

Dangerous Germs in Science Fiction & Fact



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Overview



Germs and where they live

Infection

Containment

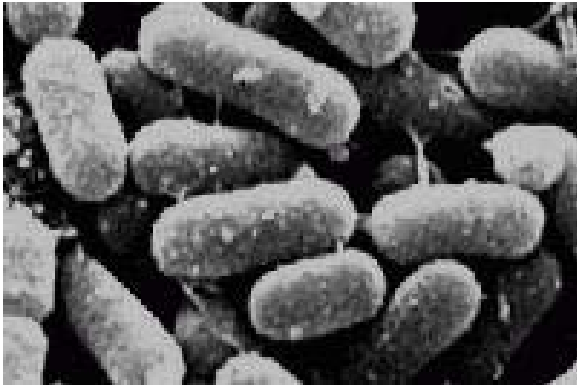
Physical laws

Fantasy

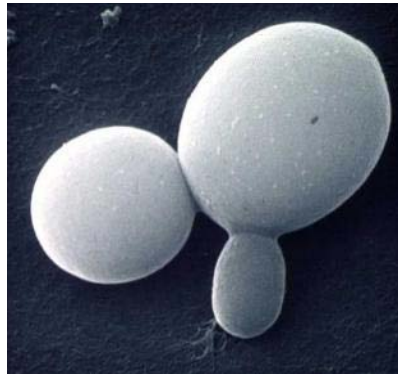
Risk assessment

Getting help

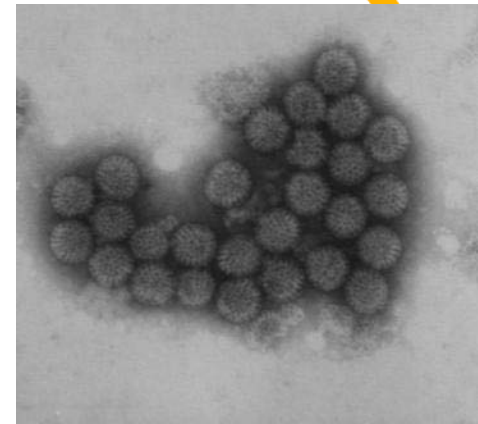
Types of Germ



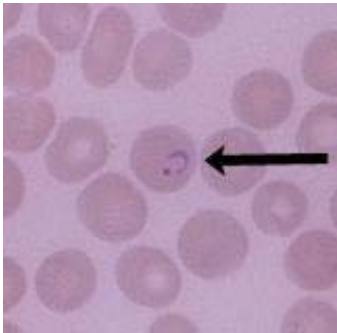
Bacteria 2 μm



Fungi 3-30 μm



Virus 20-200 nm



Protozoa 2-30 μm



Parasites 1-300 mm

Germes all around us



The air that we breathe



Isn't sterile!

Depends on place

Operating theatres

House rooms

- Number of people
 - Ventilation
- Chicken faeces....

Mostly harmless germs

But a few cause disease



Living with Germs

You have a lot!

10^8 *E. coli* per gramme of faeces

$>10^8$ bacteria per square cm of skin

Millions in the mouth

Many of these keep you healthy!

Yet:

Lungs are sterile

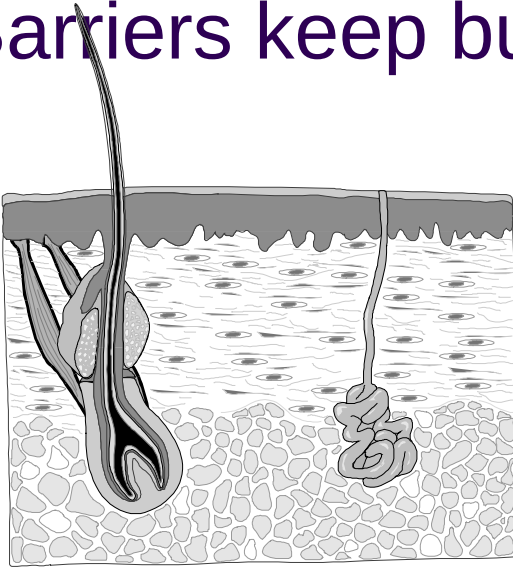
Bladder is sterile

Uterus is sterile

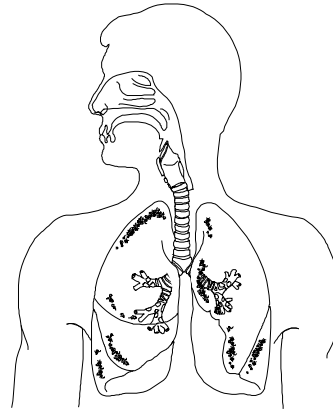
Blood and tissues are sterile

Germs in these places cause disease!

