

SAFETY IN BIOLOGICAL LABORATORIES

**Edited by
C. H. Collins**

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A Wiley-Interscience Publication

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Preface

The Health and Safety at Work etc. Act 1974 applies to virtually all teaching and research laboratories. A number of guidelines and codes of practice have been produced to help people working in laboratories but these are either closely related to particular specialisms or of too general a nature to satisfy professional needs. 'Biology' embraces a diverse and growing group of subjects and it is not surprising that a wide range of threats to safety may sometimes be offered to its students and practitioners. Biologists often need advice on problems, perhaps bridging several biological disciplines, that are not covered in existing publications or are not treated at an appropriate and helpful level.

The Institute of Biology has already contributed to the establishment of safe, sensible working practices by its publication *Safety in Biology Field Work—Guidance Notes for Codes of Practice* (1980, 2nd edition 1984). The success of this publication has now led the Institute to extend its safety advisory activity into laboratories and classrooms.

The underlying philosophy is to reconcile the need to codify and guard against hazards—to achieve safe practice—but at the same time to avoid undue restriction of the teaching and practice of biology. The study of the life sciences, and the educational processes and practical technologies stemming from them, should be made safe without being stifled in the process.

Safety in Biological Laboratories offers advice on a variety of aspects of safe working in biology, on laboratory design and equipment, and on the legal obligations of professional biologists. It makes no pretence at being comprehensive but it presents advice in a form which is immediately helpful, realistic and sensible. It will also serve as the foundation of a continuing contribution by the Institute to safety in biology and its applications.

J. L. Harley
President
Institute of Biology

The views expressed in this book are those of the authors and do not necessarily represent those of their employers.

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1 The law and biological laboratories*

M. E. Cooper

THE HEALTH AND SAFETY AT WORK ETC. ACT 1974

The Health and Safety at Work etc. Act 1974 imposed new responsibilities for health and safety and welfare in biological laboratories.

Until this Act came into force on 1 April 1975 the law was concerned largely with redress for harm caused deliberately or negligently and there existed specific safety legislation only in areas such as offices, shops and mines and in respect of certain dangerous materials. Individual bodies may have voluntarily produced safety rules but there were relatively few legal obligations which affected biological laboratories.

The Health and Safety Act now requires those responsible for biological laboratories to formulate and implement codes of safe practice, to be generally well informed upon all aspects of current law and practice relating to safety and to conform to standards set by the Health and Safety Executive. A new body of specialists is emerging—those who make safety a full- or part-time occupation.

APPLICATION OF THE ACT TO BIOLOGICAL LABORATORIES

The Health and Safety at Work Act applies overall general requirements regarding health and safety to all forms of employment (except domestic service in private homes) and therefore applies to biological laboratories

* This chapter discusses briefly the law most relevant to these guidelines. It should not be relied upon alone as a source for specific legal information but only in conjunction with the legislation, specialist literature, and professional advice.

at all levels of education as well as in research and industry. The Act affects all persons at work—employers, employees, the self-employed and even those who, although not in employment, may be affected by activities at work.

The duties imposed by the Act may be summarized as follows:

Employers All employers must ensure the health, safety, and welfare of their employees. This applies not only to their work and training but also to premises and environment, transport equipment and materials.

Employees All employees must take reasonable care for the health, safety, and welfare of themselves, fellow employees and anyone else likely to be affected by their work. They must cooperate in the fulfilment of the Act's requirements and must not interfere with anything provided for their health, safety and welfare at work.

Those not employed Employers must also take care for the health and safety of others who may be associated with their work activities. People falling into this category and who may be associated with a biological laboratory include pupils, students, research workers supported by a grant, visiting workers or teachers, social or business visitors, contractors' employees.

In addition, the duty extends to members of the public who may be affected by an employer's activities, for example, by the escape of pathogenic organisms.

Persons in control of premises made available to persons who are not their employees as a place of work where they may use plant or substances provided have responsibility for the safety of the premises and any plant or substance provided.

