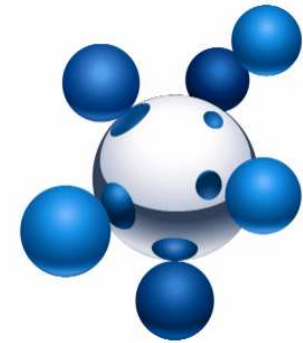
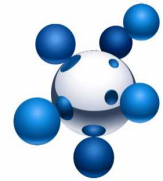


SASOL
reaching new frontiers



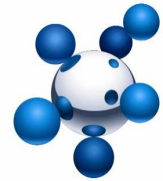
Hazardous Biological Agents

Kobus Boshoff



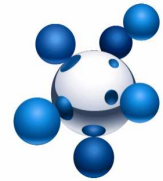
What is defined as a Hazardous Biological Agent (HBA)?

- Hazardous Biological Agents which are micro organisms, including those that have been genetically modified, pathogens, cells, cell cultures and human endoparasites that have the potential to provoke an infection, allergy, toxicity or otherwise create a hazard to human health.
- It can also include substances harmful to animals and plants



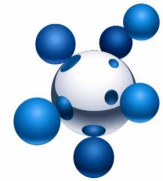
Classification

- Biological agents are classified into four hazard groups according to
 - *Ability to cause infection*
 - *Severity of resulting disease*
 - *Risk of spread to the community*
 - *Availability of vaccines and effective treatment*
- For unlisted or unknown agents the correct group must be determined by these criteria and taking into consideration factors used when doing HBA risk assessment



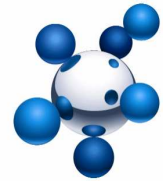
Classification

- a) **Group 1 HBA** are HBA that is unlikely to cause human disease;
- b) **Group 2 HBA** are HBA that may cause human disease and be a hazard to exposed persons, which is unlikely to spread to the community and for which effective prophylaxis and treatment is usually available;
- c) **Group 3 HBA** are HBA that may cause severe human disease, which presents a serious hazard to exposed persons and which may present a risk of spreading to the community, but for which effective prophylaxis and treatment is available;
- d) **Group 4 HBA** are HBA that causes severe human disease and is a serious hazard to exposed persons and which may present a high risk of spreading to the community, but for which no effective prophylaxis and treatment is available



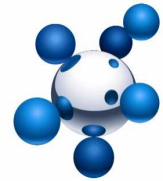
Potentially Hazardous Biological agents

- Bacteria
- Viruses
- Viroids
- Prions
- Rickettsia
- Fungi
- Parasites
- Recombinant DNA (rDNA) technologies
- Human or animal; fresh or frozen; tissues, blood, or body fluids



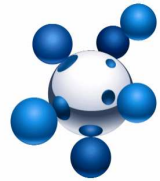
Bacteria

- Bacteria are a large group of unicellular micro organisms
- Typically a few micrometers in length, bacteria have a wide range of shapes, ranging from spheres to rods and spirals
- Bacteria are ubiquitous in every habitat on Earth, growing in soil, acidic hot springs, radioactive waste, water, and deep in the Earth's crust, as well as in organic matter and the live bodies of plants and animals
- Bacteria form much of the earth's biomass
- There are approximately ten times as many bacterial cells in the human flora of bacteria as there are human cells in the body
- The vast majority of the bacteria in the body are rendered harmless by the protective effects of the immune system, and a few are beneficial
- However, a few species of bacteria are pathogenic and cause infectious diseases
- including cholera, syphilis, anthrax, leprosy, bubonic plague and legionnaires disease



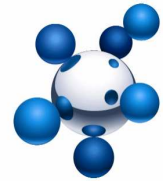
Viruses

- A virus (from the Latin virus meaning toxin or poison) is a sub-microscopic infectious agent that is unable to grow or reproduce outside a host cell
- The first known virus, tobacco mosaic virus, was discovered in 1898
- Viruses infect all forms of life, are found in almost every ecosystem on Earth and are the most abundant type of biological entity on the planet
- Viruses consist of two or three parts: all viruses have genes made from either DNA or RNA, long molecules that carry genetic information; all have a protein coat that protects these genes; and some have an envelope of fat that surrounds them when they are outside a cell
- diseases caused by viruses include the common cold, influenza, chickenpox, cold sores, hepatitis, Ebola, AIDS, avian influenza and SARS