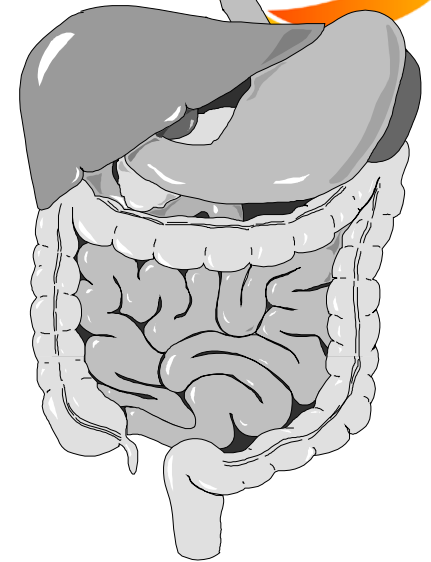
Barriers keep bugs out



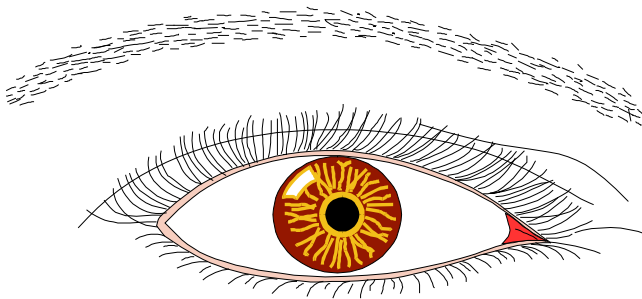
Skin



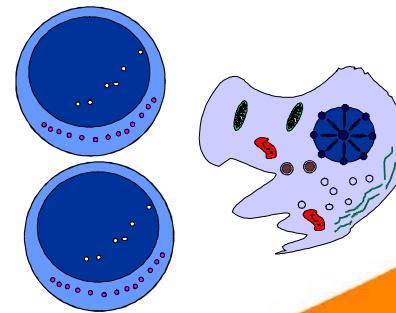
Mucous, cilia



Acid



Tears

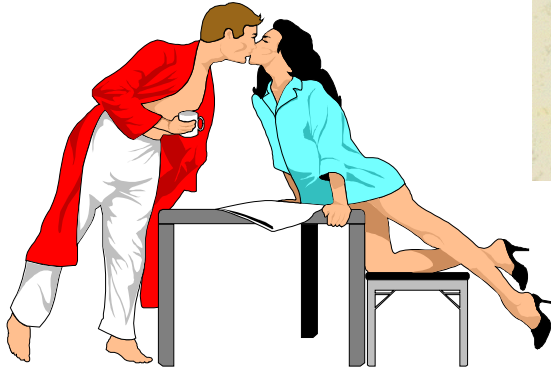
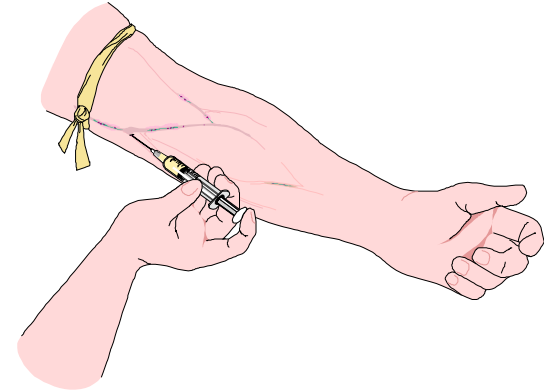
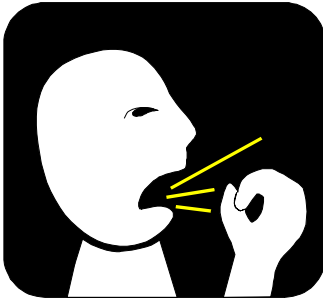


