Health and Safety Essentials

Lecture 10 – Biological & Ergonomic Hazards – An Introduction

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Undergraduate Diploma in
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Recap last week's topic

Kahoot Quiz:

https://play.kahoot.it/v2/*?quizId=9a6cdc51-7672-45fe-82c6-c4046bfb2388

Learning Objectives

- Define biological and ergonomic hazards and their workplace relevance.
- Recognise common examples of biological agents and ergonomic risks.
- Understand primary exposure routes for biological hazards.
- Identify basic ergonomic risk factors and their health implications.
- Explore introductory assessment techniques for these hazards.
- Learn basic control measures, including engineering, administrative, and PPE strategies.
- Be aware of EU and Malta regulations on biological and ergonomic safety.
- Discuss real-world examples and their impact on worker health.

Importance of Addressing Biological and Ergonomic Hazards

1. **Workplace Health Impact**:
    1. Biological hazards (e.g., bacteria, viruses, mould) can cause infectious diseases, allergic reactions, and chronic health conditions.
    2. Ergonomic hazards (e.g., poor workstation design, repetitive motions) lead to musculoskeletal disorders (MSDs) and reduced productivity.
2. **Economic Consequences**:
    1. Increased absenteeism, healthcare costs, and potential legal liabilities for organisations.
3. **Legal and Regulatory Compliance**:
    1. EU directives and Maltese laws mandate risk assessments and controls for these hazards to ensure worker safety and health.
4. **Prevention and Control**:
    1. Early identification and management of hazards prevent workplace incidents, protect worker well-being, and foster a positive safety culture.
5. **Relevance Across Industries**:
    1. Biological hazards affect sectors like healthcare, agriculture, and food production.
    2. Ergonomic risks are mostly present in both physical and office-based environments.
6. **Future-Proofing the Workforce**:
    1. Addressing these hazards reduces long-term health issues, ensuring sustainable work practices and enhancing employee retention.

What are Biological Hazards?