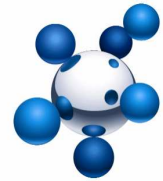
Viroids

- Viroids are plant pathogens that consist of a short stretch (a few hundred nucleobases) of highly complementary, circular, single-stranded RNA without the protein coat that is typical for viruses
- Viroids are the smallest known pathogens



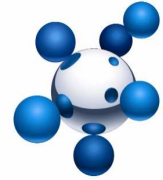
Prions

- A prion is an infectious agent that is composed entirely of protein
- Prions have been implicated in a number of diseases in a variety of mammals, including bovine spongiform encephalopathy (BSE, also known as "mad cow disease") in cattle and Creutzfeldt-Jakob disease (CJD) in humans
- All prion diseases affect the structure of the brain or other neural tissue, and all are currently untreatable and are always fatal



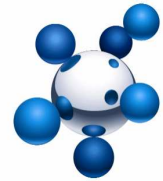
Rickettsia

- *Rickettsia* is a genus of motile, Gram-negative, non-sporeforming, highly pleomorphic bacteria that can present as cocci (0.1 μm in diameter), rods (1-4 μm long) or thread-like (10 μm long)
- Obligate intracellular parasites, the *Rickettsia* depend on entry, growth, and replication within the cytoplasm of eukaryotic host cells; typically endothelial cells (cells that line the interior surface of blood vessels)
- In the past they were regarded as microorganisms positioned somewhere between viruses and true bacteria
- The majority of *Rickettsia* bacteria are susceptible to antibiotics of the tetracycline group
- *Rickettsia* species are carried as parasites by many ticks, fleas, and lice, and cause diseases such as typhus, rickettsialpox, Boutonneuse fever, African Tick Bite Fever, Rocky Mountain spotted fever, Australian Tick Typhus, Flinders Island Spotted Fever and Queensland Tick Typhus in human beings



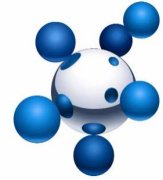
Fungi

- A fungus is a eukaryotic organism that is a member of the kingdom Fungi
- The fungi are heterotrophic organisms possessing a chitinous cell wall, with most species growing as multicellular filaments called hyphae forming a mycelium; some species also grow as single cells
- Yeasts, molds, and mushrooms are examples of fungi
- Occurring worldwide, most fungi are largely invisible to the naked eye, living for the most part in soil, dead matter, and as symbionts of plants, animals, or other fungi
- Many species produce bioactive compounds called mycotoxins, such as alkaloids and polyketides that are toxic to animals including humans
- Fungi are significant pathogens of humans and other animals, and losses due to diseases of crops (e.g., rice blast disease) or food spoilage can have a large impact on human food supply and local economies



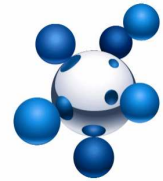
Parasites

- Parasitism is a type of symbiotic relationship between two different organisms where one organism, the parasite, takes favor from the host, sometimes for a prolonged time
- Classic examples of parasitism include interactions between vertebrate hosts and diverse animals such as tapeworms, flukes, the Plasmodium species, and scabs
- An example of this interaction is the transmission of malaria, caused by a protozoan of the genus Plasmodium, to humans by the bite of an anopheline mosquito



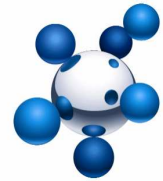
Recombinant DNA (rDNA) technologies

- Recombinant DNA is a form of DNA that does not exist naturally, which is created by combining DNA sequences that would not normally occur together
- In terms of genetic modification, recombinant DNA (rDNA) is introduced through the addition of relevant DNA into an existing organismal DNA, such as the plasmids of bacteria, to code for or alter different traits for a specific purpose, such as antibiotic resistance



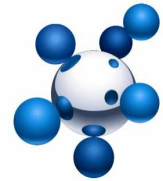
Legionellosis

- Legionellosis is an infectious disease caused by bacteria belonging to the genus *Legionella*
- Over 90% of legionellosis cases are caused by *Legionella pneumophila*, a ubiquitous aquatic organism that thrives in warm environments (25 to 45 °C (77 to 113 °F) with an optimum around 35 °C (95 °F))
- Legionellosis takes two distinct forms:
 - *Legionnaires' disease, also known as "Legion Fever", is the more severe form of the infection and produces pneumonia*
 - *Pontiac fever is caused by the same bacterium, but produces a milder respiratory illness without pneumonia which resembles acute influenza*
- Legionellosis infection normally occurs after inhaling an aerosol (suspension of fine particles in air) containing *Legionella* bacteria