White Blood Cells

How to catch germs



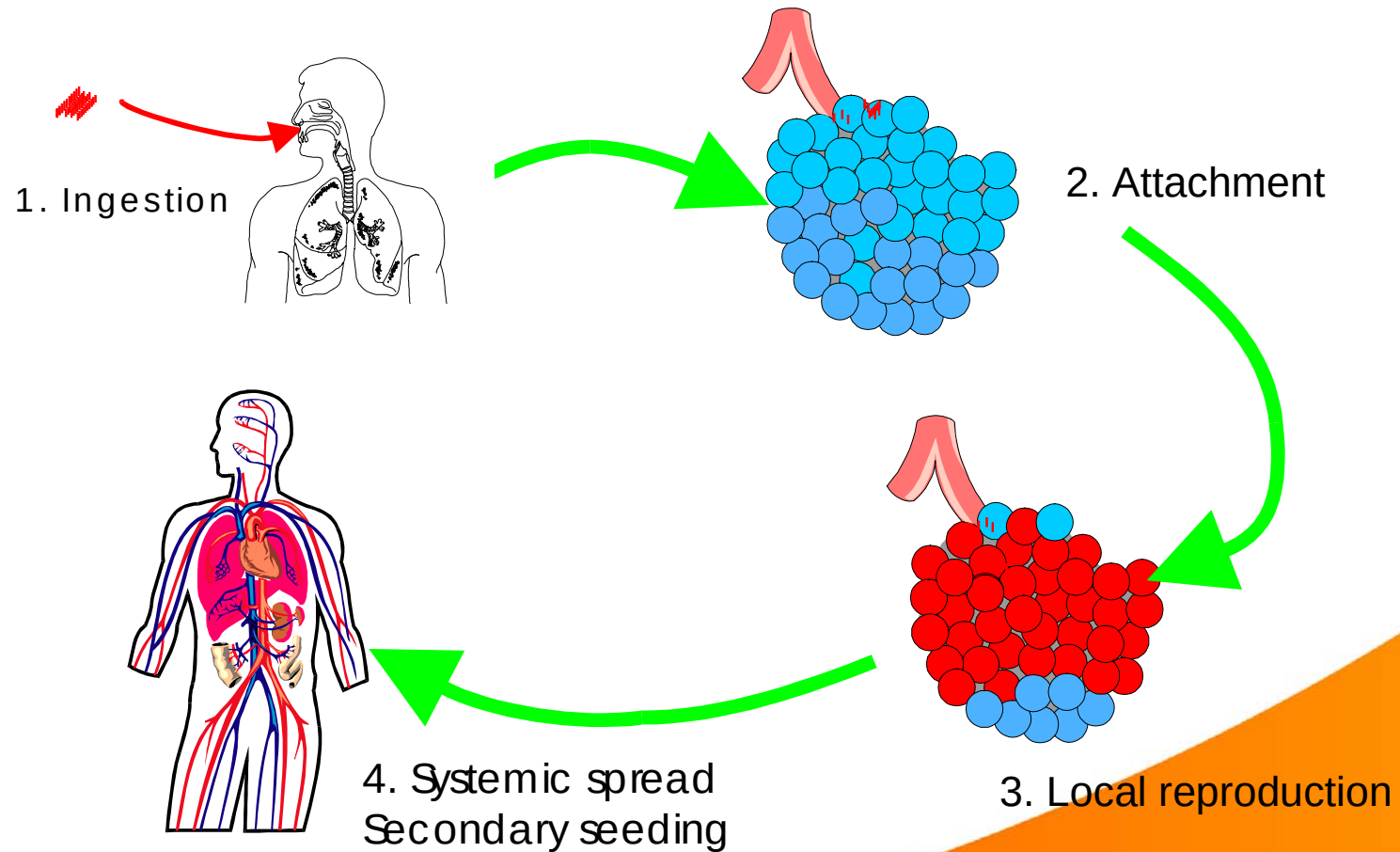
Break the barriers!