Self-employed persons Each self-employed person has an underlying duty to carry out his work in such a way as to ensure that he and other persons who may be affected thereby are not exposed to risks to their health or safety. Where a self-employed person works in a laboratory this requirement implies that he must inform other persons in that laboratory of such risks and that he should follow any safety rules or working practices prevailing in that laboratory. For work defined by the Genetic Manipulations Regulations any 'non-employed' person is deemed to be a self-employed person.

It should be noted that these duties are imposed 'so far as is reasonably practicable' and that they do not set absolute standards but those which take into consideration both the degree of hazard involved in a situation and the practicability and expense of its prevention (Cooper, 1981).

IMPLEMENTATION OF THE ACT

An employer who has five or more employees must produce a written statement of his policy, organization, and arrangements for the health and safety of his employees. This may be contained in a single comprehensive document or a collection of rules and codes of practice relating to various premises, types of work and special hazards and produced as booklets, sheets of paper or notices. They must be kept up to date and must cover every aspect of health and safety relevant to any particular employee including not only obvious hazards but also ancillary matters such as personal hygiene and rest areas.

They must be brought to the attention of the employee; this is most effectively done by supplying him with personal copies of the data relevant to his work and requiring a signed acknowledgement of his having received and read them. Alternatively, a general statement may be issued to each employee which refers him to detailed information available in notices.

In the context of a biological laboratory where it is likely that some users are not employees (but, for example, are supported by an independent grant), the authority responsible for it (although not having an express duty to supply a policy document) will best perform its general duty under the Act by issuing users with safety instructions comparable with those given to employees.

An employer must not only formulate but must also implement his safety rules and ensure that health and safety procedures are enforced. This will involve safety committees and safety officers, inspections, training and practices for emergencies. In order to assist an employer in this burden, part- or whole-time safety officers are often appointed from among employees and they are responsible for specific areas of safety, such as a given laboratory or hazards arising from radiation, chemicals or micro-organisms. In addition, under the Safety Representatives and Safety Committee Regulations 1977, recognized trade unions may appoint safety representatives who have a right to be consulted.

Within the bounds of reasonable practicability all hazards should be

anticipated. Allowance must be made for personal handicaps and different levels of comprehension in those using laboratories. Health and safety practices should also take into consideration regulations produced under the Act, other codes of practice issued, recognized or used by the Health and Safety Executive, current practices in comparable establishments and other legal obligations.

ENFORCEMENT AND LIABILITY

The Health and Safety at Work Act is enforced by the Health and Safety Executive. Its inspectors make visits to ensure that the safety provisions in biological laboratories comply with the general requirements of the Act and regulations made under the Act as well as any specific standards which the Executive has set. An inspector who is dissatisfied may:

- (a) Issue an improvement notice requiring a contravention of part of the safety legislation to be remedied;
- (b) Issue a prohibition notice to stop some activity which is causing a risk of serious personal injury until the requirements of the notice have been satisfied;
- (c) Prosecute anyone who is in breach of the safety legislation;
- (d) Seize from a biological laboratory anything which may be the cause of imminent risk of personal injury and have it destroyed or otherwise rendered harmless.

Liability and prosecution for breach of the safety legislation fall primarily upon the employer, which is often a company or other legal entity, such as a university or local authority. In addition, any of their officers, such as a director, who have direct responsibility for putting the law into effect are open to prosecution. While employees, including safety officers, are rarely prosecuted, the power to do so exists. Safety representatives, however, are exempt from prosecution when acting under the Safety Representatives and Safety Committee Regulations 1976.

LEGISLATION DEALING WITH SPECIFIC ASPECTS OF SAFETY

Other legal aspects of safety which must be observed in the biological laboratory (Cooke, 1976) include:

Fire Prevention

The provisions of the Fire Precautions Act 1971 are gradually being applied to laboratories. Their precautions have to be approved by local fire authorities which may lay down conditions stated in a laboratory's fire certificate, which must thereafter be maintained. The certificate has to be kept on view and the fire authority has power to carry out inspections. Special provisions may be made regarding dangerous substances—for example, the Hazchem Scheme operated by the London Fire Service.

