**Working practices relating to Biological Safety**

**Biomechanics Laboratory**

You must be familiar with the content of this document before starting work in the Biomechanics Laboratory, Room 639A.

**Background:**

Research is undertaken on natural and artificial human/animal joints and related musculoskeletal tissues, examining aspects such as the mechanical properties of the tissues. The work is not related to infectious pathogens. Typical procedures involve taking a cadaver joint, performing some dissection and surgical procedure on it, and then mounting it in a loading apparatus. The joint is loaded and deflections or other changes are monitored. Comparative tests can lead to identification of improved procedures in joint reconstruction.

**Risk assessment:**

Possible risks could arise from: infection of specimen; use of sharp surgical instruments; solid or liquid particles coming from the specimens; biological contamination of the workplace if fluids drip from specimens; use of chemicals. Measures to combat these possibilities are described in the Rules below. It must also be recognised that the laboratory may receive tissue specimens that are contaminated with organisms that the donating hospital are not aware of.

**Materials used:**

Human joints (hips, knees, elbows, shoulders, fingers mainly) are obtained from the mortuaries of several hospitals. These specimens are obtained according to the protocols in force at each hospital. This is confirmed by the hospital ethics committees. It is usual for the relatives of the donor body to give fully informed consent and this documentation is kept by the patient affairs officer of the hospital, since the tissue donation is anonimised. In order to allow traceability of each specimen, labelling includes the hospital number. The pathologists have confirmed that they would never knowingly allow us access to material suspected or known to be infected with dangerous pathogens. We record the age, sex and post-mortem number of each specimen in a logbook kept in the Section library; this is the responsibility of a member of the research team. In addition, similar specimens arise from animals such as rabbits and sheep. The specimens are transported double-wrapped in polythene bags and deep frozen on arrival at the laboratory. Most material is frozen prior to collection.

**Rules for Collection and Use of Human Tissues:**

Specimens will only be used with Ethical Committee approval at each hospital.

Collection: If you collect specimens from a hospital, you must ensure that they are double-wrapped in polyethylene bags. Each specimen must be labelled, and you must take blank labels with you to ensure that this is done before leaving the monitoring. The label must include the following: Hospital; hospital or p.m. number; sex; age. You must obtain a signed receipt for any payment made; receipt forms are available in the specimen logbook.

Transport: You must only transport human tissues by private car, and must be insured for work use.

On arrival at the laboratory: You must record the information from each specimen label into the red logbook. You must also note the freezer location where the specimen is to be stored. Note the specimen number in the log book onto the specimen label.

Use of specimens: If you take a specimen from the freezer, you must check that it has been logged-in and labelled correctly.

If you do not finish using the specimen, you must log the storage location in the red logbook, noting what has been done to it and that it is still ‘in use’ for your project.

If you finish your work and feel that the specimen could still be useful for another experiment, note this in the logbook, along with its location in the freezers.

When the specimen is finished with, it must be disposed of via the designated freezer compartment, sealed in a polyethylene bag. You must note the disposal date in the red logbook.

The purpose of these rules is to ensure that we can trace who has been in contact with every tissue specimen that has been in the laboratory and that we can trace it back to the originating pathologist, in case of infection.

**Specimen storage**:

Specimens are stored in a range of upright freezers at approximately –20oC. The lower half of one freezer is clearly marked as being the storage space for materials awaiting disposal (see rule 13). Each freezer is equipped with a digital thermometer mounted externally, so that deficient freezing action can be detected prior to complete failure. Each freezer also has an internal temperature sensor linked to an alarm system. In the event of the internal temperature of a freezer becoming too high, the alarm system actuates an audible warning in the laboratory and flashing lights in the laboratory, at the entrance to the staff offices and in the corridor outside, where security staff will notice it out of normal working hours. The security staff can telephone a member of staff, who will arrange to transfer material to another freezer.

**Biomechanics Laboratory access**:

The biological work is carried out in a dedicated room, 639A. The laboratory has a security lock with swipe card access only for authorised members of the Biomechanics Section, plus one for the labourer who disposes of bio waste. The laboratory, room 639A, is in a suite of rooms which includes offices 635,6,7,8, around a reception area room 639.

## Working Outside Normal College Hours:

**NO ONE MAY CARRY OUT EXPERIMENTAL WORK ALONE UNLESS THE WORK HAS BEEN DECLARED NON-HAZARDOUS AND AUTHORISED BY HIS OR HER SUPERVISOR AND THE LABORATORY MANAGER.**

**A second person must be in the same laboratory/office suite and within earshot (thus, intervening doors to be secured open) at all times when hazardous work is in progress. That will include operation of materials testing machines, or biological dissection, etc.**

***Any out of hours work in the laboratories must be authorised by the user’s supervisor and the laboratory manager*.**

**Forms are available from the lab manager, Prof Amis, who will keep copies when signed.**

Refer to “Building and Laboratory Access” at http://www3.imperial.ac.uk/mechanicalengineering/intranet/safety

For Lone Out of Hours Working Basic Guidelines, refer to the Imperial Health and Safety Manual, <http://www3.imperial.ac.uk/safety/subjects/management/safetyguide> (Personal safety, Working alone), and Guidance Note 023: Lone Working, <http://www3.imperial.ac.uk/safety/subjects/management>.

