

IN SEARCH OF DOMAIN SPECIFIC STANDARD CATEGORIES: A CASE STUDY FROM CELL BIOLOGY

Debabrata Maity and Bidyarthi Dutta

Mr. Debabrata Maity

Librarian,
Khejuri College, Baratala,
Khejuri-721431,
West Bengal
E-mail:
maitydebabrata6@gmail.com
Corresponding Author

Dr. Bidyarthi Dutta

Assistant Professor,
Department of Library and
Information Science,
Vidyasagar University,
Midnapore-721102,
West Bengal,
E-mail:
bidyarthi.bhaswati@gmail.com

Cell Biology (CB) is one of the important branches of modern-day biology, which deals with the structure and function of cells. Facet analytical approach is one of the classical approaches of Knowledge Organization (KO). A total number of 1113 focus terms or isolates have been obtained from the 25 top-cited articles from the domain of CB. These isolates are categorized according to the categories of some selected classificationists to test the applicability of those categories in the domain of CB at the present-day context. Finally, a list of standard categories has been compiled for the domain of CB.

Keywords: Facet analysis, Facet analytical approach, Category analysis, Categories of cell biology, Knowledge Organization, Cell biology

INTRODUCTION

Cell Biology (hereafter CB) is the study of the structure and function of cells. The credit of discovery of cells generally goes to Robert Hooke, an English microscopist (Karp, 2014). CB relates itself with how cell uses molecules of life (mainly nucleic acids and proteins) to survive, reproduce and carry out normal cell functions. Some commonly used CB techniques are cell/tissue culture, microscopy, brightfield, electron microscopy, fluorescence microscopy, immunofluorescence, RNA interference, time lapse microscopy, and so forth (The University of Queensland, 2018). Research in the CB domain is interrelated to some other fields like cytochemistry, biochemistry, immunology, medical microbiology, molecular biology, genetics, and so forth (“Cell Biology,” n.d.).

Document description, indexing, and classification are among the core activities of KO performed in libraries, databases, archives, and so forth by subject specialists and computer programs. Among the KO approaches developed within the LIS field, the facet analytical approach, founded by S R Ranganathan is explicit and pure in nature. This approach is based on the analytico-synthetic method, where “analysis” means breaking down each subject into its facets and “synthesis” means a combination of necessary facets to obtain the subject matter of the document in hand (Hjørland, 2008).

Category formation and facet analysis are two important aspects of this approach. The subject CB is gaining importance increasingly with the development of emerging domains like genome and proteomics. The category analysis and testing of respective current applicabilities will enable to track various inter-relational aspects among the core keywords of the said domain. This analysis will facilitate high precisional retrieval of domain-specific information.

CATEGORY AND FACET: DEFINITION AND CONTEXT

The concept of category was first given by Aristotle, who used the term to indicate ten classes of “being.” Vedic Philosophy categorized the universe of knowledge into four broad categories, namely, *Dharma*, *Artha*, *Kama*, and *Moksha*. Kant and the members of his school in the eighteenth century stated: “categories are the core concepts of the pure understanding, [...], a priori forms of our knowledge, representing all the essential functions of discursive thought” (Lalande, 1999, p. 142). J. D. Brown designed Subject Classification scheme in 1906. “However, its inclusion of “Categorical Table” as an auxiliary to the Schedule of Subject had implied the idea of Faceted Classification though in an incipient form” (Parkhi, 1968, p. 57). Lima and Raghavan (2014) mentioned that categorization in library and information science domain began with the publication of *UDC*, but Kaiser introduced the concept of categories and synthetic features into a classification/indexing system through his book *Systematic Indexing* in 1911; and they also wrote, “it is widely conceded

that the categorical approach was formulated by Ranganathan in the 1930s in his *Colon Classification* and its theoretical basis was laid down in his *Prolegomena*” (p. 90).