Dangerous Substances

Dangerous micro-organisms The Health and Safety (Dangerous Pathogens) Regulations 1981 restrict and control the use of the organisms (and their derivatives) listed in Schedule 1, such as rabies virus and Lassa fever virus. The regulations have transferred the responsibility for dangerous pathogens from the DHSS to the Health and Safety Executive and came into force on 1 September 1981.

The importation of animal pathogens must be licensed by the Ministry of Agriculture, Fisheries and Food under the Importation of Animal Pathogens Order 1980.

Proposed work involving genetic manipulations must be reported to the Genetic Manipulation Advisory Group of the DHSS and to the Health and Safety Executive in accordance with the Health and Safety (Genetic Manipulation) Regulations 1978.

Radioactive substances The supply, use, storage, transport, and disposal of radioactive substances are subject to the Radioactive Substances Acts 1948 and 1960. Numerous codes of practice have been formulated for this field over the years. New regulations are expected (Taylor, 1981; Rideout, undated). Particular note should be made of the Code of Practice for the Protection of Persons Exposed to Ionising Radiations in Research and Teaching (HSE, 1981).

Medicines and poisons There are substantial restrictions on the acquisition, possession, and use of medicines and poisons. The former are generally restricted to the medical, veterinary, and dental professions unless they are obtained by a prescription. Poisons usually have to be obtained on a signed order. However, both medicines and poisons can be obtained by scientific research and educational bodies, although the

former should be administered in accordance with the directions of a doctor, dentist or veterinary surgeon.

Great care must be taken to control the storage and availability of these substances. The production and testing of new medical products must be performed under licence.

Relevant legislation (as amended) includes: the Medicines Act 1968; the Medicines (Veterinary Drugs) or (Products Other than Veterinary Drugs) (Prescription Only) Orders 1983; the Misuse of Drugs Act 1971; the Misuse of Drugs Regulations 1973; the Poisons Act 1972; Poisons Rules 1978; Poisons List Order 1978.

Hazardous chemicals The storage, transport, and use of many chemicals are regulated by the Petroleum (Consolidation) Act 1928 and the Explosives Act 1875-1923. Such substances are also subject to the Packaging and Labelling of Dangerous Substances Regulations 1978. The use of polychlorinated biphenyls at work is restricted by the Control of Pollution (Supply and Use of Injurious Substances) Regulations 1980. Draft regulations on the Control of Substances Hazardous to Health have been produced by HSE.

Carcinogens Certain carcinogenic substances are available only under licence for use in scientific research (Carcinogenic Substances Regulations 1967) (see Chapter 9).

Disposal of waste Various Acts control the disposal of waste. The local authority must be notified of a laboratory's intention to discharge effluent into the public sewer and the consent of the water authority is required for discharge into rivers. The disposal of waste, especially toxic matter, is also controlled by the local authority, for example, the Greater London Council has a Poisonous Wastes Unit. Dumping at sea must be licensed; only limited quantities of radioactive material may be disposed of via normal drainage.

Relevant legislation includes: the Public Health (Drainage of Trade Premises) Act 1937; the Public Health Act 1961; the Control of Pollution Act 1974; the Control of Pollution (Special Waste) Regulations 1980; the Rivers (Prevention of Pollution) Acts 1951, 1961; the Water Resources Act 1963; the Dumping at Sea Act 1974; the Radioactive Substances Act 1960.

Local authorities are also responsible for noise (Control of Pollution

Act 1974) and for smoke (Clean Air Acts 1956 and 1968) and may also have by-laws made under the Public Health Act 1936 to control activities which may adversely affect public health.

Postage Pathological material sent by post must be packed in accordance with Leaflet K681 (inland) or DS061 (overseas) issued by the Post Office.

ANIMALS

Care must be taken for safety in respect of injuries caused by animals and the transmission of disease (see also general legal liability). Certain aspects of the law relating to animals are relevant to health and safety in the biological laboratory.

Dangerous Wild Animals Act 1976 The species of exotic animals listed in this Act may be kept only under local authority licence. The Act lays down general requirements for the animals' welfare and for the safety of their keepers and the general public. No licence is required where such species are kept in zoos, circuses, licensed pet shops and premises registered under the Cruelty to Animals Act 1876. It should be noted, however, that there is no general exemption from licensing for scientific or educational establishments as such.