‘Out of hours’ working is defined as being outside of 8.30 am to 5.00 pm, Monday to Friday during College opening times. Building access is available from 07.00 am to 18.30 pm Monday to Friday. Outside these times and at weekends, access to the Department is *via* a swipe card. Everyone must leave the building by 23.00 hrs.

**College Closure Periods:** During the College closure periods at Christmas and Easter access is only allowed to members of the Department with a valid security pass.

**No experimental work is allowed during College closure periods without the permission**

**of the Head of Department**

**RULES:**

**Health Protection:**

1. It is strongly recommended that people should not work in the laboratory unless they have current vaccinations for Tetanus, TB and Hepatitis B. You must not assume protection against Hepatitis until a positive antibody test has been reported. If needed, these vaccinations and tests can be provided by the College Health Centre.
2. No eating, drinking or smoking is allowed.
3. Outdoor coats, spare clothing, bags etc. must not be taken in the laboratory.
4. Pre-existing wounds or eczema must be sealed in a waterproof dressing before entering the laboratory.
5. Protective coats and boots must be worn when working in the laboratory. Clean coats hang beside the entry door and on exit the used coat must be hung on the hook inside the laboratory if it is clean enough to be reused. If it is soiled it should be left in the marked plastic bin ready for washing, which is arranged by the laboratory technician with external contractors. Normal shoes must be removed and left outside the door to the laboratory, stepping into the boots provided inside the door. On exit, the boots should be left inside the laboratory. The boots will be disinfected as required, by the laboratory technician.
6. Disposable gloves must be worn at all times when working in the laboratory. Exceptions to this are allowed under Rules 17-19.
7. You must keep the benches as clean as possible at all time, since clutter can cause accidents. Used instruments should be placed into a bowl of disinfectant ready for cleaning. Used paper towels and other **waste should be bagged ready for disposal as you proceed with your work**, and not left to accumulate. (See detailed cleaning and disposal rules below).
8. If the nature of the specimen and the work scheduled is likely to lead to significant quantities of blood drops or bone dust, you should wear the diposable plastic aprons available, and place paper towels on the floor where it is likely to be heavily contaminated.
9. Safety glasses and face mask or visor must be worn by any workers in the area at all times that aerosols or flying particles may possibly be caused – e.g., when drilling specimens that may fail suddenly, using Clingfilm, a polyethylene bag, or similar. If aerosols are likely to be created, such as when sawing or drilling bones, the work should be done with the doors and windows shut, to limit air movement, and any particles allowed to settle before opening them again.

If material gets into your eyes, wash your hands and use the eye wash station provided. **Such an incident is a reportable accident and must be reported (see rule 23).**

1. Due care should be taken when using instruments: you should never cut towards your fingers, or those of an assistant; during dissection, you should lift overlying structures aside with retractors or forceps rather than by hand. If possible, specimens should be clamped in place using a vice or retort stand, rather than using an assistant. Keep your face as far away as comfortably possible from the work piece.

When mounting specimens in polymethylmethacrylate bone cement, or similar procedures using chemicals with irritating smell, you should use the fume extraction hood system.

1. All tools used for biological work are identified by red paint marks and are not to be removed from the laboratory. In the rare event of needing another tool, this is only to be taken into the biological work area with permission of the technician or head of the laboratory. The tool must be thoroughly disinfected on exit (see rule 20).

All tools and equipment must be replaced in their correct ‘home’ when you have finished your work, after cleaning them as directed in Rule 20.

1. Any blood or other liquids spilt onto the bench top or floor must be wiped up using the paper roller towels provided. The area must be cleaned after work (see rule 20), even if you do not think you have dropped blood, sawdust, etc. This applies particularly to the floor near the bench if you have been sawing or drilling, the surfaces around/on the test machines and the floor below test rigs that have joints mounted in them.
2. Polythene bags must be used for initial containment of all contaminated rubbish except sharps (e.g.) used towels, gloves, pieces of tissue and joints that have been used). **Filled bags must be sealed and placed in the marked freezer compartment**. This is monitored by a member of the research team, who reports to the technician when it is nearly full. The materials are disposed-of via normal College channels by the technician and are transported in closed yellow polythene clinical waste/biohazard sacks inside plastic bins provided by the College.
3. All used blades, needles or broken glass must be placed into the dedicated plastic ‘sharps’ bin, which is dealt with by incineration. This bin is monitored by a member of the research team, who reports to the technician when it is nearly full and a new one is then provided. The bin should only be filled to the correct level, indicated by a line or colour change. **You should never put your fingers into these bins**.

