
Demonstration of eggs (ova) recovered from perianal skin (Scotch tape technique). Not from feces!
23. Mention 4 tissue infecting filarial nematodes!
Wuchereria bancrofti
Loa loa
Oncocerca volvulus
Dracunculus medinensis
24. How is human *Fasciola hepatica* infection acquired?
By eating aquatic vegetation containing encysted larvae
(Rarely: by eating raw sheep liver containing adult worms)
25. What disease is caused if humans are infected *per os* with *Taenia solium* eggs?
human cysticercosis (encysted larvae in brain, eyes, etc.)
26. How is human *Trichinella spiralis* infection acquired?
By eating raw or undercooked meat containing encysted larvae

27. Mention 2 helminths whose larvae enter the human body by penetrating the intact skin!
Schistosoma
Ancylostoma duodenale
Necator americanus
Strongyloides stercoralis
28. Which developmental form of *Echinococcus granulosus* can occur in humans?
Hydatid cyst
29. What are the definitive, and the intermediate hosts of *Taenia saginata*, respectively?
definitive host: human
intermediate host: cattle
30. What are the definitive, and the intermediate hosts of *Taenia solium*, respectively?
definitive host: human
intermediate host: swine (pig)
31. What is the infectious form of *Strongyloides stercoralis*?
filariform larva
32. What is the infectious form of *Trichuris trichiura*?
embryonated egg
33. Which form of *Taenia saginata* is infectious for humans?
cysticercus (in beef)
34. Is autoreinfection possible in *Ascaris lumbricoides* infection? If yes, when?
No, the eggs must mature in the soil for several days to become infectious (embryonated)
35. Is autoreinfection possible in *Strongyloide stercoralis* infection? If yes, when?
yes, especially in immunosuppression (for example: AIDS)
36. Is autoreinfection possible in *Enterobius vermicularis* infection? If yes, when?
yes, the eggs become infectious in a few hours, and *ab ano ad os* autoinfection may occur (especially in children)

VIROLOGY

1. Mention 3 DNA virus families containing **no** envelope!
Parvoviridae, Papillomaviridae, Adenoviridae
2. Mention 3 DNA virus families containing envelope!
Herpesviridae, Hepadnaviridae, Poxviridae
3. Mention 3 RNA virus families containing **no** envelope!
Picornaviriade, Caliciviridae, Reoviridae
4. Mention 3 RNA virus families containing envelope!
Orthomyxoviridae, Paramyxoviridae, Rhabdoviridae, etc.
5. Which virus family is characterized by a single-stranded DNA genome?
Parvoviridae
6. Which virus family is characterized by a double-stranded RNA genome?
Reoviridae
7. Reverse transcription is involved in the replication of which DNA virus?
Hepadnaviridae – HBV
8. Mention at least 3 diseases caused by herpes simplex viruses (HSV1, HSV2)!
oropharyngeal herpes (gingivostomatitis, herpes labialis), keratoconjunctivitis, encephalitis, herpes genitalis
9. What are the serious complications of HSV infection in newborns?
disseminated infections, encephalitis, skin, eye, mouth infections
10. Which viruses are susceptible to acyclovir? What is the mechanism of effect of the drug?
alpha herpesviruses – **HSV1, HSV2, VZV; inhibitor of viral DNA polymerase and DNA chain terminator**
11. Explain why acyclovir is selectively toxic to cells infected by alpha-herpesviruses! These viruses encode their own **thymidine kinase** enzymes, which are **needed for activation (phosphorylation) of the drug**. Cellular thymidine kinase does not activate the drug.
12. In which cells do Herpes simlex viruses establish latent infection?
Sensory ganglion cells (trigeminal or sacral ganglia)
13. What is the possible, late complication (years after acute infection) of the childhood chickenpox?
Herpes zoster (shingles)

14. What manifestations does cytomegalovirus cause in congenital infections?
cytomegalic inclusion disease – spontaneous abortion, CNS damage (deafness, blindness, mental retardation), hepatosplenomegaly, jaundice
15. What disease does cytomegalovirus cause in immunocompetent persons?
mononucleosis infectiosa (heterophil-antibody negative)
16. Mention 2 diseases that cytomegalovirus can cause in immune compromised persons!
pneumonia, chorioretinitis, colitis
17. Which antiviral drug is active against cytomegalovirus infection?
Ganciklovir, (foscarnet, cidofovir)
18. Describe the heterophil antibody test used in Epstein-Barr virus diagnostics!
Paul-Bunnell test – in mononucleosis caused by EBV, **the serum of the patient agglutinates sheep red blood cells**
19. Which virus causes exanthema subitum (roseola infantum)?
HHV6
20. Which virus causes erythema infectiosum?
Human parvovirus B19
21. What are the possible consequences of fetal infections caused by B19 parvovirus?
fetal death or hydrops fetalis
22. Which isotype of antigen-specific immunoglobulins in the newborn's blood indicates a congenital infection?
IgM
23. Which antigens of influenza viruses are recognized by neutralizing antibodies?
Hemagglutinin, neuraminidase
24. What is the mechanism of antigenic shift in influenza viruses?
reassortment of genome segments (between different influenza A virus subtypes)
25. What is the mechanism of antigenic drift in influenza viruses?
accumulation of point mutations in the hemagglutinin and neuraminidase genes of influenza viruses
26. Which influenza virus types are characterised by antigenic shift?
influenza A
27. Which influenza virus types are characterised by antigenic drift?
Influenza A and B
28. Which influenza A subtypes cause most human infections currently?
H1N1, H3N2

