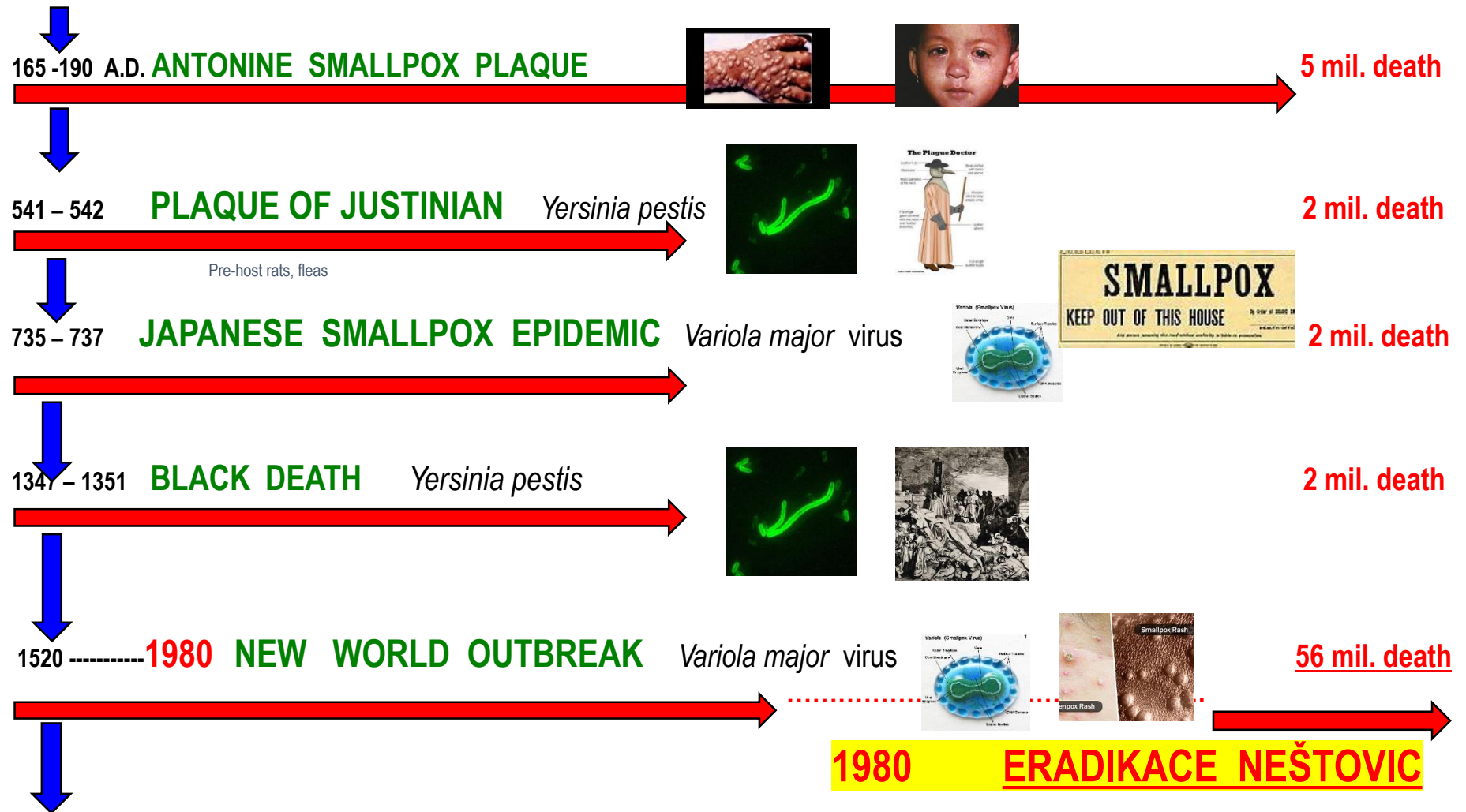


Epidemiology of infectious diseases

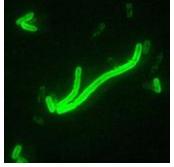
Kolářová M., EPI Autumn 2021

Historical overview



1629 - 1631
ITALIAN PLAQUE

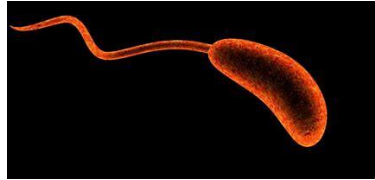
Yersinia pestis



1 mil. death

1817 - 1824
CHOLERA PANDEMICS

Vibrio cholerae



1 mil. death

1885
THIRD PLAQUE

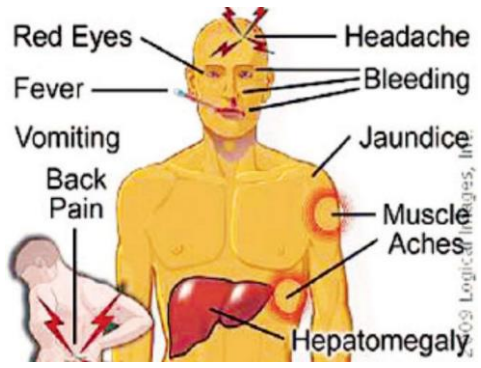
Yersinia pestis



12 mil. death

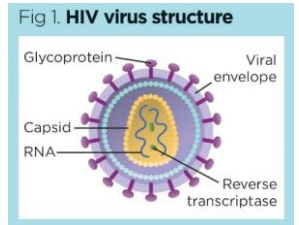
