

Biological Safety Training

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UNIVERSITY OF
CAMBRIDGE

Department of Engineering



General philosophy:

- ▶ Take **reasonable** care of your own safety and **others'**
- ▶ Use equipments, chemicals, bio-agents **safely**
- ▶ Only undertake tasks for which adequate **training** has been given
- ▶ **Cooperate** with colleagues to ensure a healthy and safe workplace
- ▶ Follow the University and Department's **procedures**
- ▶ **Report** all incidents and hazards



<http://www.hse.gov.uk/>

- ▶ Responsible for the *encouragement, regulation and enforcement of workplace health, safety and welfare*
- ▶ Get advice from advisory committees
e.g. *Advisory Committee on Dangerous Pathogens (ACDP)*
- ▶ Provides specific guidelines
- ▶ Numerous publications on the website



Central Administration

- ▶ Occupational Health and Safety Service (OHSS)
- ▶ Safety Office
 - ▶ Publications, links:
<http://www.admin.cam.ac.uk/offices/safety/>
 - ▶ Training:
<http://www.training.cam.ac.uk/ohss/>

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- ▶ Department of Engineering Health & Safety:
<http://safety.eng.cam.ac.uk/>
- ▶ Safety Committee & Safety Officer
- ▶ Local Safety Coordinators (LSC)
- ▶ Laser, Radiation & *Biological* Safety Officers



Main functions:

- ▶ Review & approve¹ biological Risk Assessments
- ▶ Provide specialist advice on biological safety issues
 - ▶ containment, storage, security, transport, disposal, disinfection, emergency. . .
- ▶ Provide and arrange training for handling bio-agents
- ▶ Ensure biological incidents are reported and investigated

⇒ You have the main responsibility!

¹most of the time. . .



~~Don't do it!~~ How can you do it safely?

Hazard: something with the potential to cause harm

- ▶ Physical, chemical, ergonomic, *biological*

Risk: likelihood of the potential harm from hazard being realised

- ▶ likelihood of occurrence
- ▶ potential severity of the outcome
- ▶ number of people who may be affected
- ▶ type of people who may be affected

⇒ Control strategies



Control of Substances Hazardous to Health (CoSHH)

- ▶ What is the substance?
 - ▶ Chemicals, dusts, *biological agents*, other
- ▶ How will you be using it
- ▶ How might exposure occur
- ▶ Who may be exposed
- ▶ For how long
- ▶ How to dispose of it

⇒ Control strategies



- ▶ **Eliminate** or avoid the risk altogether
- ▶ **Reduce** exposure (e.g. substituting with a less hazardous substance)
- ▶ **Isolate** (e.g. using the substance in a hood)
- ▶ **Control** (e.g. using safe systems of work)
- ▶ Personal Protective Equipment (PPE)
- ▶ **Discipline** i.e. training, information, signs



HSE define biological agents as:

- ▶ micro-organisms: bacteria, viruses, ...
- ▶ parasites
- ▶ moulds

Routes of infection:

- ▶ ingestion (mouth)
- ▶ inhalation via aerosols (respiratory tract)
- ▶ instillation (eyes mucosa)
- ▶ percutaneous (damaged skin)

No exposure standards are set for biological agents
(no dose-response relationship...)

When classifying a biological agent it should be assigned to one of the following groups according to its level of risk of infection to humans:

hazard group	cause human ² disease	spread to community	prophylaxis or treatment	examples
1	unlikely	-	-	disabled <i>E. Coli</i>
2	potential	unlikely	available	<i>Streptococcus</i>
3	severe	potential	available	<i>Hepatitis B</i>
4	severe	likely	not available	<i>Ebola</i>

²healthy, no pregnancy, no allergy...



Choosing the containment level:

hazard group (pathogens)	containment level (laboratories)
1	1
2	2
3	3
4	4



Cell lines:

Hazard	Cell line	Containment level
Low	Well characterised, authenticated cell lines of human or primate origin; low risk of endogenous infection with a biological agent presenting no apparent harm to laboratory; tested for the most serious pathogens.	CL1
Medium	Finite or continuous cell lines/strains of human or primate origin; not fully characterised or authenticated, except where there is a high risk of endogenous biological agents, e.g. blood-borne viruses.	CL2
High	Cell lines with endogenous biological agents or cells that have been deliberately infected.	Appropriate to the agent
	Primary cells from blood or lymphoid cells of human or simian origin.	Appropriate to the potential risk



Live animals

- ▶ No animal facility in the department

Human tissue (surgical specimens or cadavers)