29. Which virus(es) is(are) susceptible to amantadine?
Influenza A virus
30. What is the possible late complication of measles infection (several years after the acute infection)?
SSPE – subacute sclerosing panencephalitis
31. What is the portal of entry of the viruses belonging to Paramyxoviridae?
Respiratory tract – aerosol infection
32. Which age group is mostly affected by respiratory syncytial (RS) virus infection?
babies (about 6 week – 6 month old)
33. What are the possible complications of adulthood mumps virus infection? Specify at least 2 of them!
Orchitis, meningitis, pancreatitis
34. What is the route of infection of rabies virus? How does rabies virus spread in the infected body?
**By the bite of a rabid animal, (rarely by infectious aerosol)
spread of the virus in the host – along the axons**
35. What medication does a person need after exposure to rabies virus?
**Active immunization – human diploid cell vaccine (killed virus)
and passive immunization – rabies immune globulin**
36. What is the portal of entry of polioviruses? Which areas of the central nervous system are affected by poliovirus infection?
**oropharynx and gastrointestinal tract
damage in motor neurons in the anterior horn of the spinal cord + brain stem**
37. Which viruses belong to the Enterovirus genus?
Polioviruses, coxsackie A and B viruses, echoviruses, enteroviruses 68 - 71
38. Mention at least 4 diseases caused by Coxsackie viruses!
febrile rashes, herpangina, myocarditis, pericarditis, meningitis, pleurodynia, hand-foot-and-mouth disease
39. What disease do rotaviruses cause? At which age?
gastroenteritis in young children
40. List the 3 antigens of hepatitis B virus against which antibodies may develop during or after the acute phase of infection?
HBsAg, HBeAg, HBcAg
41. Which hepatitis B-specific antibody is never present in chronic hepatitis?
Anti-Hbs
42. What are the main modes of transmission of HBV (hepatitis B virus) infection?
Sexual contact; perinatally from mother to newborn; by blood or blood products

43. What are the 2 serological markers that are necessary and sufficient to prove acute hepatitis B virus infection?
HBsAg, Anti-HBc IgM
44. Describe the active and passive prophylaxis against hepatitis B!
active immunization: recombinant HBsAg vaccine
passive immunization: HBIG (hepatitis B immune globulin)
45. Which hepatitis viruses are acquired orally?
HAV, HEV
46. Which hepatitis viruses are acquired via parenteral routes?
HBV, HCV, HDV, (HGV)
47. Mention 4 diseases that can be caused by adenoviruses!
pharyngitis, pharyngoconjunctival fever, acute respiratory disease, bronchitis, atypical pneumonia, hemorrhagic cystitis, gastrointestinal infection
48. What is the portal of entry of mumps virus?
Upper respiratory tract
49. Mention at least two viruses frequently causing pneumonia!
RSV, influenza virus A and B, parainfluenza virus, adenovirus, coronavirus (SARS), metapneumovirus,
50. What is the causative agent of subacute sclerosing panencephalitis (SSPE)?
Measles virus
51. What is(are) the nature(s) of antigen(s) in the combined vaccine against measles, German measles and mumps?
live attenuated viruses
52. What is the nature of antigen in the rabies vaccine for human use?
killed virus
53. Which viral variants are included in the human influenza vaccine?
The vaccine contains 2 influenza A strains (H3N2, H1N1) and 1 influenza B strain.
54. What does the vaccine against hepatitis B contain?
Subunit vaccine, containing HBsAg
55. What is(are) the nature(s) of antigens in the vaccines against poliovirus?
IPV: inactivated polio vaccine: killed viruses (types 1, 2 and 3)
OPV: oral polio vaccine: live attenuated viruses (types 1, 2 and 3)
56. What is the causative agent of PML (progressive multifocal leucoencephalopathy)?
JC virus (Polyomaviridae)