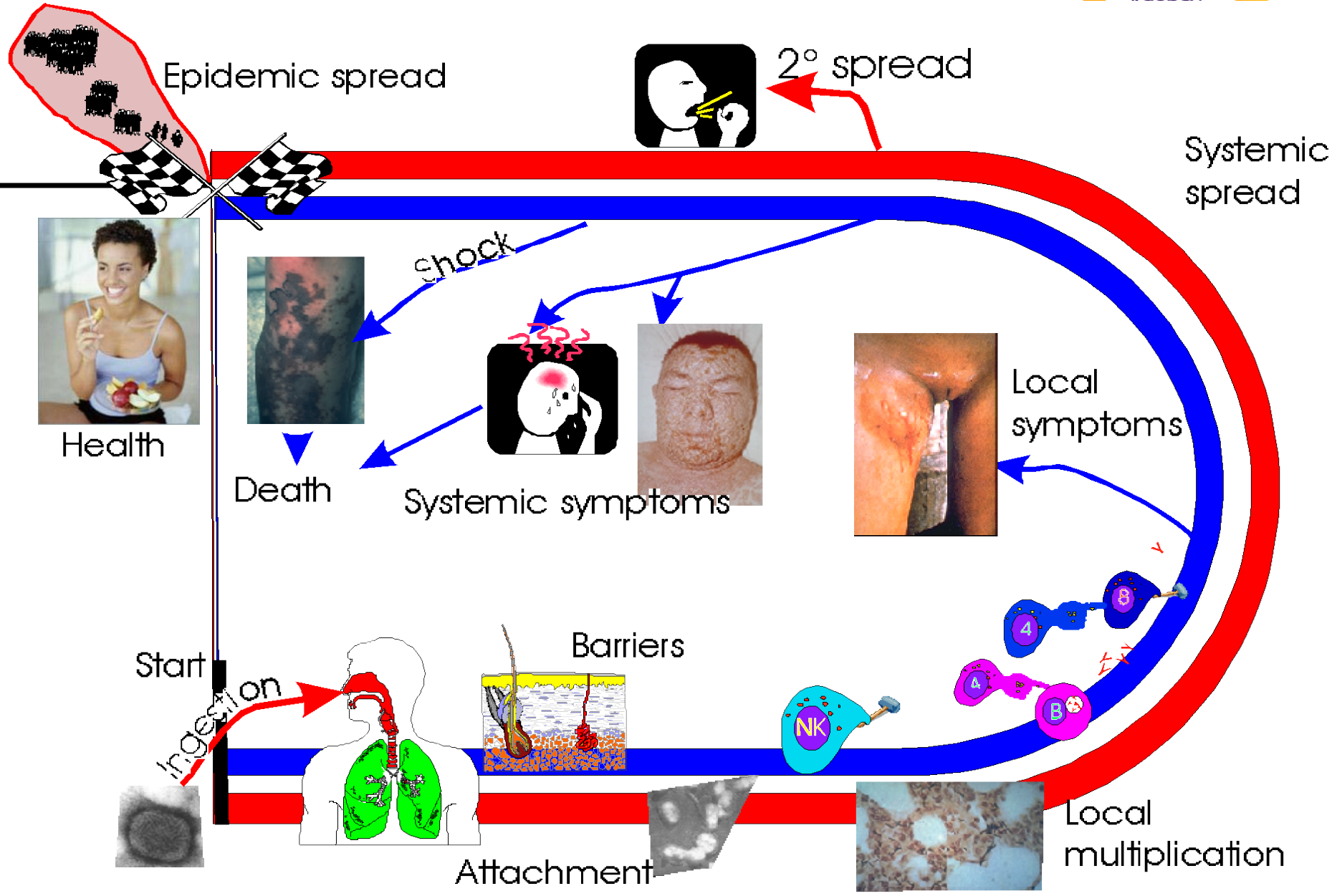
Meet the germ



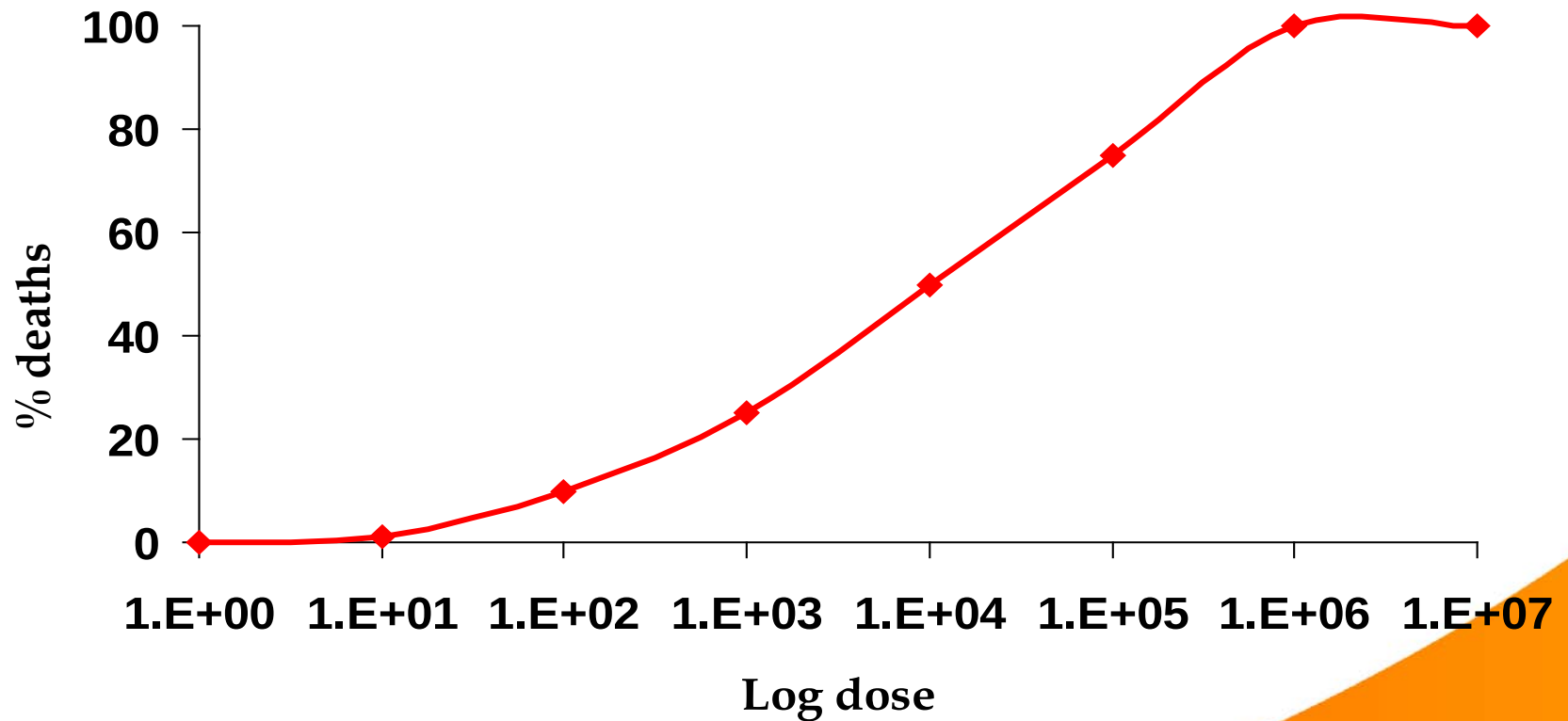
Invasion, multiplication & spread



Race for Life



Infectious dose

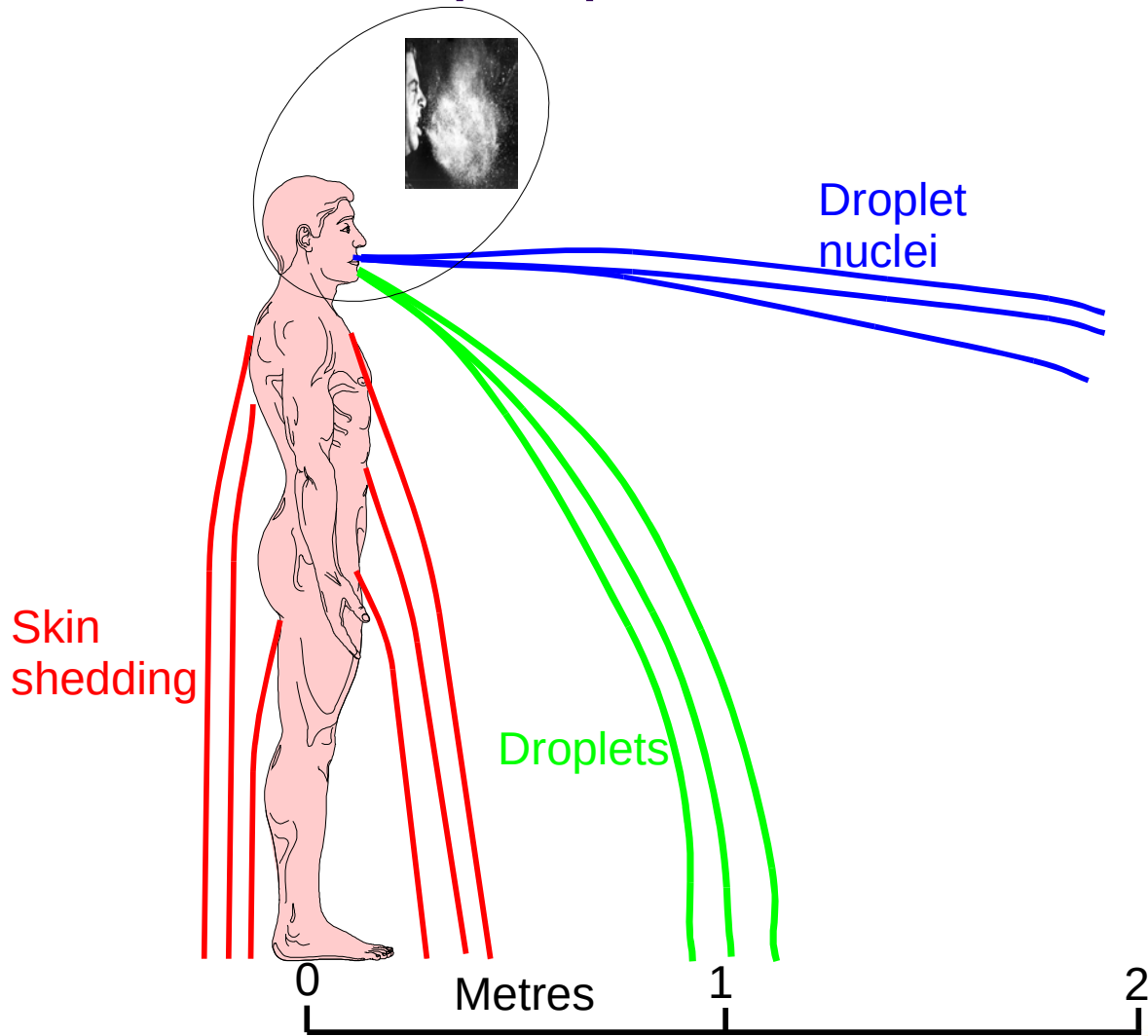


Moving germs about



Germs only move if there is a force applied

Germ transmission from people



Other ways of getting germs airborne or spattered about



Truth, half-truths and non-truths



Germs creep out of sealed containers and infect you