- ▶ Ethical approval required
- ▶ The department does not have permission to **store** human tissue samples under the Human Tissue Act 2004



Risk assessment (RA) includes biological agents

1. You must fill RA form & CoSHH forms³
2. You and your supervisor must sign all forms
3. Bring all forms to Biological Safety Officer who will review them and sign the RA form upon approval
4. Bring all forms to Local Safety Coordinator (Athina Markaki) who will sign all upon approval
5. Bring all forms to Departmental Safety Officer (Ian Slack) who will sign all upon approval

³<http://safety.eng.cam.ac.uk/procedures/riskassessment>



- ▶ GMO: organisms whose genes have been **artificially** altered to modify their characteristics
- ▶ Controls are set out in the “*Genetically Modified Organisms (Contained Use) Regulations 2000*”
- ▶ “Contained Use”: limit contact between GMO and **people** or the **environment**. It relates to:
 - ▶ the actual process of genetic modification
 - ▶ the use, storage, transport & destruction of GMOs
- ▶ Need a **specific, separate** Risk Assessment made under the GMO (CU) Regulations 2000



- ▶ For GM micro-organisms, the risk assessment **must** contain details about:
 - ▶ **recipient micro-organism** (hazard group, wild/disable, survival)
 - ▶ **inserted gene** (expression, action)
 - ▶ **donor** (species)
 - ▶ **vector** (viral, cellular, plasmid)
 - ▶ **resulting GM micro-organisms**
- ▶ Assess separately the risks for **human health & safety** and for **environmental harm**.
- ▶ Assign a **provisional** class & containment level:

Risk	Class (GM micro-organism)	Containment level (laboratories)
Negligible	1	1
Low	2	2
Moderate	3	3
High	4	4



- ▶ GMO Risk Assessment must be signed by:
 - ▶ You and your supervisor
 - ▶ BSO
 - ▶ Head of Department
- ▶ Only Class 1 work is allowed in the department
- ▶ We encourage users/supervisors to attend the training
<http://www.training.cam.ac.uk/ohss/>
search "Risk Assessment of Genetically Modified Organisms"
(next one: Nov 19th)
- ▶ HSE guidance can be found here:
<http://www.hse.gov.uk/biosafety/gmo/acgm/acgmcomp/>



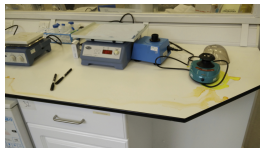
Hygiene

- ▶ No eating, no drinking, no applying cosmetic, no smoking. . .
- ▶ Always wear lab coat
- ▶ Avoid contamination of keyboards, telephone, door handles. . .
- ▶ Wash your hand before leaving the laboratory
- ▶ Remove laboratory coat before leaving (hung in the Biolab foyer)



Housekeeping

- ▶ Keep floor and benches **tidy**
- ▶ Keep floor and benches **clean** and **disinfected**
- ▶ All containers clearly **labeled**: chemicals & name of user
- ▶ Do not leave **unattended scalpels** on benches; use sharp bins
- ▶ Waste container closed and marked
- ▶ Do not leave **used glassware** in the sinks: put it in the dishwasher (will be started by the technician once full)
- ▶ Some items need to be washed by hand: do it before you leave
- ▶ **Clean** balances and **turn off** after use





Instruments

- ▶ Only use instruments you've been trained for

Ask the technician

- ▶ If you find the instrument broken

Tell the technician immediately

- ▶ If the instrument breaks

Tell the technician immediately



Equipment

- ▶ Impervious & resistant surfaces, easy to clean
- ▶ Autoclave on site

System of work

- ▶ No eating, drinking, smoking, etc.
- ▶ Door closed during work
- ▶ Observation window
- ▶ Protective clothing
- ▶ Disinfection available
- ▶ Minimize aerosol production

Waste

- ▶ Dedicated bins for contaminated solid waste
- ▶ Validated inactivation of liquid waste



Equipment

- ▶ Impervious & resistant surfaces, easy to clean
- ▶ Autoclave **in the building**
- ▶ **Negative pressure if possible, microbiological safety cabinet**

System of work

- ▶ No eating, drinking, smoking, etc.
- ▶ Door closed during work, **access restricted**
- ▶ Observation window, **signage**
- ▶ **Side or back fastening lab coats, appropriate gloves, spill trays**
- ▶ Disinfection available, **specified decontamination procedures**
- ▶ Minimize aerosol production, **control aerosol dissemination**
- ▶ **Safe storage of biological agents**
- ▶ **Written record of staff training**