Importation In the interests of disease control the importation of practically every species of vertebrate is controlled by one or more Orders made under the Animal Health Act 1981. Usually an import licence imposing a quarantine is required.

Zoonoses The occurrence in food-producing species of salmonellosis and brucellosis must be reported to the Ministry of Agriculture, Fisheries and Food, unless this is carried out for scientific or educational purposes and the animals used are disposed of so as to pose no risk to human health (Zoonoses Order 1975).

Plants The importation of plants, plant products and plant pests is controlled by the Plant Health Department of the Ministry of Agriculture, Fisheries and Food under the Import and Export (Plant Health) (Great Britain) Order 1980. The presence of non-indigenous plant pests must

be notified and a licence is required to keep or dispose of them or pests which have been subjected to genetic manipulation (Plant Pests (Great Britain) Order 1980). Similar legislation applies to tree pests.

Insects The use and supply of bees is affected by the Bees Act 1980 and the Importation of Bees Order 1980. Other insects may be regulated as pests (see above) or under legislation relating to specific species, such as the Colorado beetle.

There are many potentially dangerous substances for which no specific safety legislation is provided; nevertheless laboratory authorities must, as part of their general duties under the Health and Safety at Work Act and in common law, anticipate such hazards and make provision for their safe use.

GENERAL LEGAL LIABILITY FOR SAFETY IN BIOLOGICAL LABORATORIES

The requirements of the safety legislation discussed so far have been in the nature of criminal law and enforced by prosecution. However, obligations which relate to safety are also to be found in the general principles of the common law; they are further grounds for the provision of sound safety rules in the biological laboratory. Most significant is the law of negligence under which most claims for compensation are likely to be brought, by or on behalf of an individual who is killed, injured or suffers loss in the course of his work, by way of a civil action in the High Court. Nevertheless, a claim might well arise out of the same circumstances for which a prosecution has been brought by the Health and Safety Executive.

A person who is injured because of a failure to take reasonable care of safety may claim compensation for negligence.

An employer is likely to be sued if an accident occurs and he has not provided adequate safety procedures or has failed to enforce them. An employer should therefore aim to avoid claims by ensuring that he has an adequate code for safety and that it is enforced, although ultimately complete protection can only be provided by insurance.

An employee with responsibility for safety, including safety officers, may also be sued if he has failed to follow safety rules or to perform his duties adequately. His employer is more likely to be sued, however, because he will usually be vicariously liable for the employee's negligence

(see below), has greater financial assets and has to be insured against liability for negligence (Employers' Liability Compulsory Insurance Act 1969). Trade union safety representatives appointed and acting under the Safety Representatives Regulations are probably exempt from liability (Rideout, undated).

A claim in negligence cannot be maintained for every incident involving harm or loss; the claimant must prove that there was a duty towards him to take reasonable care for his safety, that the harm done could reasonably have been foreseen, that there was a failure in respect of these matters and that as a result he suffered harm. Further, if he had accepted the risk of such harm or had contributed to it in any way, his compensation will be reduced.

An employer has certain other liabilities in common law which may still form a basis for a claim for compensation.

Breach of Statutory Duty

Harm may be suffered by a person as a result of circumstances which also constitute a breach of legislation, such as regulations made under the Health and Safety at Work Act, which imposes a duty. The injured person may base his claim on the breach of duty rather than negligence.

Employer's Liability

There is a common law duty to ensure the general safety of an employee's work.

Vicarious Liability

An employer is liable for the negligence of his employees occurring in the course of their work.

Safety in Buildings

Under the Occupiers' Liability Act 1957 the owner or occupier is responsible for the safety of his premises and structures and must ensure that no one lawfully present on premises is harmed by structural defects.

Injuries Caused by Animals

As an alternative to a claim for negligence, a person injured by an animal

may, under the Animals Act 1971, sue its owner or keeper for harm which it has caused, although, if it is a domesticated species the owner or keeper must be proved to have known that it suffered from a propensity not normally inherent in such species, to cause that sort of harm; if it is not a domestic species he is liable for any harm which it has caused.