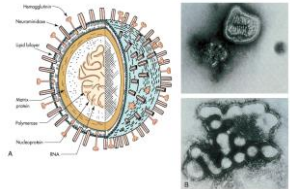
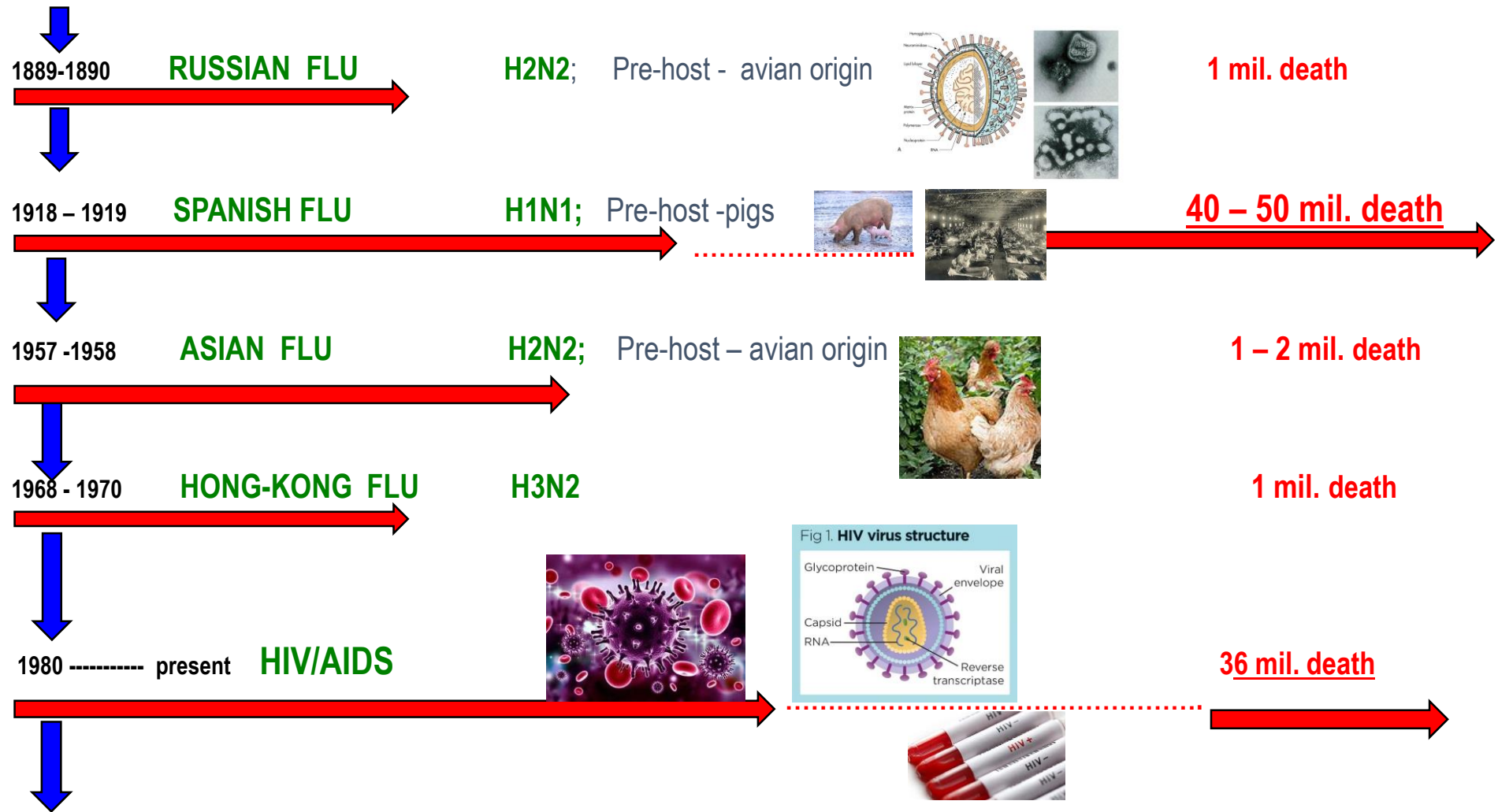
Late 1800s
YELOW FEVER

Yellow fever virus

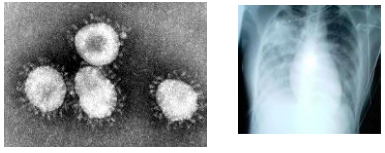


100 000 - 150 000





2003 **SARS (Severe Acute Respiratory Syndrome) Coronavirus**



770 death

2009-2010 **SWINE FLU**



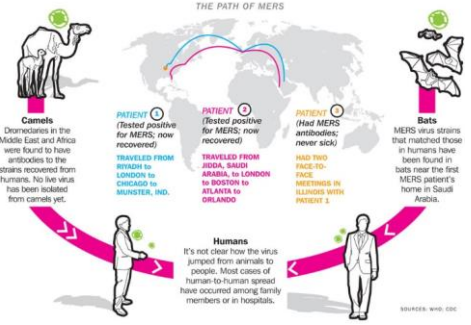
200 000 death

2014-2016 **EBOLA**



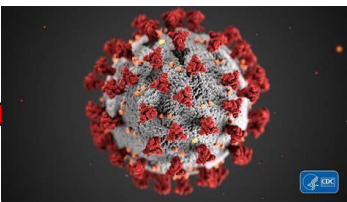
11 000 death

2012--- present **MERS (MERS-CoV - Middle East Respiratory Syndrome Coronavirus)**