Only in the minds of Safety Officers

Germs in a liquid will fly out and get you

Only if you help them (some force needs to be applied)

You are safe if you have less than the ID

Ask Cadbury's where they went wrong

Laboratory containment



Designing equipment for safety



Closed path, sealed systems

Lab & equipment design



Protect operator, environment and public



Protective equipment



Biosafety: UK authorities



Health & Safety Executive (HSE)

Provide guidance

Inspect sites

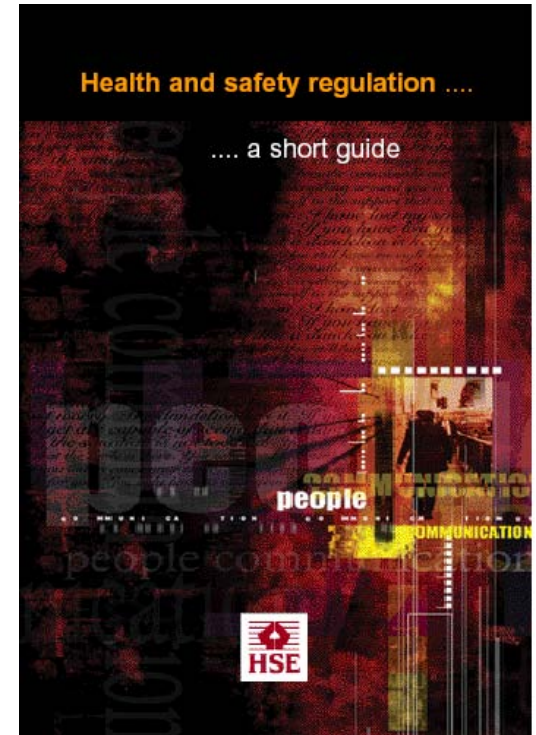
Enforce law

Can bring actions against companies or individuals

Can serve improvement or closure notices

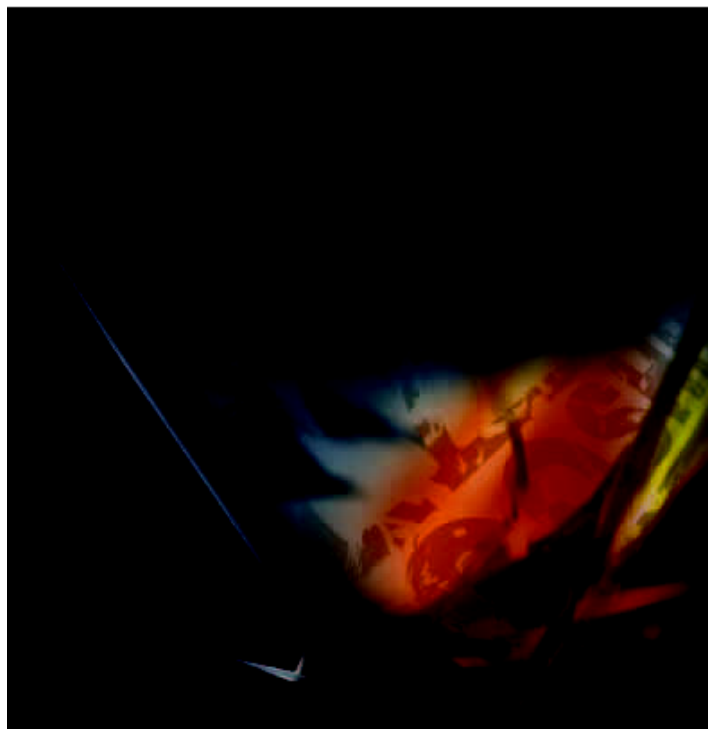
DEFRA (Agriculture)

Environment Agency



COSHH: A brief guide to the Regulations

What you need to know about the Control of Substances Hazardous to Health Regulations 2002 (COSHH)



