Objectives

- To relate quality to the generic and specific goals of Analytical Chemistry.
- To introduce students to the planning and development of quality systems in the analytical laboratory.
- To describe the strategic and methodological tools needed to implement control and assessment actions in the analytical laboratory.

Table of Contents

8.1 Introduction .................................................. 308
8.2 A Generic Approach to Quality ................................. 310
  8.2.1 Integral Definition of Quality .......................... 310
  8.2.2 Types of Quality ........................................... 313
  8.2.3 Quality Compromises ..................................... 314
  8.2.4 Structure of Quality ...................................... 315
  8.2.5 Benefits of Quality ....................................... 316
8.3 General Aspects of Quality in Analytical Chemistry ........ 317
  8.3.1 Types of Quality in Analytical Chemistry .............. 317
  8.3.2 Quality and Analytical Properties ........................ 318
  8.3.3 Quality and the Analytical Problem ...................... 319
8.4 Quality Systems in the Analytical Laboratory ................. 319
  8.4.1 Elements of Quality Assurance .......................... 319
  8.4.2 ISO Guide 25 (EN-45000) ................................. 321
  8.4.3 Good Laboratory Practices ............................... 323
  8.4.4 Specific Quality Systems Used in Analytical Chemistry 324
8.5 Analytical Quality Control .................................... 326
8.6 Assessment of Analytical Quality ............................. 327
  8.6.1 Types of Assessment Systems ............................ 327
  8.6.2 Laboratory Accreditation ................................. 330
  8.6.3 Proficiency Testing ....................................... 331
8.7 Supports of Analytical Quality Assurance ...................... 334
8.8 Costs and Benefits of Analytical Quality Systems ............ 336
 Questions .................................................. 339
Seminars .................................................. 341
Suggested Readings ........................................... 344
8.1 Introduction

The word "quality" has been used systematically in the previous chapters of this book, devoted to the fundamentals of Analytical Chemistry, to refer to the degree of excellence of various analytical objects, systems and events. These are some of the more meaningful examples:

- In the definition of Analytical Chemistry (Sect. 1.1), quality is an attribute of the information produced.
- Analytical information encompasses three quality levels, viz. ideal, referential and real (see Fig. 1.6).
- Quality as applied to information, traceability and the analytical process, and as related to analytical properties, is one of the key words of Analytical Chemistry (see Fig. 1.10).
- Analytical quality (viz. quality of CMPs and of results) is directly related to analytical properties and their hierarchies (see Fig. 2.1).
- As shown in Box 3.15, standards contribute to quality of analytical laboratories.
- The principal aim of method validation is to assure analytical quality (see Sect. 4.6).
- Analytical properties and errors (false positives and false negatives) characterize the quality of the binary response in qualitative analysis (see Sects. 5.2.3 and 5.2.4).
- The analytical properties of a quantitative response somehow dictate its quality (Sect. 6.2).
- As shown in Sect. 7.7, the analytical problem is also related to quality.

This final chapter aims to provide an integral, comprehensive, though not exhaustive, picture of the Analytical Chemistry-quality binomial from two different points of view, namely:

(a) a basic one (most analytical chemical facets are related to quality in its broadest sense) and
(b) an applied one (the implementation of quality systems in the analytical laboratory).

Continuously improving analytical information in order to bring it as near as possible to the intrinsic information latent in the object or sample considered is an essential goal of Analytical Chemistry. Tests involving expert analytical laboratories that applied specific CMPs to identical samples in order to determine the same analytes have exposed differences in the results that can be taken as warnings for the absence of quality. Boxes 8.1 and 8.2 show two typical examples that more than justify the need for quality systems and for their inclusion in the basic curriculum taught to future analytical chemists.