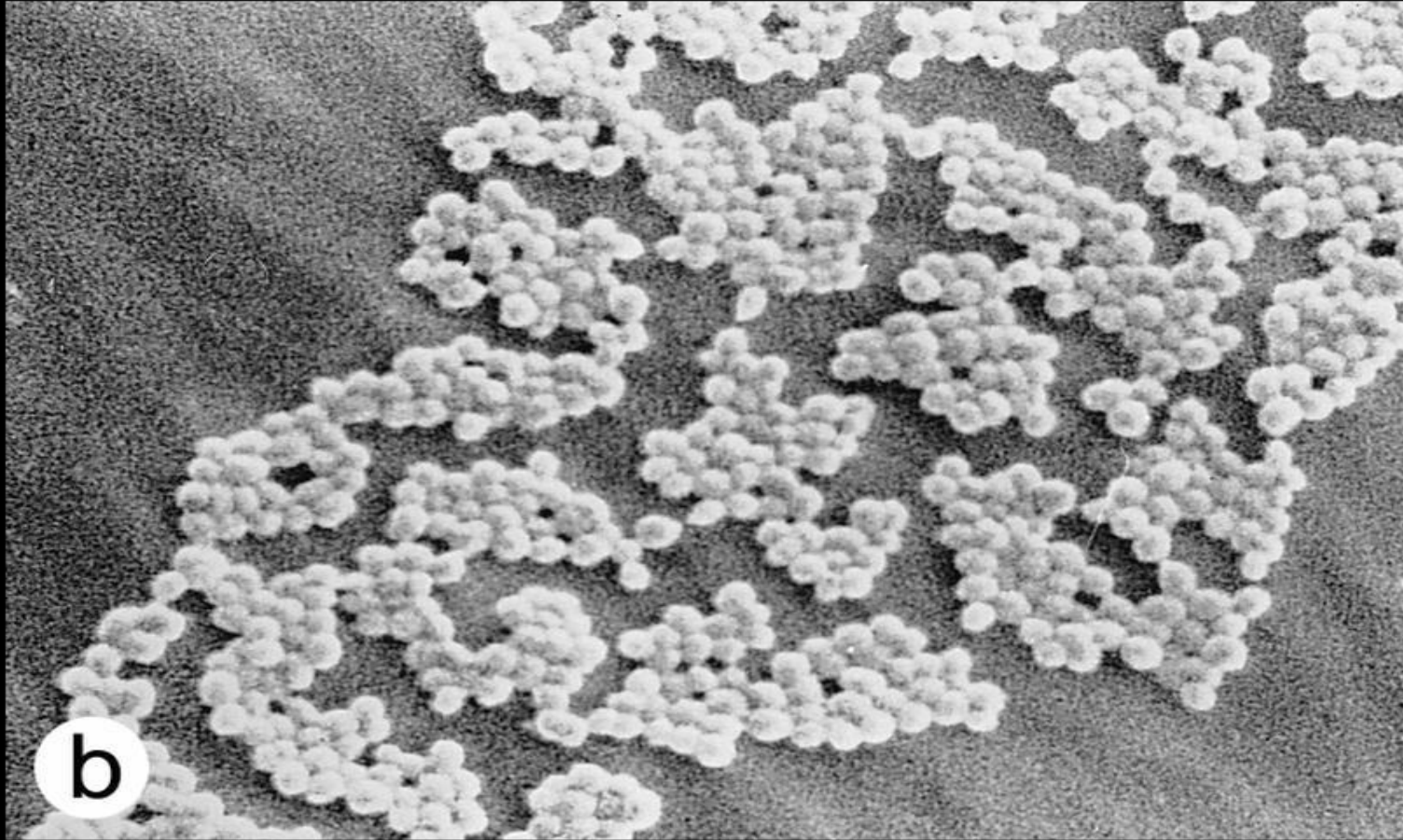
866 death

2020--- present **COVID 19**

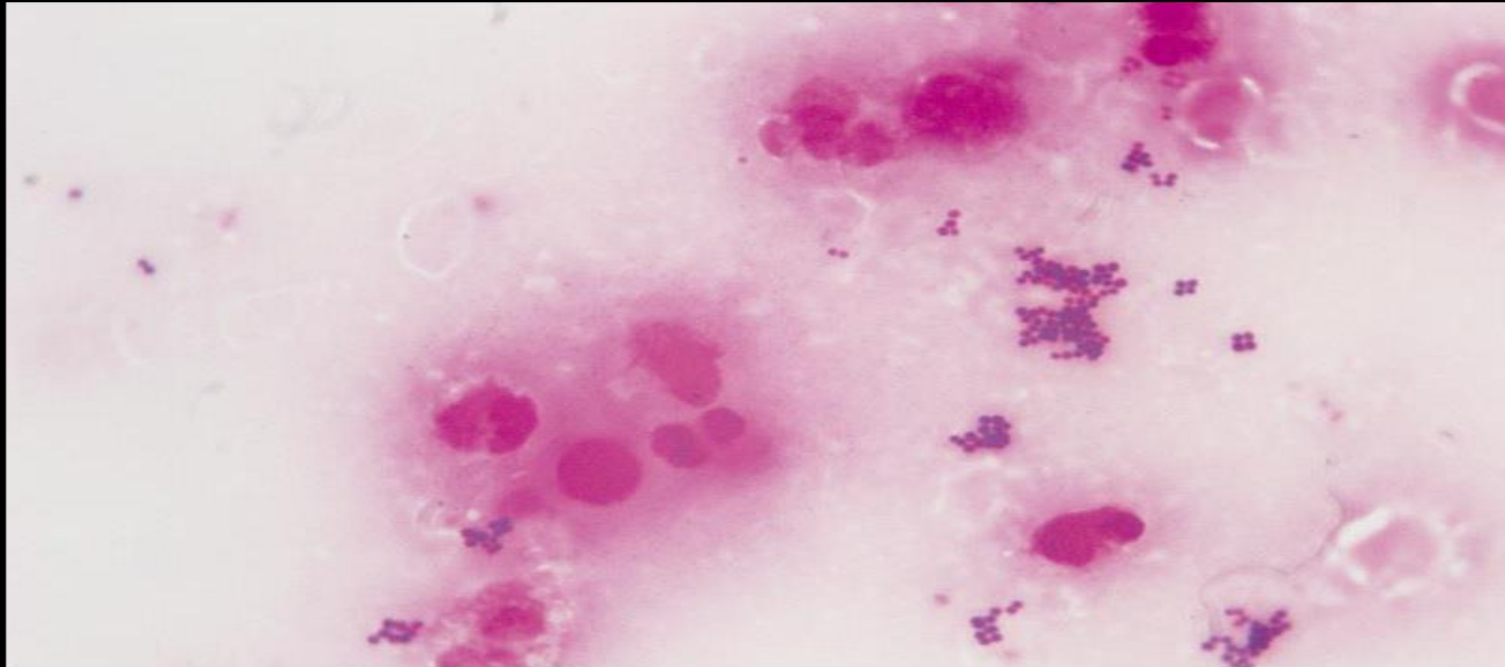


46 mil. infections/1 196 272 death

Slime-producing coagulase-negative staphylococci. Scanning electron micrograph of the surface of an intravascular catheter incubated *in vitro* with (a) slime-producing and (b) nonslime-producing strains of *Staphylococcus epidermidis*. With permission from Christensen.⁹