**You should never leave ‘slightly used’ needles or scalpel blades out for re-use on a later occasion – dispose of them.**

1. Tools likely to cause airborne particles, such as high-speed electric drills and band saws are not allowed.
2. No-one may undertake potential hazardous work (e.g. use of machinery or sharp instruments) in the laboratory unless another person is within calling distance.
3. If you need to use a computer, it must be set-up prior to any biological work so that it will not be contaminated. The keyboard and mouse, plus mat must be inside polythene bags when it must be used by an experimenter. If possible, it is preferable that you ask someone else to work the computer during experiments, who can remain uncontaminated.
4. When taking photographs, gloves must be removed and hands must be disinfected thoroughly prior to handling camera, lights, tripod, etc. You will have to leave the laboratory for this. This is essential, since use of the camera requires you to place your face against it – the photographic equipment is kept outside the laboratory and must be kept scrupulously clean, even if this is awkward and time consuming.
5. Apart from the photographic equipment and sometimes a computer brought into the laboratory, as detailed above, you must assume that all surfaces and objects in the laboratory are contaminated; this also includes the Instron machine chart recorder, so data must be copied from the paper charts while in the laboratory. The chart paper that is kept for archive purposes should be sealed in a polythene bag.
6. **Laboratory disinfection policy**:

It is important that you clean up any spillages or contamination of tools, specimen holders or other apparatus, either immediately or at the cessation of your day’s work as appropriate.

Spillages of biological fluids will only be on a small scale (i.e. blood drips): they should be mopped-up using the paper towels provided as the work progresses. If you are working at the edge of the bench, you should spread paper towels on the floor, if drips or sawdust are anticipated and when work has finished, the floor should be washed with disinfectant. The laboratory disinfectant is Hycolin, which is used at 5% concentration.

The workbench should always be washed with disinfectant when you have finished work, or at the end of the day. In addition, it should be wiped dry using paper towels.

Electrical apparatus used in experiments must have all controls and their surroundings wiped with paper towels wetted using 70% ethanol solution, after being turned off. Squeezy bottles for dispensing ethanol solution are always available and should be kept topped-up from the supply in the chemical cupboard.

**Tools and instruments:**

These should be placed in the sink and immersed in disinfectant solution. The instruments should be brushed to remove gross contamination, especially over serrated surfaces, and then soaked for one hour. After draining off, the instruments should be put away in the correct places in the trolley storage racks. If a tool is vulnerable to corrosion, it should be sprayed with 70% ethanol solution and wiped clean using ethanol-soaked paper towels, then dried. After this, it should be sprayed/wiped lightly with a water repellent, such as WD40.

1. On leaving the laboratory, hands must be washed at the dedicated hand wash basin with lever taps and Hibiscrib dispenser.

Nothing else is to be washed here.

1. **Personnel:**

Most newcomers to the laboratory have an engineering background. Because of this, they are issued with a set of laboratory rules and taught the relevant safety procedures by an experienced member of the team. This starts with instructions on immunisation, which precedes any work in the laboratory, then progresses through protective clothing, hygiene, handling and disposal of specimens, dissection techniques, laboratory cleaning, etc, as appropriate. There is usually an orthopaedic surgeon available to assist in some of the teaching.

Other occasional visitors, such as electricians, do not come into contact with contaminated equipment and are instructed not to touch the benches or equipment that might be, when taken into the lab by a member of the research team.

1. **IN THE EVENT OF AN ACCIDENT**:

The **FIRST AID KIT** is located n the wall by the washbasin in the clean laboratory area. If needed, contact a trained first-aider: see laboratory notice board for their locations.

If particles of bone, or blood etc. have got into your eyes, you should **immediately** wash it out very thoroughly by means of running water from the rubber hose at the designated eye wash station.

ALL ACCIDENTS AND DANGEROUS OCCURRENCES MUST BE REPORTED in accordance with College requirements and paperwork completed. The Section Technician will help with this and you must ensure that both your Laboratory Head (Dr Amis) and the Departmental Safety Officer (Mr Ian Wright) are informed. All accidents that involve biological materials must also be reported to the Health Centre. You must complete the Accident Report form, which will be given to you by the D.S.O. or via the Section Technician.

IF THE ACCIDENT HAS POTENTIALLY CONTAMINATED YOU WITH BLOOD OR BODY FLUID OFHUMAN ORIGIN (i.e., all skin punctures from needles, scalpels, sharp bones etc. or body fluid has splashed into eyes, nose or mouth or got into an open cut or skin lesion), then **you must attend the Health Centre straight away**, or next morning if after 17:00 hrs. On weekends, contact the doctor on call. You will be counselled and your hepatitis immunity will be checked.

1. **FINALLY:**

The laboratory is a safer, more efficient and much pleasanter place to work if it is **neat, tidy and clean**. So:- always keep it as you would like to find it; *think of others, clean up any messes that you find, even if left by another (when you should complain loudly);* **never leave the lab at the end of the day without putting everything away and cleaning up properly** – tools in their racks, bones in their freezers!

Please inform the laboratory technician if supplies of any consumables are getting low, such as paper towels, plastic bags, disinfectant etc. Please also do this if there are few remaining clean gowns or boots, or if the freezer disposal compartment is filling up.