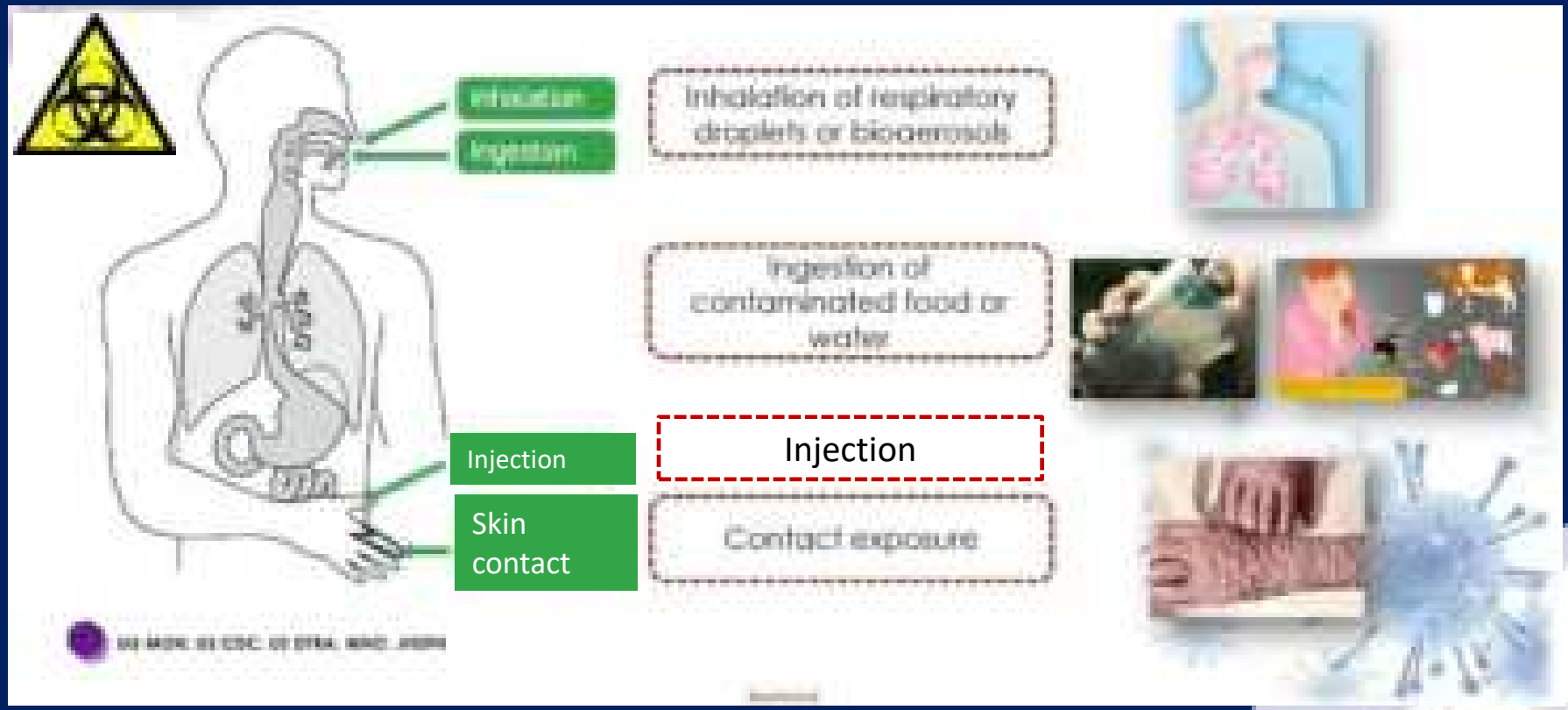
- Biological hazards refer to harmful organisms or substances that can affect human health. These include microorganisms (like bacteria and viruses), genetically modified organisms, cell cultures (cells grown in labs), and human parasites.
- Different systems are used to identify these hazards.
- Some countries define biological hazards by classifying biological agents into categories based on their potential to harm health.

The Legal Framework – Biological Hazards

Malta Regulation	EU Directive
Protection of Workers from Risks Related to Exposer to Biological Agents at Work Regulations L.N. 228 of 2003	Directive 2000/54/EC - Biological Agents at Work Commission Directive (EU) 2020/739 of 3 June 2020 amending Annex III to Directive 2000/54/EC of the European Parliament and of the Council as regards the inclusion of SARS-CoV-2 in the list of biological agents known to infect humans and amending Commission Directive (EU) 2019/1833

Main Routes of Exposure (RoE)

1. Inhalation
2. Ingestion
3. Skin Contact
4. Injection/ Penetration



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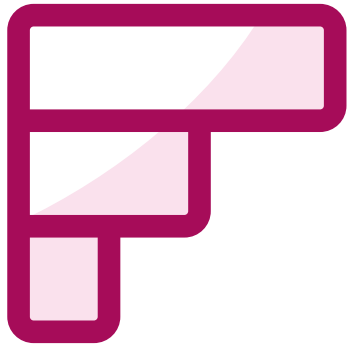

What do you consider the most significant hazard in your workplace: Biological or Ergonomic?