Staphylococcus aureus



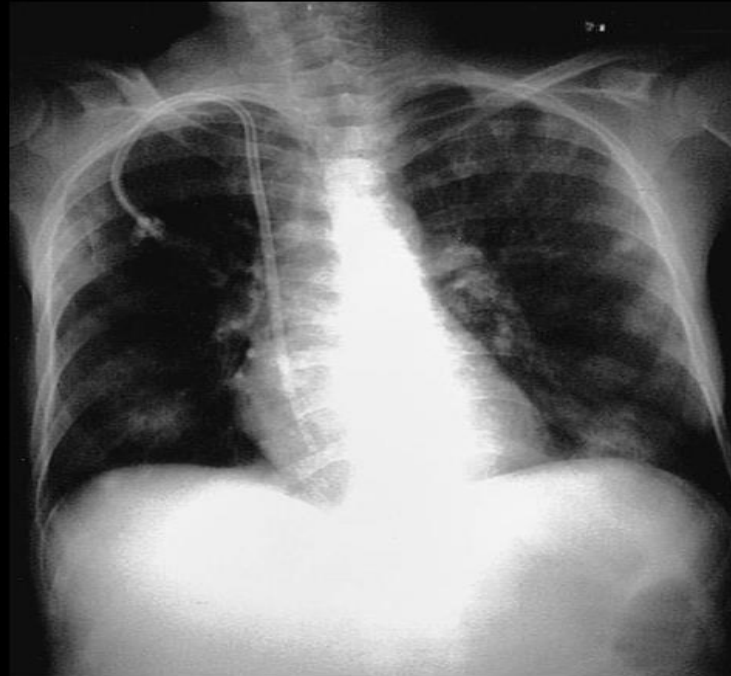
Staphylococcal nasal carriage. This patient had a small staphylococcal abscess beneath the mucosa of the nose, illustrating how *Staphylococcus aureus*, which colonizes the nares, can infect skin and submucosa. Intact mucosa is highly resistant to infection; such infections usually occur as a result of defects in the mucosal membranes or via hair follicles inside the nose.





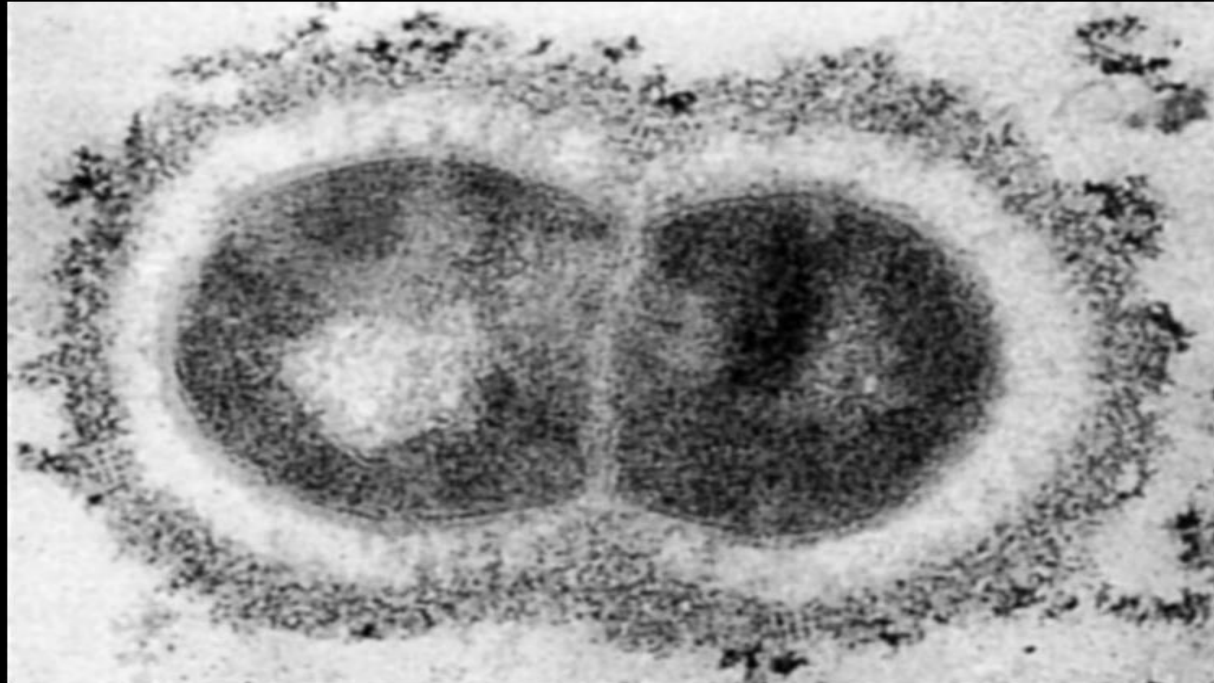
- Impetigo in a child.

Septic pulmonary emboli. Multiple nodular pulmonary infiltrates secondary to a dialysis catheter-associated infection. The patient presented with high fevers, cough and pleuritic chest pain. *Staphylococcus aureus* was isolated from multiple blood specimens.





- **β -Hemolytic streptococci group A** on a blood agar plate. Note the clear β -hemolytic zone.



- Electron microscopy of **group A streptococcus**. The fuzzy M protein layer can be seen protruding from the cell wall..



Erysipelas. Note the sharp demarcation of the affected skin.

Scarlatina (scarlet fever)



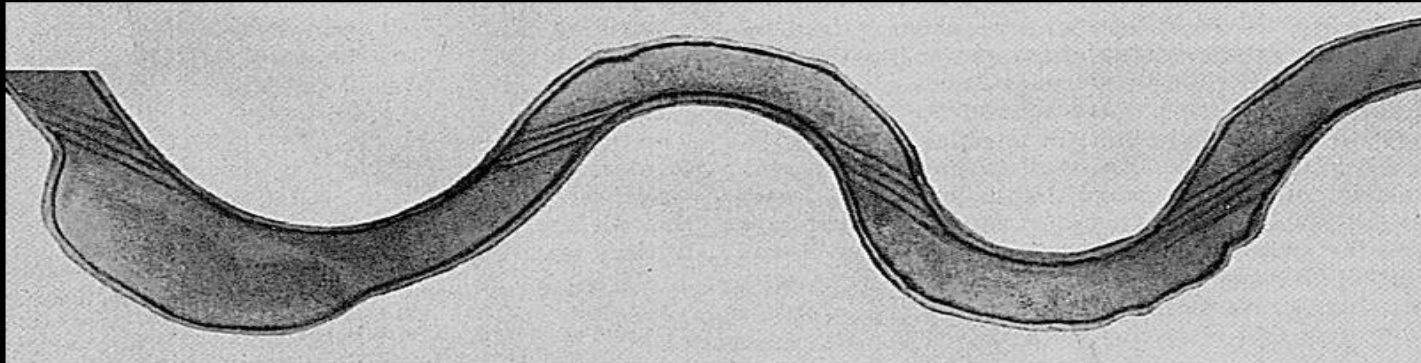


- Necrotizing fasciitis caused by **group A streptococci**. There is only moderate erythema but at surgery there was extensive soft tissue damage.