The concept of isolate, facet, and category are interrelated to each other. According to Ranganathan (1991) “Discussions of problems in classification will be facilitated if we can introduce a new term Isolate to denote the focus in a facet” (p. 73) and the focus in a facet is denoted by Isolate Idea, Isolate Term and Isolate Number in idea plan, verbal plan and notational plan respectively. Isolate is a solitary, unattached idea that can’t form a subject by itself but is fit to be a component of many subjects. For example silver is an isolate, which is not a subject by itself but fit to be a component of many subjects like silver mining, economics of silver, the chemistry of silver, and so forth. On the basis of common characteristics isolates are grouped into what is called a facet. “A facet is thus a totality of the isolates obtained on the basis of a single train of characteristics applied to a given entity” (Satija, 2000, p. 224). A number of facets may be included in the main class. For example in medicine (in *CC* 7th ed.), we have a number of facets like body and its organs, digestive system, circulation system, respiratory system, ductless gland, nervous system, musculoskeletal system, and so forth. All these facets related to the organ form a category called a Personality category. “The totality of the facets, having a very broad or pervasive common characteristic, form a category” (Satija, 2000, p. 224). Similarly from the same main class we find some facets like nursing, etiology, symptom and diagnosis,

pathology, therapeutics, surgery, diet regulation, and so forth. All these facets have a broad characteristic (i.e. action) form a category named the Energy category. Ranganathan (1944) postulated Five Fundamental Categories Time, Space, Energy, Matter, and Personality to be used in library classification. According to him (as cited in Grolier, 1962, p. 15), “each facet of any subject, as well as each division of a facet, is considered as a manifestation of one of the five fundamental categories.” D J Foskett and some other classification theorists saw facet as a synonymous term of category. But according to Ranganathan’s classification theory one category may include more than one facet and they may occur in *Rounds* and *Levels* under that particular category.

REVIEW OF RELATED LITERATURE

Seetharama (1972) made a comparative study among the categories of isolate ideas as developed by various classificationists. In the study he tried to map a comparison of the categories as reflected in almost twenty separate classification schemes or as developed by contemporary classificationists with the Ranganathan’s Fundamental Categories. He concluded that the concept of the Five Fundamental Categories is more comprehensive and versatile in nature and the various numbers of categories developed by distinct classificationists can be reducible to the Five Fundamental Categories. Bhattacharyya (1981) generalized the same Five as Discipline, Entity, Property, and Action (DEPA), along with modifiers. Panigrahi (2007) discussed the method of facets

identification from the title of the document and also described “the technique of selecting respective category-name of facets to follow the facet formula in general” (p. 309). Broughton (2007) described the necessary principles and procedures for constructing a faceted classification scheme to be used in the online resource discovery system and also explained how the facet analysis technique “was applied to the humanities in the FATKS project” (p. 727).

Li and Belkin (2008) established a faceted classification scheme of tasks related to an individual’s information behaviour. After reviewing and analyzing previous tasks classification schemes and related literature on work tasks, information-seeking tasks, and information search tasks—the three levels of tasks related to information behaviour, they listed essential facets and broadly categorized them into generic facet of a task, and common attributes of the task. Source of task, task doer, time, product, process, and goal are included to a generic facet of a task, whereas common attributes of task incorporates two facets i.e., task characteristics, and user’s perception of the task. Facet analysis technique was used to develop domain ontology in a study by Deokattey et al. (2010). Through the generation of one-to-many correspondences and using facet analysis technique, they developed clusters around descriptors or concepts. They identified a separate set of facets for each descriptor. Giunchiglia and Dutta (2011) introduced the DERA framework Domain, Entity, Relations, and Attributes, an alternative approach of Fundamental Categories, applicable to any domain in the universe of knowledge. Shiri (2014)

conducted a study for the identification and mapping of the key facets and aspects of big data. The author identified six facets to capture the key aspects of big data, namely data type, environment, people, operations and activities, analytics, and metadata. The author also identified sub-facets under each facet for demonstrating specific aspects that constitute the key topics. In the present study, the keywords are selected not only from the titles and abstracts, but also from the captions of the objects (Figures, Graphics, Photographs etc.) that is a new approach. As the objects play a vital role in the biological sciences, its captions are appropriate sources of searching metadata like keywords that may result high precisional output.