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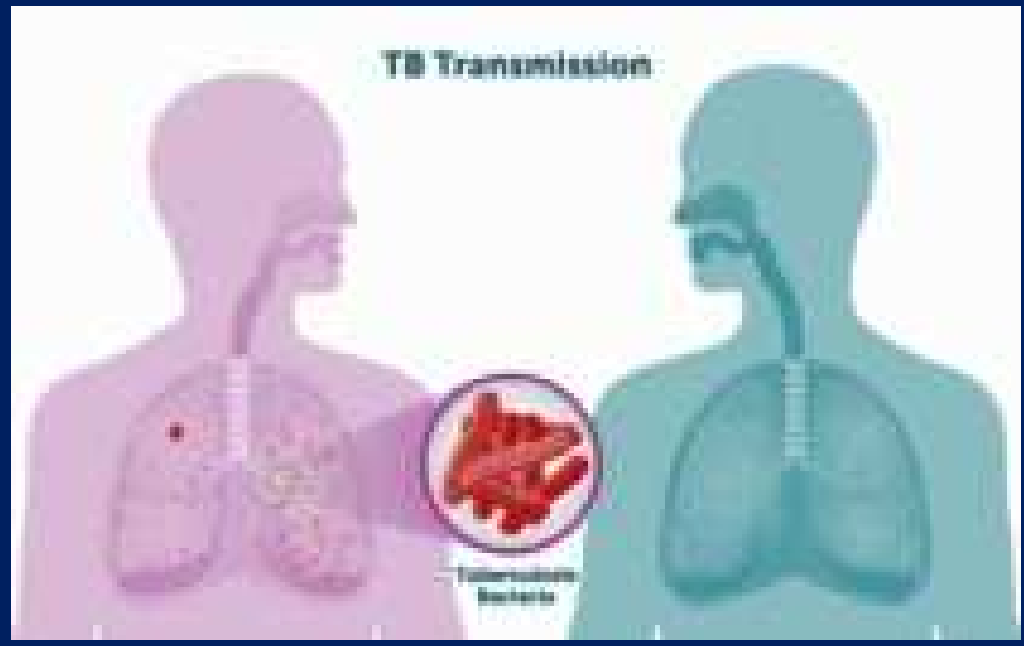
Inhalation: Breathing in Hazards

- Inhaling airborne particles, droplets, or aerosols.
- Examples:
  - *Mycobacterium tuberculosis* (tuberculosis) or **SARS-CoV-2**
  - **Legionella pneumophila** from contaminated water systems, such as cooling towers, air conditioning units or even showers.
- Control Measures:
  - Inoculation (TB)
  - Use of masks/respirators.
  - Proper ventilation systems.
  - System hygiene & maintenance



Ingestion: Swallowing Contaminants

- Consuming contaminated food or water, or hand-to-mouth contact.
- Examples:
  - *Salmonella* & *Campylobacter chicken bug* in poultry. (e.g. undercooked or splashes of water from uncooked chicken).
    https://www.youtube.com/watch?v=c4wbqWA2qI8
  - *Escherichia coli* in contaminated water.
    https://www.youtube.com/watch?v=ZmtjuCvzjOQ
    https://www.youtube.com/watch?v=sMgba065JJA
- Control Measures:
  - Handwashing before eating.
  - Ensuring food hygiene and safety.
    Visuals: Handwashing and safe food preparation scenes

Skin Contact: Direct Exposure

- Contact with contaminated surfaces, substances, or animals.
- Examples:
  - Farmers exposed to *Brucella spp.*.
  - Lab workers handling contaminated samples.
- Control Measures:
  - Wearing gloves and protective clothing.
  - Frequent handwashing with soap.
    Visuals: Gloved hands handling biological samples.

Injection/Penetration: Breaking the Skin Barrier

- Entry through punctures, cuts, or wounds.
- Examples:
  - Needlestick injuries exposing workers to HIV or Hepatitis B.
  - Animal bites causing rabies or tetanus.
- Control Measures:
  - Safe disposal of sharps.
  - Use of puncture-resistant gloves.
    Visuals: Sharps disposal container and animal handling safety.

Mucous Membrane: Special Case of Skin Contact

- Exposure through eyes, nose, or mouth.
- Examples:
  - Splash of infected blood into eyes during surgery.
  - Hand-to-face contact introducing pathogens.
- Control Measures:
  - Face shields or goggles.
  - Avoiding face-touching with unclean hands.
    Visuals: Healthcare worker with face shield.