Primoinfection HIV



Helical structure of *Treponema pallidum* with the periplasmic flagella.



Secondary **syphilis** with typical skin rash.



Gonococcal urethritis.



Varicella (chickenpox)



Varicella (chickenpox). Lesions at various stages, including vesicles, can be seen.



Morbilli (Measles). A disseminated erythematous rash can be seen over the trunk and arms.



Rubella. A pink macular rash can be seen on the forearm.



Rubella

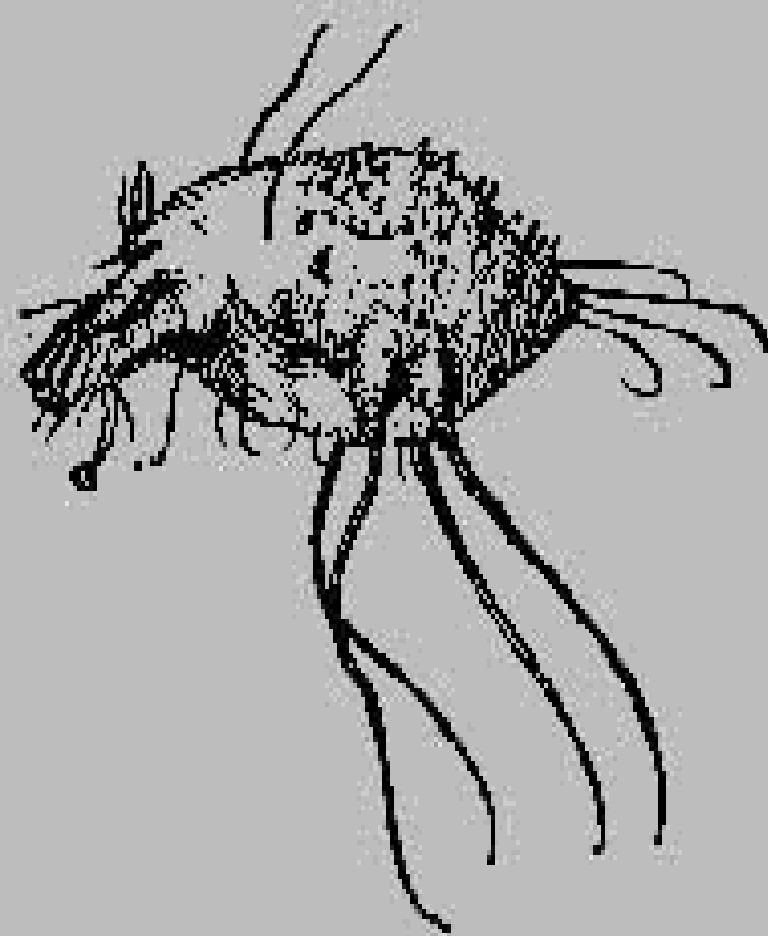


Parotitis epidemica (mumps)

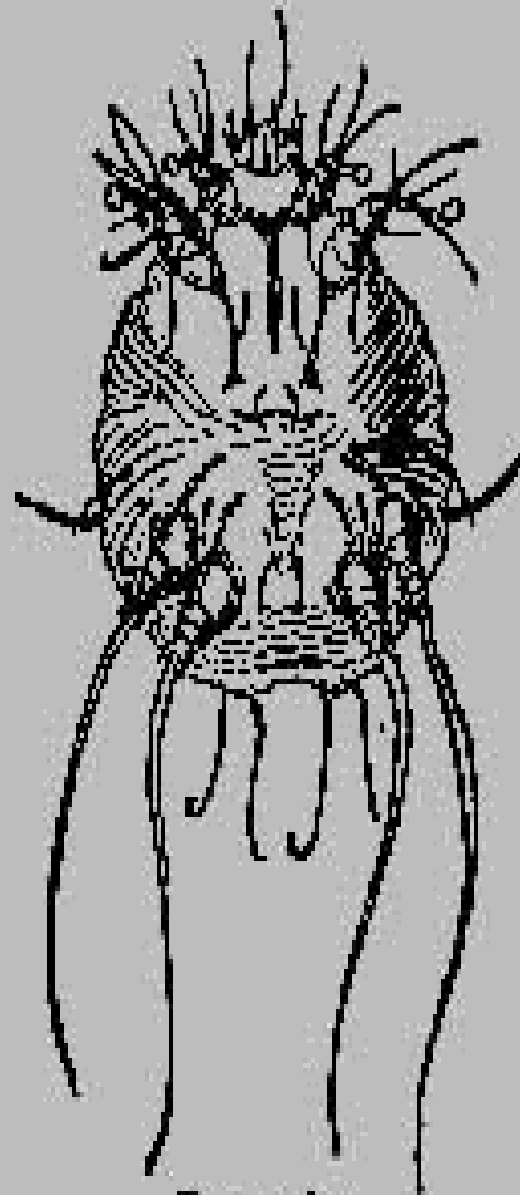


Sarcoptes scabiei

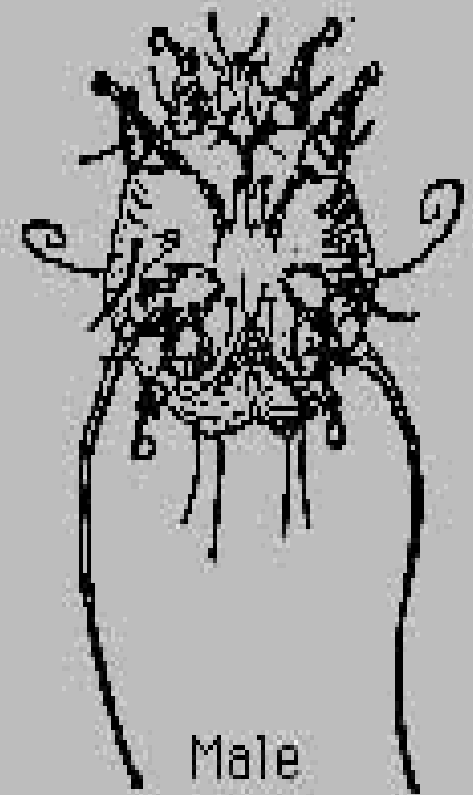




lateral



Female



Male

0.4 mm in length

Scabies



Crusted or **Norwegian scabies** in a patient who has AIDS.