OBJECTIVES OF THE STUDY

1. To see whether the categories of general schemes for classification are sufficient to categorize isolates of CB or not?
2. To measure how far the categories of special schemes for classification, designed for the allied field of science and technology can be applied in the domain of CB.
3. If the categories of general schemes for classification are not sufficient for CB then try to compile a list of standard categories for the domain of CB.

METHODOLOGY

Twenty-five top-cited research articles in the domain of CB have been taken as a sample of the present study from the Web of Science database by using the search term *cell biology* in double inverted comma and mentioning the period of

1980-2014. Each article must have at least one object (may include the table, diagram, figure, chart, photograph, and map etc.—the non-textual elements of an article) with proper caption has been considered. Captions of the objects from the sample articles have been analyzed to derive keywords. In all, 1593 keywords have been derived from the captions of the objects of the articles and additionally 325 keywords have been derived from by analyzing the titles and abstracts of the articles, figuring a total of 1918. Then the following steps were done:

1. Acronyms of keywords are expanded (e.g., Fluorescence-activated Cell Sorting for FACS). Numerical figures (including 1, 2, 3, I, II, III, etc.), qualifiers (including low, high, derived, etc.), jargons (including A23187, B-100, M71/2, etc.), common words (including and, of, for, etc.) have been removed from the keywords.
2. All the remaining terms of the keywords are separated and arranged together with its frequency of occurrence. Now, we have got 1113 terms from 1918 keywords. Then the terms are categorized and tested separately according to the categories as proposed by or used in the scheme of S. R. Ranganathan (in *CC*, 7th ed.), B. C. Vickery, C. Gnoli, *Bibliographic Classification (BC)* 2nd ed., G. Cordonnier, and D. J. Foskett.
3. Finally from the tested work, a list of categories has been compiled for the domain of CB.

Important to mention here that *CC* 7th ed. and *BC* 2nd ed. are general schemes for

classification, which means these schemes are applicable to the universe of subjects. Vickery's category as mentioned latter is also applicable in general to all disciplines. Categories of Gnoli are applicable to any phenomenon. Schemes of Cordonnier and Foskett are special schemes for classification, which means they are designed for a specific domain.

ANALYSIS AND DISCUSSION

CLASSIFICATIONISTS, CLASSIFICATION SCHEMES, AND CATEGORIES

S. R. Ranganathan: Seventh edition of Ranganathan's *CC*, published in 1987 (first edition in 1933) under the editorship of M. A. Gopinath, is a freely faceted scheme for classification. "It has been found possible – and it is also convenient – to reduce all the Isolates to the following five generic ones at the Near-Seminal Level:

- 1 Time (T);
- 2 Space (S);
- 3 Energy (E);
- 4 Matter (M); and
- 5 Personality (P)." (Ranganathan, 1987, p. 38).

Ranganathan developed the concept of Fundamental Category. According to him (1967, p. 399), "there are five and only five fundamental categories—viz, Time, Space, Energy, Matter, and Personality. . . . this set of fundamental categories is, for brevity, denoted by the initonym PMEST." In *CC* 7th ed., Matter is of three kind - Material, Property and Method.

Bibliographic Classification, 2nd edition. *BC* 2nd ed. (1977) is a fully faceted classification scheme which has a detailed and broad structure

and specific citation order of categories it uses. This scheme is helpful for use in libraries and information services of all kinds (Bliss Classification Association, 2015a). It is a complete revised edition by Jack Mills and his colleagues, whose attempt was to "integrate theoretical work carried out by British Classification Research Group as far as could be possible without departing totally from the original structure" (Kumar, 1988, p. 70). At present following categories are used in *BC* 2nd ed.:

"Thing – kind – part – property – material – process – operation – patient – product – by-product – agent – space – time" (Bliss Classification Association, 2015b).

