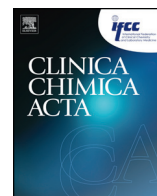




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Understanding the ‘Silver Book’ – An important reference for standardised nomenclature in clinical laboratory sciences

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ABSTRACT

Clinical laboratories perform a wide menu of testing (examinations). Successful requesting, examination, and ordering in this environment requires clear standardised nomenclature. The Silver Book (SB) is an IUPAC (International Union of Pure and Applied Chemistry) publication, produced with the support of both IUPAC and the IFCC (International Federation of Clinical Chemistry and Laboratory Medicine), that makes recommendations on logical standardised nomenclature, symbols, properties, and units in many disciplines of the clinical laboratory sciences.

These recommendations are founded on and in agreement with the principles and work of the International Organization for Standardization (ISO), Bureau International des Poids et Mesures (BIPM), IUPAC, and the IFCC. Practical applications described are based on those scientific principles. The SB recommendations apply to all types of examination, not only to measurement of quantities but also examination of nominal properties where no magnitude is involved. The SB is applicable not only to clinical chemistry, but to many other clinical laboratory disciplines. For examples, reports regarding haemostasis, toxicology, clinical microbiology, reproduction and fertility, clinical pharmacology, clinical allergology, clinical molecular biology, and clinical immunohaematology have been published by the IUPAC and the IFCC.

Peak scientific bodies such as the IUPAC and the IFCC have important roles in the development of sound international standards for nomenclature of examinations. Such standards support safe and effective representation of patient health information, foster portability, and empower future decision support systems.

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1. Introduction

All disciplines within the clinical laboratory sciences rely on the examination of properties in the human body. Clinical laboratories perform a wide menu of testing (examination), communicated in report formats that sometimes change little over many years. In this setting, it is perhaps easy to underestimate the importance of clearly defining what is observed, the units of measurement, and being able to communicate this information successfully to others. These challenges increase when results are compared between laboratories.

IUPAC, the International Union of Pure and Applied Chemistry, recognised many years ago the need for a standardised language for scientific communications. The Gold Book (named to honour the chemist who initiated its first edition, Victor Gold (1922–1985)) became in 1987 the first in a series of publications recommending terminology,

nomenclature and ontology in chemistry-related disciplines, which has now grown to encompass the publications listed in Table 1.

The International Federation of Clinical Chemistry (IFCC) emerged as an international body under auspices of the IUPAC in 1952 [1]. In 1998 the IFCC title was changed to the International Federation of Clinical Chemistry and Laboratory Medicine (IFCC). Since 1968, work on clinical terminology in the two organisations has been conducted in a joint IFCC Committee/IUPAC sub-committee on Nomenclature for Properties and Units (C/SC-NPU). First published in 1995 [2], the Silver Book has recently been fully updated with support from both IUPAC and IFCC, resulting in a second edition that is currently in pre-publication (Silver Book 2 – “SB2”) [3]. This paper will seek to explain the key concepts of the Silver Book, and why terminology and nomenclature are more important than ever in the eHealth era.

2. Overview of Silver Book sections

The content of the Silver Book may at first seem challenging to the scientist or professional not used to dealing with the principles of

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Table 1
Summary of the “Colour Book” publications.

Book	Applicable sciences	Title	Utility
Gold	Combined glossary	Compendium of Chemical Terminology	Glossary of internationally accepted definitions for chemistry concepts
Blue	Organic	Nomenclature of Organic Chemistry	Recommendations on organic chemical nomenclature
Green	Physical	Quantities, Units and Symbols in Physical Chemistry	Terms and definitions used in physical chemistry including tables of physical constants and conversion factors
Orange	Analytical	Compendium of Analytical Nomenclature	Internationally accepted definitions for concepts in analytical chemistry
Purple	Macro-molecular	Compendium of Polymer Terminology and Nomenclature	Currently out of print
Red	Inorganic	Nomenclature of Inorganic Chemistry	Recommendations on inorganic chemical nomenclature
Silver	Clinical	Compendium of Terminology and Nomenclature of Properties in Clinical Laboratory Sciences	Recommended properties, units and formats for the reporting of clinical laboratory examinations
White	Biochemical	Biochemical Nomenclature and Related Documents	Definitions relating to biochemical research – joint publication of IUPAC and the International Union of Biochemistry and Molecular Biology