CONCLUSION

The health and safety legislation has made it imperative that biological laboratory authorities pay close attention to their obligations in the field of safety. To make proper provision under the Act will also help to provide some protection against accidents which give rise to a common law claim for compensation. Inherent in the legal obligations is the need to keep up to date with current legal and practical information and to review existing safety provisions regularly.

It has been the intention of this chapter to provide an outline of the legal requirements which prompted the production of the guidelines. It is hoped that it will lead to an appreciation of the heavy responsibilities for safety which are imposed by the law and provide the rationale for the practical approach to safety to be found in the ensuing chapters.

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2 Animals in the classroom and laboratory

P. N. O'Donoghue

This chapter deals mainly with hazards offered by mammals. Other vertebrates in general pose similar but lesser risks. Invertebrate metazoa tend to come packed, wet or dry, in discrete vivaria and so pose little hazard unless you get in with them or they out with you. The suggestions for safe practice are general and of wide application. While having much in common with the treatment by D. W. Jolly (Hartree and Booth, 1977), this chapter differs in considering a wider spectrum of animal use and in seeing the hazards offered by the animals themselves as only a part of the picture; there are also differences in emphasis. Because the suggestions given here are intended to apply widely, particular cases may need additional advice. An indispensable starting point for any consideration of safety in laboratory animal work is *Safety in the Animal House* (Seamer and Wood, 1981). Where monkeys are involved, *Hazards of Handling Simians* (Perkins and O'Donoghue, 1969) is useful and includes a code of practice which has been developed and updated by the Medical Research Council (MRC, 1985). *The Educational Use of Living Organisms* (Kelly and Wray, 1975) is particularly valuable for work in schools. McSheehy (1976) provides an unrivalled source of information about environmental control and the effects on animals, together with relevant safety considerations.

The importance of avoiding problems by attention to animal health and well-being will be emphasized: access to relevant literature can be gained through the Institute of Biology's *Handbook for the Animal Licence Holder*. The section on health and safety (O'Donoghue, 1980) is largely covered here but is followed by useful references, as is the chapter by Festing, itself a valuable source of guidance on the characteristics and health status of commonly available species. The *Handbook* ends with a

glossary and some addresses for further enquiry. The journal *Laboratory Animals* is useful for its scientific and technical articles, for the reference lists that customarily accompany them, and for its book reviews. Most major suppliers of equipment and supplies will advertise in such a periodical. The legislation proposed to replace the Cruelty to Animals Act 1876 may well engender codes of practice, but how far they may go, beyond ensuring observance of the new law, remains to be seen.

Hazards can arise from the animals themselves or from the buildings and equipment used with them. The main danger is mechanical from teeth, horns, claws, hooves, spines or stings, or from poorly designed or poorly maintained premises or apparatus. While microbiological risks such as rabies, Weil's disease and tetanus do exist, the great majority of injuries are without apparent infective complication. However, the important thing about medical statistics—aside from their unreliability—is that no matter how disappearingly small the incidence of a disease, it can represent a personal catastrophe. Accident prevention policy must not be dominated by the more melodramatic possibilities, but they must be taken into account.

Hazards in animal work can never be avoided with absolute certainty but they can be minimized by precautions which are often straightforward and inexpensive. Although considered here under six heads they are interdependent, and the precautionary measures adopted should give a coherent programme of safe practice. Because it may have to be operated by a variety of people—schoolchildren, professors, animal technicians—the essence of the programme must be practical simplicity. All the worry and sophistication must go into its formulation so that safe practice is then achieved without too much reliance on thought or self-discipline. Animals require time and attention every day of the year: it is unrealistic to expect that to be extended by dedication to troublesome routines which may perhaps slightly diminish some already remote hazard. It must be made easy to do the right thing.

These considerations apply as much to pets kept in a classroom as to the most sophisticated laboratory animal house: only the means to achieve safe practice—the distribution of emphasis among the six headings—will vary. But there can never be certainty. The worst injury I have met in an animal house arose when a lighting fitting fell off a ceiling and broke a girl's foot.

It is important that one concerned and informed person (animal curator, director, chief animal technician) be in charge of the area where