B. C. Vickery. In 1958, Vickery, in the first edition of his book *Classification and Indexing in Science* provided diagrams of three special schemes for classification. His first scheme related to 'Soil and Earth Science' includes eight categories; scheme for 'Astronomy' includes ten categories; and scheme for 'Reactors' includes nine categories (Vickery, 1975).

Pandey (1996, p.144) highlighted:

In spite of this the author has provided a list of 9 categories which may be applicable in general to all disciplines. These 9 categories are:

1. P Substance, Product, Organism.
2. O Part, Organ, Structure.
3. C Constituent.
4. Q Property and Measure.
5. R Object of Action, Raw Material.
6. E Action, Operation, Process, Behaviour.
7. A Agent, Tool.

8. G General Property, Process, Operation.
9. ST Space and Time.

C. Gnoli. Gnoli, one of the renowned persons associated with the field of Integrative Levels Classification (ILC) at present days. ILC is a knowledge organization system, where unlike other bibliographic classification schemes, phenomena of the world are directly organized without any a-priori implication that in which discipline a phenomenon included to.

Gnoli (2008, p. 179) mentioned:

“To abandon disciplines as the primary structuring principle of knowledge organization means that what should be organized are now directly phenomena of the world (as known by us). A classification scheme should then have phenomena as its primary subdivisions. It should make its users able to express, instead of the concept “the objects of zoological studies,” directly that of “animals,” without any a-priori implication that they be studied by zoology, or veterinary medicine, or food science, or transport history.”

Gnoli (2008) proposed following categories which can be applicable for each phenomenon in integrative levels.

Phenomenon

- 0 Modality
- 1 Time/Ordinal
- 2 Place/Neighbourh
- 3 Process/Transform
- 4 Element
- 5 Organ/Subsystem
- 6 Agent/Premise
- 7 Purpose/Result

- 8 Pattern
- 9 Quality/Type

G. Cordonnier. At the Dorking Conference in 1957, Cordonnier presented a list of categories used in designing a special scheme for classification. Cordonnier (as cited in Pandey, 1996. p.92) presented about the scheme designed for the *Centre de Documentation des Constructions et Arms Navales*, includes following categories:

- “1. Organisms and Services (Origin, or Subject, of documents) (nature; places).
2. Persons (miscellaneous categories . . .)
3. Individuals (living beings . . .); biological conditions . . .
4. Bodies (natural; simple, compound, . . .) (miscellaneous condition)
5. Miscellaneous equipments (property, fittings . . .)
6. Miscellaneous actions (physical; technical; economic; . . .)
7. Intellectual concepts
8. Documentary forms . . .
9. Time. . . .”

D. J. Foskett. Douglas John Foskett was one of the founder members of the Classification Research Group and with A. J. Wells, he was one of the pioneers to introduce Ranganathan’s ideas in England. Though he designed several faceted special schemes for classification but at least three of which were published, mentioned below:

Metal Box Container Manufacture Company’s Classification System (S1). The scheme includes six categories, which are mentioned below:

The Metal Box Company's Classification System comprises six 'facets' (categories), of which four relate to the manufacture of boxes (products, parts, materials, operations) and two for packing and crating (packed and crated products—and material condition of the latter; process). 'Various common subdivisions' are also added: research, development, instruments, control, special operations (welding, stamping, etc.) (Grolier, 1962, p. 95).

Food Technology Classification Scheme (S2). The scheme includes only four categories, which are Products, Parts, Materials and Operations (Vickery, 1975).

Health and Occupational Safety Classification Scheme (S3). Following sixteen categories have been used by Foskett (1960) for designing the scheme:

- B Physical agents and natural phenomena.
C-G Substances.