Legionellosis

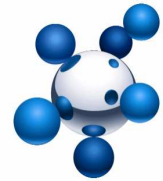
- Such particles could originate from any infected water source.
- When mechanical action breaks the surface of the water, small water droplets are formed, which evaporate very quickly.
- If these droplets contain bacteria, the bacteria cells remain suspended in the air, invisible to the naked eye but small enough to be inhaled into the lungs
- Potential sources of such contaminated water include cooling towers used in industrial cooling water systems as well as in large central air conditioning systems, evaporative coolers, hot water systems, showers, whirlpool spas, architectural fountains, room-air humidifiers, ice making machines, misting equipment, and similar disseminators that draw upon a public water supply.
- The disease may also be spread in a hot tub if the filtering system is defective.
- *Legionella longbeachae*, an organism in the *Legionella* family, is found in soils and compost.
- Thus, the dust from purchased bags of soil, compost, or potting mix is also a potential source of *Legionella*



Five Main Routes Of Transmission

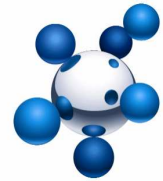
- **Contact**

- The most important route of transmission in a workplace is by –
 - *direct contact with an infected or contaminated body surface or fluid; and*
 - *indirect contact via contact with an object previously contaminated with organisms from an infected person or animal*



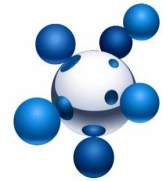
Five Main Routes Of Transmission

- **Droplet Transmission**
- Droplets are generated during coughing, sneezing, talking and during procedures such as suctioning.
- Droplets may carry organisms that can infect a new host if they are deposited on conjunctivae, nasal mucosa or the mouth.
- Droplets do not remain suspended in the air.
- Droplets do not travel more than one meter.



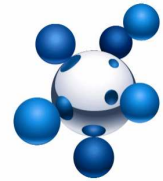
Five Main Routes Of Transmission

- **Airborne Transmission**
- Small particles (droplet nuclei) that remain suspended in air for long periods of time have a far greater potential for spreading disease than large droplets.
- Few organisms are carried by this route, the most important being *Mycobacterium tuberculosis* and the viruses causing measles and chickenpox.
- Prevention of spread requires an enclosed area with at least six air changes per hour, or an open window that provides adequate ventilation.



Five Main Routes Of Transmission

- **Common Vehicle Transmission**
- Transmission by items such as food, water, devices and equipment.
- Normal hygienic practices and proper sterilization or disinfections of equipment should make this type of spread a rare event in certain workplaces, e.g. hospitals



Five Main Routes Of Transmission

- **Vector-Borne Transmission**

- Vectors such as mosquitoes, flies, fleas, etc. are hopefully not frequently encountered in workplaces as a cause of outbreaks.

- In areas where there is a problem the appropriate measures, e.g. screens on windows and the use of insecticides must be instituted.

- Two levels of precautions are recommended :

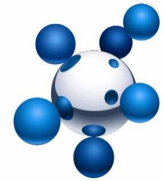
- *Standard Precautions*

- These are applied at all times to all patients irrespective of their diagnosis. All body fluids (except sweat) are regarded as potentially infectious.*

- *Transmission-Based Precautions*

- These are applied when a specific infectious disease is diagnosed or suspected.*

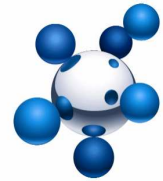
- The route by which the disease is transmitted will determine the category of precautions that must be applied.*



Precautions

- Administrative Controls
 - *Education and Training*
 - *Adherence to precautions*

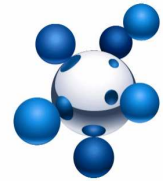
- Precautionary measures
 - *Standard Precautions*
 - *Airborne Precautions*
 - *Droplet Precautions*
 - *Contact Precautions*
 - *Formidable Epidemic Disease (e.g. viral haemorrhagic fevers) Precautions*



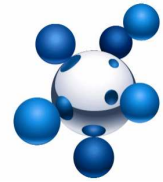
- The backbone of microbial safety in the work place is the HBA risk assessment



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Thank you !!



Escherichia Coli

