CHAPTER 8

Biological Monitoring in Perspective

8.1 INTRODUCTION

The diversity of biological monitoring/indicating processes should be apparent from a study of the preceding chapters. Whether or not biological monitoring/indicating is undertaken at the scale of sampling individual animal tissues (e.g. Chapter 5) or assessing the presence or absence of an individual plant species (e.g. Chapter 2), the value of the resulting information hinges upon two overriding factors. These are the aims of the exercise when it was instigated, and the purpose to which the resulting information is put. These two factors are not only closely related, but inseparable. Their importance in all biological monitoring programmes has been emphasised throughout this book. Biological monitoring and indicating are not new concepts, rather they are labels which have been attached to a much longer-lived subject, i.e., the process of investigation. This process occurs at a series of levels and any investigation that is envisaged at one reference level can rise during its operating time scale to another higher, or fall to another lower, level. The shortcomings and value of biological monitoring are thus essentially those to be expected from any investigative science. They can also be expected to change over the operating time scale according to the information accrued during the study and with the skill and investigative talent of the staff involved. Heavy metals in the environment, similarly, are not a new phenomenon, rather it is the level of attention which has been applied to them in recent years which is unprecedented and which determines the importance which we attach to them relative to other toxic materials.

In this Chapter we discuss the following topics which we feel need at least passing reference to in the context of biological monitoring. First,
monitoring related topics which include radioisotope and isotope ratio studies, analytical techniques, and interactions between metals and other pollutants. Secondly, the selection of material for individual studies in relation to the aims of those studies and, thirdly, sampling/analytical standardisation with respect to the requirement for cross calibration and elimination of bias.

8.2 RELATED STUDIES

In any biological investigation concerning a specific pollutant or contaminant, there is an inclination to consider only that pollutant or contaminant which is of direct interest to the investigator. As a result, there has been a tendency within the extensive published literature on environmental pollution to consider individual, or groups of pollutants in isolation. When considering effects on individual ecosystem components, this may be a useful categorisation. However, when studying environmental transport processes, it is often possible to consider toxic materials as a homogeneous group. Thus, studies of the dispersion and transport of radioactive contaminants may be especially relevant to studies of airborne heavy metals. Naturally, chemical factors need to be taken into account in making comparisons between the environmental characteristics of radioactive fallout and heavy metal particulates, nevertheless the general principles involved are, to a large extent, similar. As stressed in Chapter 1, heavy metals are significantly different to almost all other environmental contaminants. This difference is the result of two factors. First, heavy metals, some of which are essential elements to living organisms, are natural components of the environment and occur at differing concentrations throughout all environmental media. Secondly they are, to a large extent, persistent, i.e. they are non-biodegradable. This is true at least of the metal ions themselves although the differing chemical characteristics and toxicity of various compounds should be acknowledged.

The literature concerning environmental transport of other environmental pollutants is vast. However, biological monitoring and indicating techniques have not been applied as widely to these other pollutants as to the heavy metals. A study of the environmental characteristics of certain of these other contaminants can demonstrate particular sites or organisms which show accumulative tendencies. Thus, radionuclides released from weapons testing or normal nuclear fuel cycle operations