Vector-Borne: Special Case of Injection

- Pathogens introduced by insect or animal vectors.
- Examples:
  - Mosquitoes transmitting malaria or Zika virus.
  - Ticks spreading Lyme disease.
- Control Measures:
  - Insect repellents and protective clothing.
  - Pest control in workplaces.
    Visuals: Worker in protective clothing in a mosquito-prone area.

ILO - ILC.112/Report IV

1. **Classification Systems**:
   Biological agents are often classified into risk groups (e.g., Risk Group 1 to 4) based on their potential to cause disease in humans, as per guidelines such as those by the World Health Organisation (WHO) or national biosafety frameworks.
2. **Laboratory Biosafety Levels (BSL)**:
   Facilities are categorised into biosafety levels (BSL-1 to BSL-4) depending on the type of biological hazard present, with specific containment and safety measures at each level.
3. **Occupational Exposure Limits (OELs)**:
   Some systems set thresholds for acceptable levels of exposure to biological hazards, especially in laboratory or healthcare settings.
4. **Hazard Identification Systems**:
   These systems involve assessing workplace activities to identify the presence of pathogens, allergens, or other biological risks through monitoring and reporting mechanisms.
5. **Pathogen Lists and Databases**:
   Organisations and countries maintain lists of regulated or high-risk biological agents (e.g., the US CDC's Select Agents and Toxins list or the EU's Biological Agents Directive), aiding in hazard recognition.
6. **Risk Assessment Frameworks**:
   Structured methodologies are applied to evaluate biological hazards, considering their infectivity, modes of transmission, and available controls.

Classification Systems

The EU uses **Directive 2000/54/EC** to classify biological agents into four risk groups:

- **Risk Group 1**: Non-harmful microorganisms (e.g., *Lactobacillus* found in yogurt).
- **Risk Group 2**: Pathogens causing mild disease (e.g., *Escherichia coli* strains).
- **Risk Group 3**: Severe pathogens but with effective treatments (e.g., *Mycobacterium tuberculosis*).
- **Risk Group 4**: High-risk pathogens with no known treatment (e.g., *Ebola virus*).

Laboratory Biosafety Levels (BSL)

- **BSL-1**: Research labs handling *Bacillus subtilis*, a harmless soil bacterium.
- **BSL-2**: Labs working with *Salmonella enterica* or *Staphylococcus aureus*.
- **BSL-3**: Containment labs handling *Brucella abortus* (common in animal health).
- **BSL-4**: High-containment facilities like the European BSL-4 labs in Germany handling *Lassa virus*.

Occupational Exposure Limits (OELs)

In the EU, exposure to **bioaerosols** in certain professions is regulated:

- Workers in waste treatment facilities are monitored for exposure to airborne **Aspergillus spores** (a fungus).
- In healthcare, monitoring is conducted for **tuberculosis** exposure.

Hazard Identification Systems

- **Hospitals** use infection control logs to track exposure risks to biological hazards like **MRSA (Methicillin-Resistant Staphylococcus aureus)**.
- **Food industry facilities** monitor for contamination risks from pathogens like **Listeria monocytogenes**.

Pathogen Lists and Databases

The EU maintains a **list of biological agents** (Annex III of Directive 2000/54/EC), identifying high-risk pathogens:

- Priority pathogens for occupational health, e.g., **Hepatitis B virus** for healthcare workers.
- Zoonotic pathogens like **Brucella spp.** for veterinarians and farmers.

Risk Assessment Frameworks

- A risk assessment in a healthcare facility could identify exposure risks from **bloodborne pathogens** like **HIV** during surgery.
- In agriculture, risks from **Hantavirus** exposure (from rodent droppings) are assessed and mitigated through hygiene measures.

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Which pathogen is associated with undercooked poultry?

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Breakout Room 1

Scenario: You are a health and safety team assessing biological hazards

- **Question 1 – Groups 1 & 2**: What are the most likely biological hazards in a modern office environment in Malta, and what control measures would you implement?

- **Question 2 – Groups 3 & 4**: What are the most likely biological hazards in a restaurant kitchen in Malta, and what control measures would you implement?

