17.3: Labelling and storage

3.1 Labelling

Proper labelling of samples is essential. The labelling scheme should be as simple as possible, consistent with the study objectives, and must take due account of the size of containers and how the specimens will be handled, transferred, and stored. In most cases, computer-generated, self-adhesive, pre-printed labels, with the individual identification or code numbers duplicated on data sheets, can speed processing. Also, labels in a variety of materials suitable for differing storage conditions, and with each number duplicated several times, are available commercially. Bar codes for specimen containers that can be read automatically by bar code readers are also available commercially.

The information recorded on a label will vary, according to particular requirements. It may include a unique identification number assigned to a study participant, which is utilized during laboratory processing and which may be linked back to an individual by reference to records kept at the time the sample was taken. In some circumstances, it will be appropriate to include on the label a record of the date of collection, the type of specimen, if not evident, and possibly the location (for example, name of the village). Individual names may also be recorded on the label, but this can create problems with blinding and confidentiality, and often names are not a unique identifier, as several individuals may have the same name.

Containers should usually be labelled using waterproof marker pens (but see item 1 in Box 17.2), writing directly onto the container-labelling area or onto adhesive labels attached to the container. If the container has a cap, the marking should be on the body of the container (and possibly on the cap as well, but never on the cap only). For smaller micro- or capillary tubes, an adhesive label with the identification information on it can be wrapped around a container with the two ends joined, such that they protrude (sometimes known as a 'flag'). Flags can be written on with a waterproof marker pen, and tubes may be stored in labelled envelopes, as they are collected in the field.
If smaller tubes are stored in boxes that are too large for them, staff need to be careful to record and maintain the correct numbering and not to invert or tip the box, so that they can fall out and move around in the box. Packing with cotton wool will help to keep the tubes in place in a box, and tape can be used to secure the lid.

Filter paper can be written on either directly or on the protective cardboard surround.

It is not possible to recommend a single standardized form of labelling for different sample containers that will be appropriate in all circumstances. It will be necessary in a particular study to establish, through field testing, a method that guarantees the reliability of the labelling from the time the sample is first collected, through transportation, processing, analysis, and storage. Using sets of labels with series of identical numbers on them, for coding samples and associated record forms, reduces the chances of labelling errors.

Some warnings regarding labelling and storage are given in Box 17.2.

Box 17.2 Some warnings regarding labelling and storing specimens

1. If the transport cold chain includes a stage where samples are frozen in salt–alcohol mixtures, never use felt pens (even waterproof ones). Always use ordinarily pencils or pre-printed highly adhesive labels.
2. Written numbers and letters must be in a clear and standardized form. For example, 191 looks the same as 161 upside down!
3. The methods to be used for collection, storage, and transport of specimens should be thoroughly researched and pilot-tested.
4. Special containers and labels are required if samples are to be stored in liquid nitrogen.

### 3.2 Storage

The storage area of a field laboratory should be designed to be adequate for the studies to be conducted. This will require estimation of the rate at which samples will be collected and processed and for how long they must be stored before being transported on to another location (for example, for processing or long-term storage in the base laboratory). Serum and plasma samples should be frozen as soon as possible after separation, and storage in a field laboratory at \(-20 \, ^\circ C\) is adequate for most purposes, at least for several weeks, although some tests require immediate storage at \(-70\, ^\circ C\). The location and positioning of any fridges, freezers, and liquid nitrogen containers need to take account of access, power supply, and consistency of ambient temperature. Specifically designed freezer rooms with conduits to vent air from the freezer exhaust externally are often a good option.

Stool, urine, and tissue samples may be stored under various conditions, using appropriate fixatives and stabilizers; different possibilities are summarized in World Health Organization (2003).

### 3.3 Aliquoting

Biological samples are easily damaged by repeated freezing and thawing. This can be avoided if samples are divided into small portions (aliquots) before freezing; moreover, this provides a backup sample if problems are encountered during shipping. Ideally, the size of aliquots should be chosen so that there is just sufficient material in each aliquot to
perform the tests that will be required at one particular time. This is not always possible, and, in practice, compromise procedures may have to be adopted (for example, on grounds of cost). It is important that the laboratory recording procedures are such that the histories of each aliquot are properly documented (especially recording how many times each one has been thawed and re-frozen), so that any recipient of the samples can be given detailed information about their preparation (for example, whether volumes are precisely measured or are approximate) and subsequent storage.

### 3.4 Storage system

When large numbers of samples are collected and stored, a storage and record system must be devised that allows the rapid retrieval of particular samples. If this is not done, sorting through large numbers of samples can be a very time-consuming activity. The particular storage system used should be tailored to the design of the specific study. Often, it is appropriate to store samples in batches, according to the date they were collected or frozen, with a record being kept of the contents of each batch. For longer-term storage and/or transport, storage boxes of standardized tube capacities (for example, nine by nine or ten by ten) with coded slots can be used. These boxes can be part of a racking system, for which a detailed inventory can be maintained as part of a computerized laboratory data management system. Generic software systems (some of which are free) are available. These computerized systems are used to record the receipt and storage of samples and can be used to track everything that happens to a sample, from when it was collected until it is disposed of or used up. Two of the most widely used examples are the Laboratory Data Management System (LDMS) and the Laboratory Information Management System (LIMS), though neither of these is free.