Giemsa stain of blood with *Borellia burgdorferi*.



Tick – *Ixodes ricinus*



Lyme boreliosis (LB)



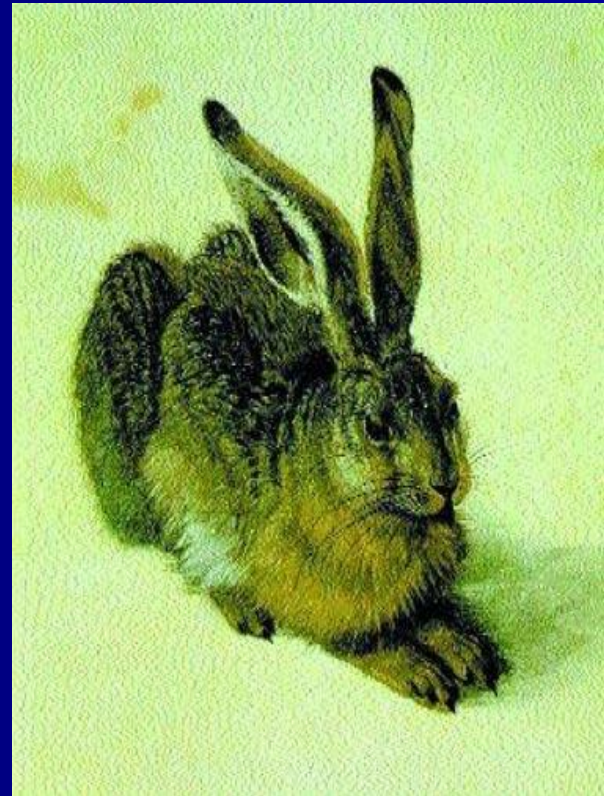
LB - Typical **erythema migrans** rash.



A blood-engorged female *Aedes albopictus* mosquito feeding on a human host.



Francisella tularensis



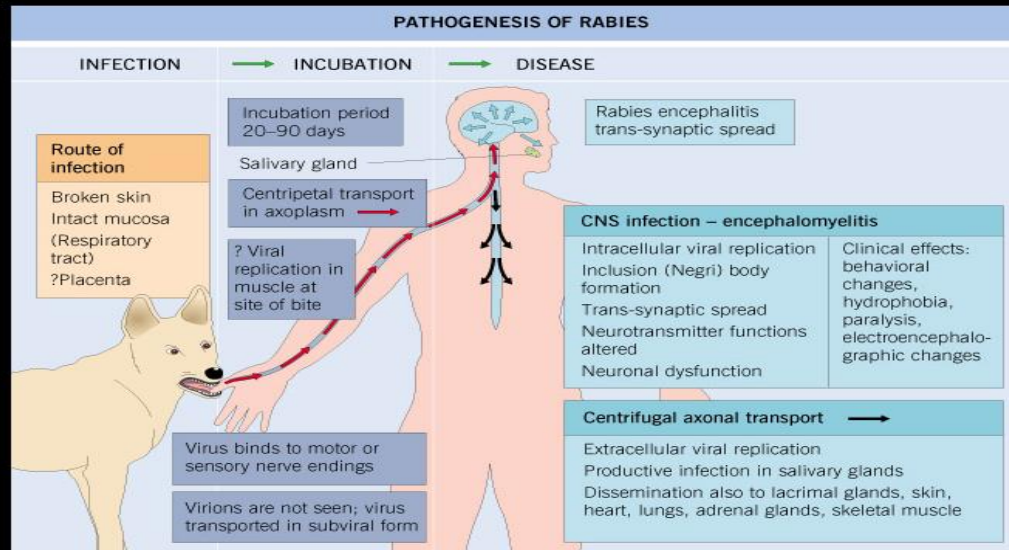
Tularemia



Hístice *Trichinella spiralis*



Pathogenesis of rabies.



THE CAUSATIVE AGENT OF INFECTION (bacteria, viruses, fungi, prions, protozoa)

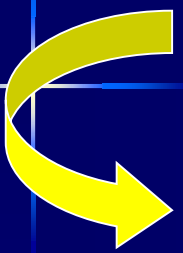


1. the presence of rezervoir (source) of infection

man, animal

at the end of incubation period

- acute stage
- carriers



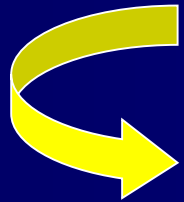
2. the way of transmission A/ direct contact

touching, kissing or sexual intercourse (Staphylococcus spp., Gonococcus spp., HIV ...),

- vertical transmission – from mother to fetus (VHB, VHC, HIV, listeria, rubella, cytomegalovirus...)

B/ indirect contact

- inhalation of droplets containing the infectious agents (TBC, measles, influenza...)
- ingestion of food or water that is contaminated (salmonella, giardia, Norwalk virus, VHA....)
- biological transmission by insects (malaria, borellia....)



3. the susceptibility of the population or its individual members to the organism concerned

Host factors: age, nutrition, genetics

immunity – natural (nonspecific),

- acquired



THE INFECTION

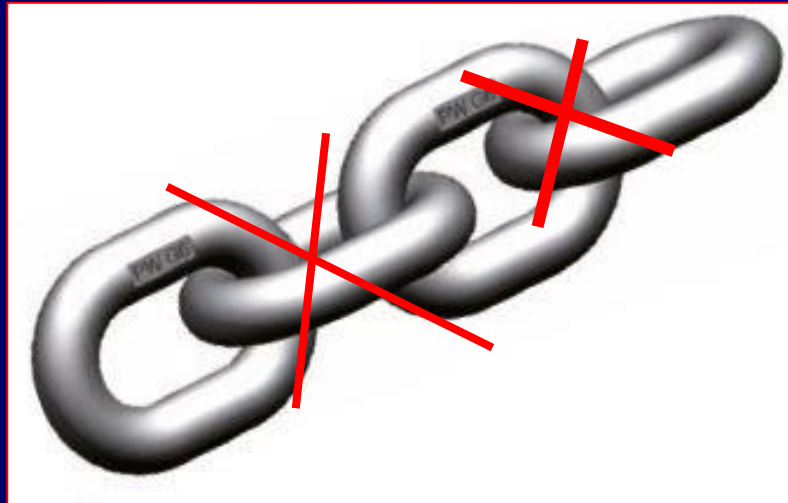
= 1. source of infection



.....