Breakout Room 1…

Instructions for Participants:

1. **Discuss and List** the hazards identified in your assigned scenario.
2. **Prioritise** the top 2 hazards and justify why they are most critical.
3. **Suggest Control Measures** to mitigate these risks effectively.
4. Choose a spokesperson to share your findings with the main group.

Break

Ergonomic Hazards

- Ergonomics, also known as human factors, is the scientific discipline focused on understanding the interactions between humans and other elements within a system. This field applies theoretical principles, data, and methods to design processes and products that optimise human well-being and overall system performance. OSHwiki

- It is about the systematic study of people at work with the objective of improving the work situation, the working conditions and the tasks performed. (ILO)
- "Ergonomics, in simplified terms, is the process of adapting work equipment, tasks, and environments to suit the physical and cognitive needs of the worker, ensuring safety, comfort, and efficiency."

The Legal Framework - Ergonomics

Malta Regulation	EU Directive
Minimum Health and Safety Requirements for Work with Display Screen Equipment Regulations (LN 43 of 2002)	**Directive 90/270/EEC - Display Screen Equipment**
Protection against Risks of Back Injury at Work Places Regulations (LN 35 of 2003)	**Directive 90/269/EEC - Manual Handling of Loads**

Additionally, Guidance issued by the EU Commission in 2010 to explain the relationship between the ergonomic requirements of the Machinery Directive 2006/42/EC and the harmonised standards.
https://ec.europa.eu/docsroom/documents/9484/attachments/1/translations

Why These Focus Areas?

- Manual handling and display screen tasks are widespread in modern workplaces.
- High prevalence of musculoskeletal disorders (MSDs) among workers.
- **EU Directives address these risks to:**
  - Enhance worker safety and comfort.
  - Improve productivity by reducing work-related injuries.
- Focus reflects growing awareness of workplace ergonomics' importance.

Guidance on Machinery Directive and Ergonomics (2010)

- In **2010**, the EU Commission issued a **Guidance Document** to clarify the relationship between the:
  - Ergonomic requirements of the **Machinery Directive (2006/42/EC)**.
  - **Harmonised standards** developed for machinery safety.
- **Key Points:**
  - Machinery design must address ergonomic principles to reduce risks of physical strain.
  - Compliance with harmonised standards ensures machinery meets ergonomic safety.
- **Aim:** To ensure machinery is designed to **adapt to human capabilities and limitations**, reducing risks such as MSDs.

Ergonomic Risk Assessment Tools

- **KIM (Key Indicator Method)**
  Origin: Germany
- **MAC (Manual Handling Assessment Charts)**
  Origin: United Kingdom
- **REBA (Rapid Entire Body Assessment)**
  Origin: International
- **RULA (Rapid Upper Limb Assessment)**
  Origin: International
- **QEC (Quick Exposure Check)**
  Origin: International

Key Indicator Method (KIM)

- **Origin:** Developed by the German Federal Institute for Occupational Safety and Health (BAuA). BAuA
- **Purpose:** Assesses physical workloads, particularly manual handling operations, to identify ergonomic risks.
- **Application:** Used to evaluate tasks involving lifting, holding, carrying, pushing, and pulling loads.
- **Features:**
  - Screening tool requiring detailed knowledge of workstations.
  - Identifies structural deficits in ergonomic design.
  - Provides guidance on measures to reduce health risks.

Manual Handling Assessment Charts (MAC)

- **Origin:** Developed by the UK's Health and Safety Executive (HSE). Health and Safety Executive
- **Purpose:** Identifies high-risk manual handling activities to prevent musculoskeletal disorders.
- **Application:** Assesses lifting, carrying, and team manual handling operations.
- **Features:**
  - Uses a numerical and color-coded system to indicate risk levels.
  - Helps employers understand and categorise risk factors.
  - Guides interventions to control identified risks.