- H-J Premises, equipment, processes and operations.
K Organisation of labour and industrial structure.
L Fire and explosions.
M-N Pathology.
P Physiology and Psychology.
Q Research techniques.
R Medical prevention and treatment.
S Techniques of safety and health.
T Equipment for individual protection.
V Organisation of safety and health.
W Categories of persons.
X Industries.
Y Special aspects.
Z Generalia.

ENERGY: AN ANALYSIS

According to Ranganathan (1967), identification of Energy is little harder than the

Table 1: Distribution of Method and Process Isolates in Matter and Energy in CC 7th ed.

Sl. No.	Isolates/ Terms Indicate	Formed the Category	Concerned Subject	Page No.
1	Method	Energy	BYC Astrophysics	159
2	Method	Energy	FX Welding	203
3	Method	Energy	J Agriculture	219
4	Method	Energy	L Medicine	234
5	Method	Energy	Δ Mysticism	238
6	Method	Energy	T Education	281
7	Method	Matter-Method	Secondary Basic Subjects under B Mathematics (B1, B2, B3, B6, and B6T)	137 and others
8	Method	Matter-Method	H1 Mineralogy	207
9	Method	Matter Method	P Linguistics	252
10	Method	Matter Method	X45 Artificial Control (Planned Economy)	316
11	Process	Matter-Property	C4 Heat Physics	166
12	Process	Matter-Method	F Technology	202
13	Process	Energy	E Chemistry	196

identification of Space, and Time; “its manifestation is action of one kind or another” (p. 400). But method and process isolates are also used to form the category Energy as we found some provisions from *CC* 7th ed. Actually the use of method and process isolates to form the Fundamental Category varies mostly from Energy to Matter and it varies from subject to subject. The Table 1 explains the judgment. From the table the authors found that method isolates are used to form the category Energy for six subjects and the same is used to form the category Matter-Method for four subjects. Again the process isolates are used to form the category Energy for chemistry, Matter-Property for heat physics, and Matter-Method for technology.

Vickery very carefully used the three terms—Action, Operation, and Process under his sixth category “E.” Gnoli (2008) also kept Vickery-Broughton’s categories Process/Action, and Operation used in FATKS project as parallel to Ranganathan’s Energy and who own proposed Process/Transform as equivalent to the same. The term action is not used in *BC* 2nd ed. But, process and operation are used. Cordonnier also omitted Operation, and Process, but used a category Miscellaneous actions, which is similar to Ranganathan’s Energy. Foskett within his three

schemes as mentioned above omitted the term(s) Action in S1, Action, and Process in S2, and Action in S3; but used Operations, and Process in S1, Operations in S2, and Operations, and Process in S3 as similar to Ranganathan’s Energy. Considering the issues mentioned here, isolates indicate domain-specific process, general process, and method are represented together with the isolates indicate action, and operation under Ranganathan’s Energy in Table 5.

CATEGORIZATION OF ISOLATES FROM THE DOMAIN OF CB

Ranganathan found that PMEST operate in all field of knowledge; “the categories which can be used for special as well as general schemes for classification” (Kumar, 1988, p. 265). It is extensive in nature and Seetharama (1972) also discussed about the comprehensiveness and versatility of the same. Table 2 shows the categorization of isolates of CB domain using Ranganathan’s PMEST. As shown in the Table, out of 1113 isolates, 481 included to Personality, <510 included to Matter, 120 included to Energy, and one each to Space, and Time category. Categorizations of isolates using the categories of other scholars (except Ranganathan) are represented in the Table 3 to Table 5 focusing on Ranganathan’s Five Fundamental Categories.

Table 2: Categorization of Isolates According to Ranganathan’s PMEST

Fundamental Category	Personality (%)	Matter (%)	Energy (%)	Space (%)	Time (%)	Total (%)
No. of Isolates	481 (43.22)	510 (45.82)	120 (10.78)	1 (0.09)	1 (0.09)	1113 (100.00)

A total number of 481 isolates goes to Ranganathan's Personality have been categorized in Table 3, where 91.27% isolates are not groupable according to *BC 2nd ed.*, only 0.83% for Vickery, 49.27% for Gnoli, 28.69% for

Cordonnier. Considering the three schemes of Foskett, 91.27%, 97.27%, and 60.29% isolates are not groupable according to S1, S2, and S3 respectively.