scientific nomenclature. The latter sections of the SB2, including section 8 and 9 are particularly extensive, covering many different scenarios. These complex sections are well formatted into dedicated sub-sections addressing specific applications. It is not possible in this paper to delve into these sections in detail. However the summary table below (Table 2) outlines the sections of SB2 and gives brief examples of how the content may be utilised.

3. The ‘Vocabulary’ of terminology and nomenclature

3.1. Communicating clinical laboratory results – the need for interoperability

Clinical laboratories have evolved to efficiently and promptly provide a large number results under stringent quality requirements. Laboratory Information Systems (LIS) and laboratory reports have likewise evolved to provide electronic and paper results to requesting clinicians in a logical, easily assimilated format. The international standard, ISO15189:2012 [4], states that the laboratory report must specify key attributes, including the nature of the original sample (e.g. blood, urine), the component term (e.g. sodium ion), any unit, and a relevant reference interval for interpretation of results. Unfortunately, there can be significant variations in reports between laboratories seeking to communicate these attributes. Consider a report on ‘random urine sodium’. Possible reporting variations, depending

on the clinical chemistry provider and available report space, might include:

Urine sodium	13 mmol/L	(<20)
R-U-Sodium	13 mmol/L	(0 – 20)
U-Na	13.1 mmol/L	(<20.0)

Even where a human client may correctly interpret all of these formats successfully, the communication problem becomes more complex for computers attempting to communicate information.

Interoperability is the term used to indicate the ability of information systems to successfully communicate and interpret information across organisational and system boundaries. Ensuring interoperability, for both computers and people, in healthcare messaging is not just an accuracy imperative, but also one of patient safety. Terminologists know that historical reporting precedent is unlikely to ensure reliable interoperability. What is required is an agreed *ontology* – a formal naming of each examination, the applicable sample types, the properties which may be examined, the units of measurement and any relationships between these entities. SB2 describes a recommended logical system for communication and reporting in the clinical laboratory sciences – the so-called NPU format. Thus, the property given in 6.1 above would read Urine–Sodium ion; amount-of-substance concentration.

Table 2
Summary of Silver Book 2 contents.

SB section	Theme	Application/example
1	Background history of nomenclature in the clinical laboratory sciences	
2	Scheme indicating the relationship between different defined disciplines of the clinical laboratory sciences	The naming and organization of clinical laboratory departments varies between organizations and countries. This section describes key disciplines for which the SB2 recommendations are applicable.
3	SB2 layout conventions	Explanation of typographical conventions both in the SB itself and in communications using the recommended syntax.
4	List of concepts and rules for reporting a laboratory result (examination)	(See Table 3 of this paper.)
5	Derivation, application, and nomenclature for kinds-of-quantity and units. Precedents for unit systems (e.g. SI units). Symbols and correct representation of different unit types.	Clarify the most appropriate reporting unit and ensure it is clearly specified in the minimum possible amount of text. Also recommends how to express numerical values and mathematical operations.
6	Recommendations for requesting, generating, and transmitting clinical laboratory information	Describes IFCC and IUPAC NPU format: why 3 parts (System, Component, kind-of-property) and an examined value are necessary. How the NPU terminology can assist in representation and transmission of results.
7	Choice of kinds-of-property and unit for different examinations	More detail on kinds-of-property that may be examined, recommendations on the most appropriate unit, with examples. E.g. how to measure and express substance concentration or enzymatic activity.
8 and 9	Lists of kinds-of-quantity with explanatory notes and many practical examples taken from different domains of clinical laboratory sciences	Assists with the selection of the correct kind-of-quantity, unit, and symbol with applicable dimensions.
10	Kinds-of-property without dimensions of the International System of Quantities (ISQ)	Presents nominal and arbitrary kinds-of-property.

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