Rapid Entire Body Assessment (REBA)

- **Origin:** Developed by Dr. Sue Hignett and Dr. Lynn McAtamney in the UK.
- **Purpose:** Assesses whole-body postural risks associated with job tasks.
- **Application:** Evaluates static and dynamic postures, forceful exertions, and repetition.
- **Features:**
  - Provides a quick and systematic assessment.
  - Generates a risk score indicating the urgency of intervention.
  - Applicable across various industries and job functions.

Rapid Upper Limb Assessment (RULA)

- **Origin:** Developed by Dr. Lynn McAtamney and Professor E. Nigel Corlett in the UK.
- **Purpose:** Evaluates postural loading on the neck, trunk, and upper limbs to assess risk of musculoskeletal disorders.
- **Application:** Suitable for sedentary tasks and tasks requiring upper limb movements.
- **Features:**
  - Assesses biomechanical and postural loading.
  - Generates scores that indicate the need for ergonomic interventions.
  - Useful in designing workstations and job tasks.

Quick Exposure Check (QEC)

- **Origin:** Developed through collaboration between ergonomists and practitioners at Robens Center for Health Ergonomics in the UK.
- **Purpose:** Assesses exposure to risk factors associated with work-related musculoskeletal disorders.
- **Application:** Evaluates factors such as posture, movement, and manual handling.
- **Features:**
  - Combines worker and assessor inputs for a comprehensive evaluation.
  - Provides immediate feedback on risk levels.
  - Facilitates the development of targeted ergonomic interventions.

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When performing an ergonomic assessment, what key factors should you consider? Choose all correct.

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What is the main aim of cognitive ergonomics in safety?

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Breakout Room 2

Assign a specific **work setting** to each breakout group:

- **Group 1:** Office (desk jobs, screen work)
- **Group 2:** Construction site (manual handling, lifting, awkward postures)
- **Group 3:** Manufacturing (assembly lines, repetitive tasks, machinery use)
- **Group 4:** Healthcare (patient handling, long standing hours)

Breakout Room 2

Task:

- One participant in each group will share an example of a bad ergonomic design or lack of awareness they've observed in the assigned setting.
- The group will:
  - Identify at least 3 ergonomic issues.
  - Propose 3 practical solutions to address these issues using ergonomic principles.

Group 1: Office Environment

- **Scenario:**
  Maria a rather tall lady, works as a data analyst and spends 8-10 hours daily at her workstation. Her setup includes:
- A **basic cushioned chair** with four fixed legs.
- A **small desk** tucked into a corner, which is cramped.
- Her **computer screen** is placed directly on the desk.
- The workspace is dimly lit with no natural light.

Group 2: Construction Site

- **Scenario:**
  James a 19-year old, works as a construction worker and spends his days moving materials. His situation involves:
- Frequently lifting **heavy objects** such as cement bags and planks.
- Carrying these materials across **uneven, muddy ground**.
- Performing the lifting and moving tasks repeatedly without a designated place to **rest or recover**.
- Tools and materials are scattered.

Group 3: Manufacturing Environment

- **Scenario:**
  Anna works 8 to 12 hours/day Monday to Friday on an assembly line producing small electronic devices. Her workstation setup includes:
- A **stool without back support** that's at a fixed height.
- A **narrow workstation** where components are placed too far from her reach.
- Continuous **repetitive hand and wrist movements** to assemble small items without tools to aid precision.
- Overhead **poor lighting**, making it hard to see details clearly.

Group 4: Healthcare Setting

- **Scenario:**
  Sophie is a nurse in a busy short-staffed hospital ward. Her daily responsibilities include:
- Assisting patients to move from beds to chairs, which involves **bending, twisting, and pulling** awkwardly.
- Repositioning patients in bed without help.
- Standing for extended periods on **hard flooring** while wearing basic flat shoes with little support.
- Frequently working in **tight spaces** around beds, limiting her maneuvering ability.

21 ACADEMY

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