If the epidemiology is known, we can try to interrupt this process of spreading. :

BREAKING THE CHAIN OF INFECTION



Different infections have different epidemiologies and thus require different methods of control

1. the presence of source of infection

is the site or sites in which a disease agent normally lives and reproduces in different stages of a disease

May be classified as:

- **human** - at the end incubation period, if is ill, reconvalescent, carriers – healthy, chronic diseases
- **animals** - at the end incubation period, if is ill, carriers – healthy, reconvalescent, chronic

2. the method of transmission

A/ direct contact

touching, kissing or sexual intercourse (Staphylococcus spp.,
Gonococcus spp., HIV ...),

- **vertical transmission** – from mother to fetus (VHB, VHC, HIV,
listeria, rubella, cytomegalovirus...)

B/ indirect contact

- **inhalation of droplets** containing the infectious agents (TBC,
measles, influenza...)

- **ingestion of food or water** that is contaminated (salmonella,
giardia, Norwalk virus, VHA....)

- **biological transmission** by insects (malaria, borellia....)

3. the susceptibility of the population or its individual member to the organism concerned, and the characteristic of the organism itself.

Host factors :

Non specific immunity

Barrier action (natural barrier)

External barrier:

skin , mucosa

Secretion of skin and mucosa

Accessory organ

Internal barrier: placenta, blood-brain barrier

Phagocytosis

Humoral action :

Complement, Lysozyme, Fibronectin, Cytokines.

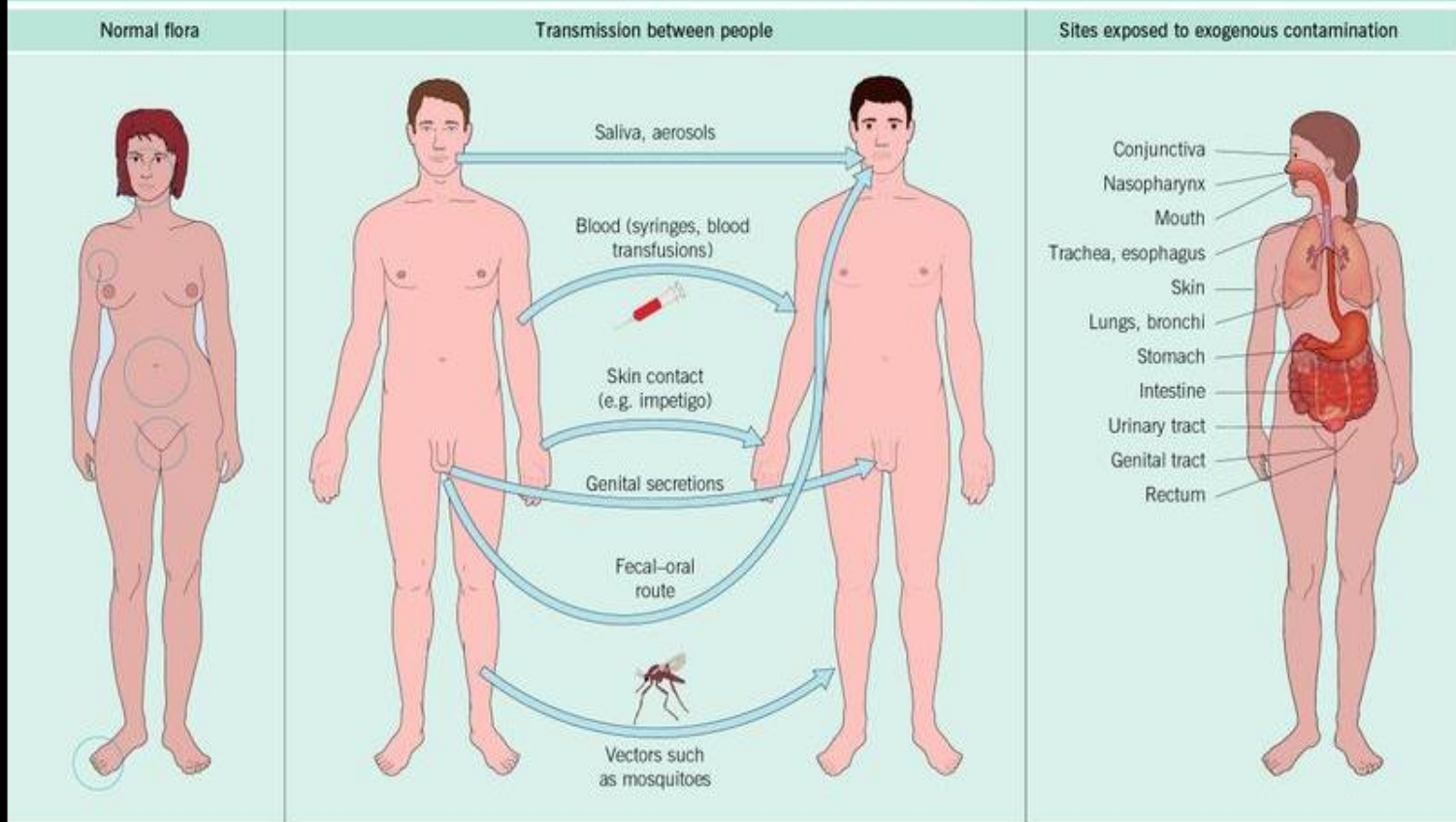
Specific immunity

Humoral immunity

Immunoglobulin: IgG, IgM, IgE, IgA, IgD

Cell mediated immunity

CONTAMINATION OF HUMANS BY MICRO-ORGANISMS



Organisms vary in their capacity **to survive** in the free state and to withstand adverse environmental conditions, for example:

* heat, cold, dryness.

Sporo-forming organisms, such as tetanus bacilli which **can survive for years** in a dormant state, have a major advantage over an organisms like the gonococcus which survive for only a very short time outside the human host.

Colonisation and contamination of humans by micro-organisms.

Many parts of the body are colonized by normal flora, which can be the source of endogenous infection. Large numbers of micro-organisms are found in moist areas of the skin (e.g. the groin, between the toes), the upper respiratory tract, the digestive tract (e.g. the mouth, the nasopharynx), the ileum and large intestine, the anterior parts of the urethra and the vagina.

Other routes are interhuman transmission of infections and exposure to exogenous contamination.