Biological agents: Managing the risks in laboratories and healthcare premises

Advisory Committee on Dangerous Pathogens

Advisory Committee on Dangerous Pathogens

The Approved List of biological agents

Real practice



Practice should cope with unknowns

e.g. Up to requirement for Blood-borne pathogens

Anthrax in a soil sample

E. Coli O157 in a food prep area

This means:

Gloves, gown, goggles/visor

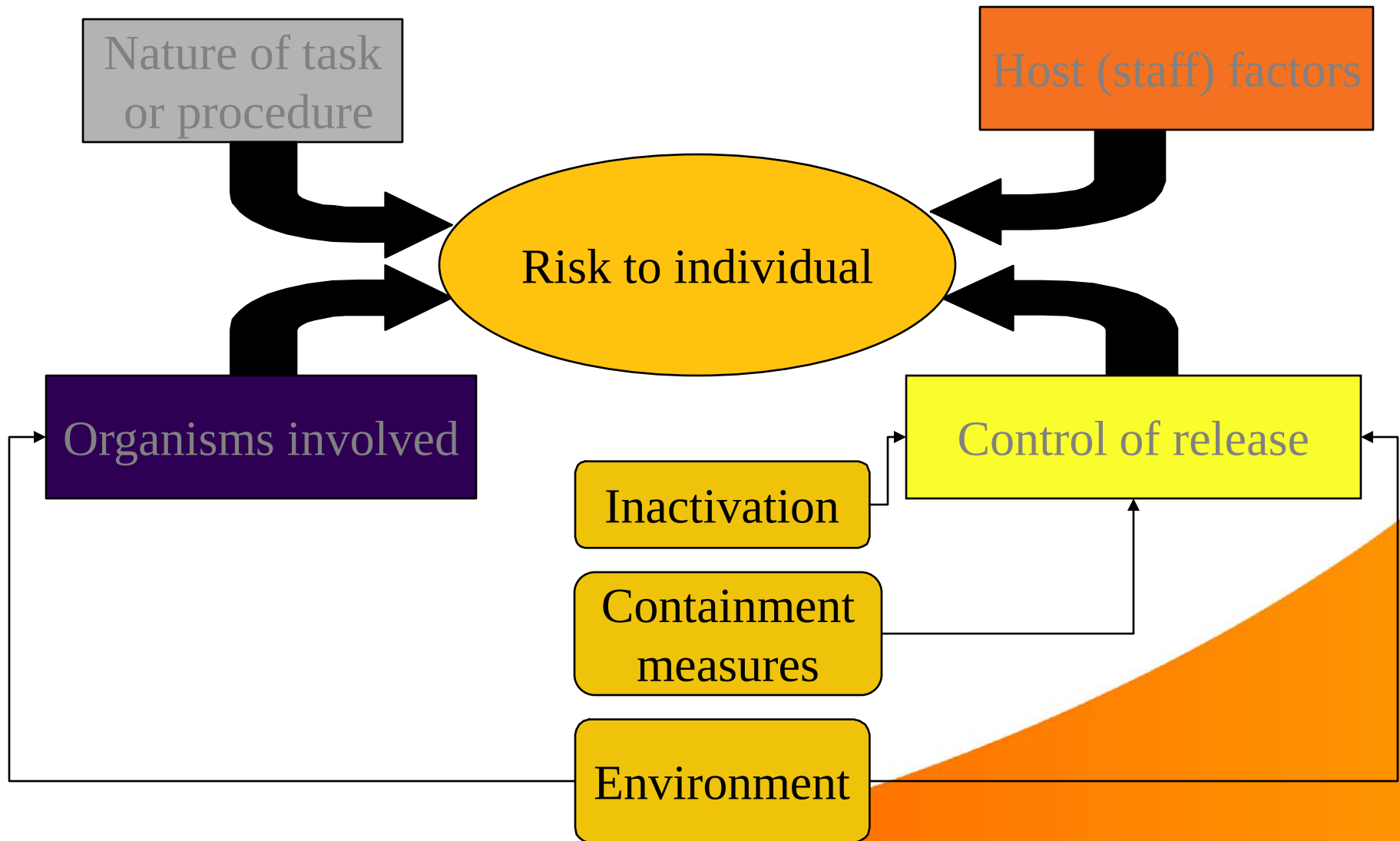
Aerosol generating procedures in cabinet

Splash/spatter precautions

IF you isolate something suspicious

Put it in a cabinet or sealed container and seek help

Factors in risk assessment



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INFECTION CONTROL MEASURES
NO/ MINIMAL RISK

Hand hygiene, gloves, plastic apron

STAFF AT RISK

Hand hygiene, gloves, plastic apron, fluid repellent surgical facemask, disposable visor.