57. What are the possible consequences of fetal infections caused by rubella virus? Specify at least 3 of them!
Congenital malformations involving the heart (patent ductus arteriosus, septum defects), the eyes (cataract, glaucoma) and the brain (deafness, mental retardation).
58. Mention 3 human prion diseases!
Kuru, Creutzfeldt-Jacob disease, Gerstmann-Straussler-Scheinker syndrome, fatal familial insomnia
59. What is the nature of the immune response in diseases caused by prions?
There is no immune response, as prions are self proteins.
60. Mention 3 main viral targets of antiretroviral chemotherapy!
HIV reverse transcriptase, protease and integrase
61. Mention 3 nucleoside (or nucleotide) type reverse transcriptase inhibitors used in the therapy of AIDS!
azidothymidine (zidovudine), abacavir, lamivudine, emtricitabine, tenofovir, dideoxyinosine (didanosine), dideoxycytidine (zalcitabine), stavudine
62. Mention 2 non nucleoside type reverse transcriptase inhibitors used in the therapy of AIDS!
nevirapine, efavirenz
63. Mention 2 protease inhibitors used in the therapy of AIDS!
ritonavir, atazanavir, darunavir, lopinavir, fosamprenavir, indinavir, saquinavir
64. Mention an integrase inhibitor used in the therapy of AIDS!
raltegravir
65. What is the principle of the „highly active antiretroviral therapy” (HAART) currently used in the treatment of AIDS!
**Combination of two nucleoside/nucleotide reverse transcriptase inhibitors (2 NRTI) with either a nonnucleosid reverse transcriptase inhibitor (NNRTI) or a protease inhibitor (PI) or an integrase inhibitor (II)
2 NRTI + NNRTI / PI / II**
66. What does the term robovirus mean? Write an example for a robovirus!
Robovirus: rodent reservoir (rodent-borne)
Arenaviridae – Lassa, Junin, Machupo, LCM virus; Bunyaviridae – Hantaan virus, Puumala virus, Sin Nombre virus; Filoviridae – Marburg, Ebola virus
67. What does the term arbovirus mean? Write an example for an arbovirus!
Arbovirus: arthropode vector (arthropode-borne);
Flaviviridae – yellow fever, Dengue-fever; Bunyaviridae – Rift-valley fever, Crimean-Congo hemorrhagic fever; etc.

68. Which virus can cause haemorrhagic fever with hepatitis and nephritis?
yellow fever virus
69. Describe the 2 different epidemiological cycles of yellow fever!
Jungle yellow fever: reservoir: monkeys; vector: *Haemagogus* mosquitos; humans: accidental hosts
Urban yellow fever: reservoirs: humans; vectors : *Aedes aegypti* mosquitos
70. How can we prevent tick borne encephalitis?
Active immunization: killed virus vaccine, passive: specific immune globulin
71. Mention at least 4 opportunistic infections characteristic for AIDS!
Viruses: HSV-1, HSV-2, VZV, HCMV, EBV, HHV-8, HPV
Protozoa: *Toxoplasma gondii*, *Pneumocystis jiroveci*
Bacteria: *Mycobacterium tuberculosis*, atypical *Mycobacteria*, *Salmonella septicaemia*
Fungi: *Candida*, *Cryptococcus neoformans*
72. Describe the principals of the laboratory diagnosis of HIV infection!
Demonstration of antiviral antibodies.
Presumptive diagnosis: ELISA
Verification: Western-blot assay
73. Mention at least three sexually transmitted viral infections!
HPV, HSV-1, HSV-2, HIV, HBV, HCV, molluscum contagiosum virus
74. Mention two viruses capable of getting through the placenta.
Rubella virus, HCMV, parvovirus B19, HIV, HTLV-1
75. Mention 2 viral infections whose preventive strategy involves passive immunization!
Rabies, tick-borne encephalitis, HBV, VZV, measles
76. List at least three viruses capable of causing (meningo)encephalitis!
Rabies, HSV, VZV, tick-borne encephalitis, Japanese B encephalitis, eastern and western equine encephalitis, mumps, poliovirus, coxsackie virus, echovirus
77. What is the nature(s) of antigen in the vaccine against yellow fever?
Live attenuated virus (17D strain)
78. Which viruses can cause human tumors? Mention at least 4!
HPV, EBV, HHV-8, HBV, HCV, HTLV
79. Which non-malignant disease is caused by Epstein-Barr virus?
Mononucleosis infectiosa (heterophil positive)
80. Mention 3 types of human malignancies caused by EBV?
Nasopharyngeal carcinoma, Burkitt's lymphoma, other B-cell lymphomas
81. What type of human cancer is caused most frequently by HHV8?
Kaposi's sarcoma

82. What types of human cancers are caused by high-risk human papillomavirus (HPV) types?
genital cancers, most importantly **cervical cancer**
83. Which malignant disease is caused by human T-lymphotropic virus 1 (HTLV-1)
adult T-cell leukemia/lymphoma (ATL)
84. Which hepatitis virus infections increase the risk of hepatocellular carcinoma?
HBV, HCV, HDV