Waste

- ▶ Dedicated bins for contaminated solid waste
- ▶ Validated inactivation of liquid waste

Containment Levels

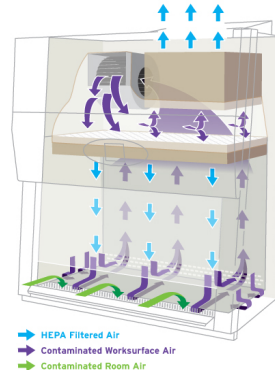
Microbiological Safety Cabinets



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- ▶ Requirement according to risk assessment (e.g. aerosols)
- ▶ Class II cabinet with HEPA⁴ filter protects **worker** and **work**



credit: nuaire.com

⁴High-Efficiency Particulate Air

Containment Levels

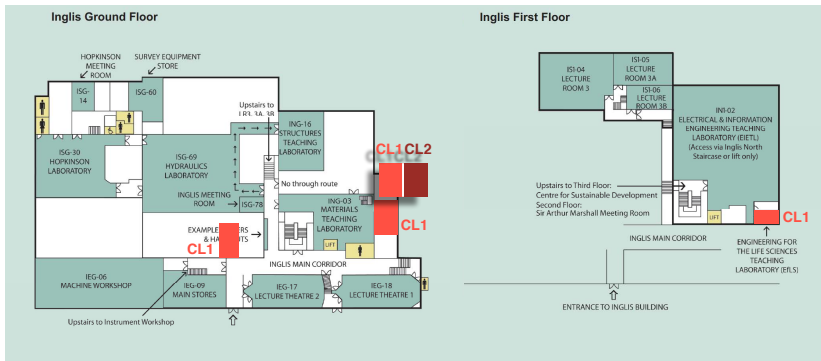
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- ▶ INO-03 to INO-07 Biolab 1 - Inglis mezzanine: **CL1+CL2**
- ▶ ING-09/10 Biolab 2 - *via* materials teaching lab: **CL1**
- ▶ IN1-06 EfLS teaching lab: **CL1**
- ▶ ISG-87 Geotech lab: **CL1**



Contaminated solid waste

- ▶ Dispose into **dedicated** clinical waste bins
- ▶ Do not tape clinical waste to benches
- ▶ Do not overfill
- ▶ Company pick-up bins at the beginning of the month



credit: initial.co.uk

Contaminated sharps

- ▶ Must be placed in dedicated sharps bins
- ▶ Place pipette tips in provided **puncture-proof** containers
- ▶ Orange-lidded bins for blood (human or animal) contamination



credit: sterplast.co.uk



Biological liquid waste

- ▶ Must be **deactivated**
 - ▶ **Treat** with an appropriate disinfectant (e.g. Trigene, Virkon)
 - ▶ Allow sufficient **contact time** (see manufacturer's guidelines)
- ▶ **Dispose** in an appropriate lab sink
- ▶ **Flush down** with copious amounts of water



Transport of hazardous substances should be **minimized**

- ▶ **Internal transport (same building)**
 - ▶ Minimum quantities
 - ▶ Secondary containment
 - ▶ Use (goods) lift if possible
- ▶ **Transport between buildings**
 - ▶ Sealed, leakproof primary container
 - ▶ Leakproof, closable secondary container
 - ▶ signage, list of content
- ▶ **External transport**
 - ▶ Highly regulated, extremely complicated
 - ▶ Talk to BSO



General procedure

- ▶ Evacuate area (if you can not assess the spill, large spills)
- ▶ BSO must **assess** the spill
- ▶ Ventilate area, allow aerosols to settle
- ▶ **Contain**, and apply **disinfectant** (e.g. Virkon powder)
- ▶ **Clean** up, fumigation may be needed
- ▶ **Waste disposal**
- ▶ Need **permission** for re-entry



- ▶ **Bleed** the wound and **wash** the area with soap and water
- ▶ Scrubbing should be avoided
- ▶ **Cover** the wound with a waterproof dressing
- ▶ Contamination on skin eye or mucous membranes should be washed **immediately**
- ▶ **Seek advice** on post-exposure prophylaxis
- ▶ **Report** the accident



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References

- ▶ Safe biological practice at the University of Cambridge:
<http://www.safety.admin.cam.ac.uk/publications>
- ▶ Biological Safety @CUED:
<http://safety.eng.cam.ac.uk/procedures/biological>
- ▶ The Approved List of biological agents:
<http://www.hse.gov.uk/pubns/misc208.pdf>