FFP3 respirator and visor/goggles for potential aerosolisation or splash procedures

STAFF AT HIGH RISK

Hand hygiene, fluid repellent disposable gown, double gloves, disposable visor, FFP3 respirator or equivalent

LABORATORY - POSSIBILITY

Lab coat, gloves.

Goggles for potential aerosolisation or splash procedures

LABORATORY - HIGH POSSIBILITY

Lab coat, gloves, goggles. Fluid repellent surgical facemask for potential aerosolisation or splash procedures

A) Does the patient have a fever [$> 38^{\circ}\text{C}$] or history of fever in previous 24 hours AND has returned from (or is currently residing in) an endemic area within 21 days?
OR
B) Does the patient have a fever [$> 38^{\circ}\text{C}$] or history of fever in previous 24 hours AND has cared for / come into contact with body fluids of / handled clinical specimens (blood, urine, faeces, tissues, laboratory cultures) from a live or dead individual or animal known or strongly suspected to have VHF?

NO to A and B

Patient's VHF risk does not need to be considered

YES to A only

YES to B

CLINICAL:

- Has the patient had a fever [$> 38^{\circ}\text{C}$] persisting after 72 hours of appropriate antimalarials or antimicrobials?

EPIDEMIOLOGICAL:

- Has the patient lived or worked in basic rural conditions where Lassa fever is endemic i.e. West/Central Africa
- Has the patient travelled to any area where there is a current VHF outbreak?
- Has the patient travelled in an area endemic for Crimean-Congo Haemorrhagic Fever and received a tick bite and/or crushed a tick with their bare hands and/or travelled to a rural environment where contact with livestock or ticks is possible?
- Has the patient visited caves or mines in a VHF endemic area?

NO to ALL

YES to ANY

**POSSIBILITY OF VHF
PUT PATIENT IN A SIDEROOM**

CLINICAL QUESTION TO DETERMINE INFECTION CONTROL BEHAVIOUR AND PROTECT STAFF:
Does the patient have bruising OR bleeding OR uncontrolled diarrhoea OR uncontrolled vomiting OR cough?

NO

YES

Urgent discussion with HSIDU

Urgent local investigations (inform lab of VHF likelihood) FBC, U&E, LFTs, PT, APTT, Glucose
Urgent Malaria investigation
Blood cultures, CXR

Malaria Positive

Malaria negative

Inpatient longer than 72 hours, continuing fever without diagnosis?

YES

VHF screen (EDTA & serum)

Re-assess patient at least daily

NO

VHF screen negative
Maintain possibility of VHF until alternative diagnosis has been confirmed

**HIGH POSSIBILITY OF VHF
PUT PATIENT IN A SIDEROOM**

CLINICAL QUESTION TO DETERMINE INFECTION CONTROL BEHAVIOUR AND PROTECT STAFF:
Does the patient have bruising OR bleeding OR uncontrolled diarrhoea OR uncontrolled vomiting OR cough?

NO

YES

Investigations as below and urgent discussion with HSIDU - consider early transfer to HSIDU

Urgent VHF screen (EDTA & serum)
Urgent local investigations (inform lab of VHF likelihood) FBC, U&E, LFTs, PT, APTT, Glucose
Urgent Malaria investigation
Blood cultures, CXR

Launch initial public health actions - including notification of suspected case and identification of contacts

VHF screen positive

- Urgent discussion with HSIDU, transfer via Category 3 ambulance to HSIDU
- Launch full public health actions, including categorisation and management of contacts

VHF HIGHLY UNLIKELY

but reassess if fails to improve or deteriorates e.g. nosebleed, bloody diarrhoea, sudden rise in AST or CK, sudden fall in platelets, fall in BP, rapidly increasing O_2 requirements in absence of other diagnosis.

Preparing for an incident



Staff training

Defined procedure

Vaccination used

Licensed vaccines may be required

Unlicensed offered

Not a substitute for containment

Drugs on site

24 hr availability

Authorised by physician



What Sarawashi saw



Influenza virus cultured
in eggs.....

Summary



Germs are everywhere

Most are harmless but specific & opportunistic pathogens abound

Physical laws apply (but you may need to think)

Safety depends on not letting the germ get to its target site

Use barriers & procedures

Design exposure out of process

Centrifuge accident



Worker centrifuged botulinum in wrong tubes

Risk of inhalation

Known to cause accidents in past

Lab fumigated

Worker banned from lab

Observed with active monitoring

No disease

Major safety enquiry



After simulated accident



Inside of rotor seal

Fluid cannot aerosolise
as deposition velocity is
so high

Deposited fluid can run
out of tubes when
centrifuge stops

Removal of lid exposes
only seal

No measurable aerosol
of fluorescein or spores



UV and swab sampling of drum clear