Table 3: Mapping of Personality with the Categories of Others Classificationists

Sl. No.	<i>BC 2nd ed.</i>	Vickery	Gnoli	Cordonnier	Foskett		
					S1	S2	S3
1	Part-42 (8.73)	Organism - 173 (35.97)	Phenomenon-173 (35.97)	O-173 (35.97)	Part-42 (8.73)	Part-42 (8.73)	Substance-191 (39.71)
2	NG-439 (91.27)	Organ-71 (14.76)	Organ-71 (14.76)	P-3 (0.62)	NG-439 (91.27)	NG-439 (91.27)	NG-290 (60.29)
3	-	Part-42 (8.73)	NG-237 (49.27)	I ₁ -164 (34.10)	-	-	-
4	-	Substance - 191 (39.71)	-	B-3 (0.62)	-	-	-
5	-	NG-4 (0.83)	-	NG-138 (28.69)	-	-	-
Total	481 (100.00)	481 (100.00)	481 (100.00)	481 (100.00)	481 (100.00)	481 (100.00)	481 (100.00)

Note. Value in parentheses indicate percentage; NG = NotGroupable; O=Organisms; P = Persons (miscellaneous categories . . .); I₁ = Individuals (living beings . . .), biological conditions; B = Bodies (natural; simple, compound, . . .) (miscellaneous condition).

The Table 4 represents the isolates goes to Matter of Ranganathan's PMEST. From the table it is found that 28.43% isolates are not groupable according to the categories of *BC 2nd ed.*; where as 7.45%, 45.88%, and 81.38% isolates are not groupable according to the categories of Vickery, Gnoli, and Cordonnier respectively.

Action, and Operation are synonym to each other. Though, Process is also near synonym of previous Two, but here used to group the isolates indicate biological processes like biosynthesis, culturing, coating, clustering and so forth; and also used to group the isolates indicate general processes like classification, computation,

condensation, configuration, degradation, and so forth. Frequency of Process, and General Process are presented together below under Process except Vickery.

A total number of 120 isolate fallen under Ranganathan's Energy and one space isolate and one time isolate have been represented in Table 5. Both Space, and Time category are not used in the three schemes of Foskett; where Cordonnier used only Time. Considering Energy isolates, 26.67%, 73.73%, and 73.73% isolates are not groupable according to the categories of Gnoli, Cordonnier, and S2 of Foskett respectively.

Table 4: Mapping of Matter with the Categories of Others Classificationists

Sl. No.	BC 2 nd ed.	Vickery	Gnoli	Cordonnier	Foskett		
					S1	S2	S3
1	Agent-6 (1.18)	Agent-6 (1.18)	Agent-6 (1.18)	I ₁ -3 (0.59)	Materials-38 (7.45)	Materials-38 (7.45)	Substances-44 (8.63)
2	Material-38 (7.45)	Tool-3 (0.59)	Quality-269 (52.74)	B-27 (5.29)	Material condition-3 (0.59)	Products-29 (5.69)	Pathology-28 (5.49)
3	Part-4 (0.78)	Constituent-5 (0.98)	Result-1 (0.20)	M ₁ -60 (11.76)	Parts-4 (0.78)	Parts-4 (0.78)	Research techniques -2 (0.39)
4	Product-29 (5.69)	Behaviour-12 (2.35)	NG-234 (45.88)	I ₂ -4 (0.78)	Products-29 (5.69)	NG-439 (86.08)	NG-436 (85.49)
5	Property-288 (56.47)	General Property-7 (1.37)	-	D-1 (0.20)	NG-436 (85.49)	-	-
6	NG-145 (28.43)	Part-4 (0.78)	-	NG-415 (81.38)	-	-	-
7	-	Structure-30 (5.88)	-	-	-	-	-
8	-	Product-29 (5.69)	-	-	-	-	-
9	-	Substance-44 (8.63)	-	-	-	-	-
10	-	Measure-24 (4.71)	-	-	-	-	-
11	-	Property-269 (52.74)	-	-	-	-	-
12	-	Object of action-1 (0.20)	-	-	-	-	-
13	-	Raw material-38 (7.45)	-	-	-	-	-
14	-	NG-38 (7.45)	-	-	-	-	-
Total	510 (100.00)	510 (100.00)	510 (100.00)	510 (100.00)	510 (100.00)	510 (100.00)	510 (100.00)