Routes of transmission

- Air
- Food, Drink or Water
- Direct or indirect contact
 - * Transplacental
- Insects (Artropods)

Main portals of entry

- Respiratory tract
- Gastro-intestinal tract
- Genito-urinary tract
- Direct break through skin
 - * surgical and wounds
- Direct into blood via needles/catheters

The pathogenicity of pathogen is related to:

- invasiveness
- virulent
- number of pathogen (infectious dosis)
- mutation (variability)

THE CAUSATIVE AGENT OF INFECTION (bacteria, viruses, fungi, prions, protozoa)

1. the presence of rezervoir (source) of infection

man, animal

at the end of incubation period

acute stage
carriers

2. the way of transmission

A/ direct contact

touching, kissing or sexual intercourse (Staphylococcus spp., Gonococcus spp., HIV ...),

- vertical transmission – from mother to fetus (VHB, VHC, HIV, listeria, rubella, cytomegalovirus...)

B/ indirect contact

- inhalation of droplets containing the infectious agents (TBC, measles, influenza...)

- ingestion of food or water that is contaminated (salmonella, giardia, Norwalk virus, VHA....)

- biological transmission by insects (malaria, borellia....)

3. the susceptibility of the population or its individual members to the organism

concerned Host factors: age, nutrition, genetics

immunity – natural (nonspecific),

- acquired

THE INFECTION

= 1. source of infection

.....

THE CAUSATIVE AGENT OF INFECTION (bacteria, viruses, fungi, prions, protozoa)

1. the presence of rezervoir (source) of infection

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- biological transmission by insects (malaria, borellia...)

3. the susceptibility of the population of individual members to the organism

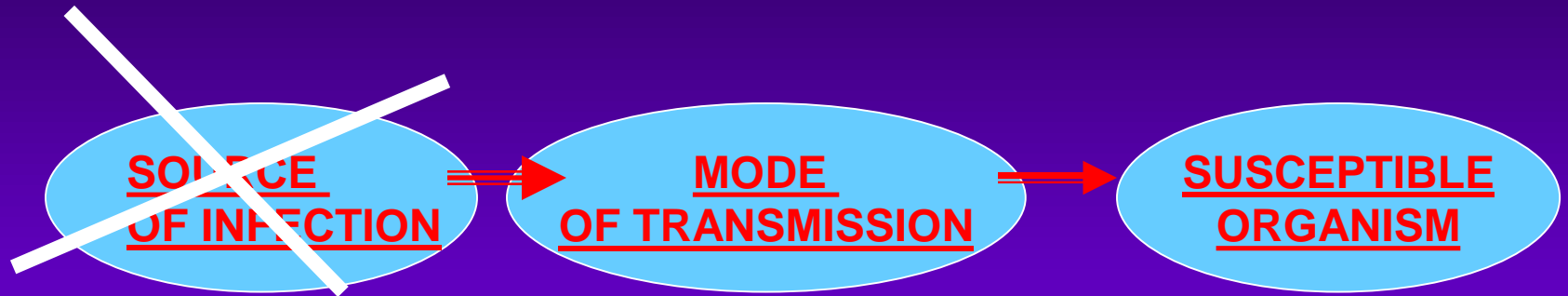
concerned Host factors: age, nutrition, genetics
immunity – natural (nonspecific),
- acquired

THE INFECTION

= 1. source of infection

.....

Prevention of infectious diseases



Isolation of patients:

- Dpt. of infectious diseases,
- „high degree of isolation“ (ebola)
- at home,
- barriers nursing technique

Prevention of infectious diseases



HANDWASHING, DISINFECTION OF HANDS

**LINEN WASHING,
CLEANING**

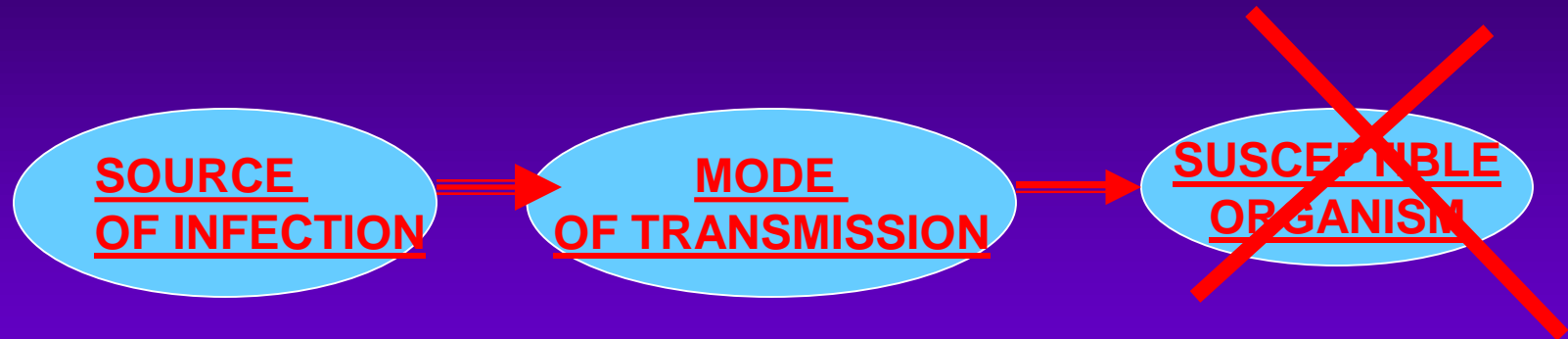
**GOOD PREPARING OF FOOD, SAFE
WATER.....,**

.....

DISINFECTION

STERILIZATION

Prevention of infectious diseases



immunity

- natural (nonspecific),
- acquired (vaccination)

- **The distribution of the smallpox rash is usually similar to that shown here. It is most dense on the face, arms and hands, legs and feet. The trunk has fewer pocks than the extremities.**



Smallpox is a disfiguring disease. Three out of ten cases may die. It is caused by variola virus. The disease is spread by secretions from the patient's mouth and nose, and by material from pocks or scabs. It is transmitted directly from one person to the next. Close contact with patients, or their clothing or bedding, is thus required for infection. A patient who has developed the distinctive symptoms of smallpox will have been exposed to the virus about two weeks previously.



If the epidemiology is known, we can interfere with transmission:

„BREAKING THE CHAIN OF INFECTION“

Different infections have different epidemiologies and thus require different methods of control

In the practical part it is preoccupied with

preventive measures

repressive measures

related to infectious diseases