Note. Value in parentheses indicate percentage; NG = Not Groupable; I₁ = Individuals (living beings . . .), biological conditions; B = Bodies (natural; simple, compound, . . .) (miscellaneous condition); M₁ = Miscellaneous equipment; I₂ = Intellectual concepts; D = Documentary forms

Table 5: Mapping of Energy, Space, and Time with the Categories of Other Classificationists

Category	BC 2 nd ed.	Vickery	Gnoli	Cordonnier	Foskett		
					S1	S2	S3
Energy Σ	Process-88 (73.33)	Action-30 (25.00)	Process-88 (73.33)	M ₂ -32 (26.67)	Operations-32 (26.67)	Operations-32 (26.67)	Operations-31 (25.83)
	Operations-32 (26.67)	Operation-2 (1.67)	NG-32 (26.67)	NG-88 (73.73)	Processes-88 (73.73)	NG-88 (73.73)	Processes-83 (69.17)
	-	Process-64 (53.33)	-	-	-	-	R-6 (5.00)
	-	General process-24 (20.00)	-	-	-	-	-
	120 (100.00)	120 (100.00)	120 (100.00)	120 (100.00)	120 (100.00)	120 (100.00)	120 (100.00)
Space ($\Sigma = 1$)	Yes	Yes	Yes	NG	NG	NG	NG
Time ($\Sigma = 1$)	Yes	Yes	Yes	Yes	NG	NG	NG

Note: Value in parentheses indicates percentage; NG = Not Groupable;

M₂ = Miscellaneous actions (physical; technical; economic; . . .); R = Medical prevention and treatment

Number of Not Groupable Isolates

Lima (as cited in Ferreira, Maculan, & Naves, 2017, p. 289) wrote:

“With regard to the fundamental categories, the CRG stated that they should be based on the nature of the subjects to be classified and that not all subjects have fundamental categories. The CRG prefers to identify the fundamental categories by the context of the subject itself, concluding that lists of fundamental categories should not be too long or mechanically imposed on the subjects.”

Not groupable isolates are represented together in the table 6. From the table it is found

that though BC 2nd ed. is a general scheme for classification but 52.47% isolates from the domain of CB are not groupable according to the scheme. Considering the categories of Vickery and Gnoli, 3.77% and 45.19% isolates are not groupable respectively according to them. These findings lead to the compilation of a category list applicable to CB. From the perspective of special scheme for classification, 57.68% isolates are not groupable according to Cordonnier's scheme; where as 78.80%, 86.97%, and 65.41% isolates are not groupable respectively according to the categories used in S1, S2, and S3 of Foskett. This information completes the second objective of present study.

Table 6: Number of Not Groupable Isolates

Fundamental Category	BC 2 nd ed.	Vickery	Gnoli	Cordonnier	Foskett		
					S1	S2	S3
Personality	439	4	237	138	439	439	290
Matter	145	38	234	415	436	439	436
Energy	0	0	32	88	0	88	0
Space	0	0	0	1	1	1	1
Time	0	0	0	0	1	1	1
$\Sigma = 1113$	584	42	503	642	877	968	728
%	52.47	3.77	45.19	57.68	78.80	86.97	65.41

Table 7: Distribution of Isolates to Form Standard Categories of CB

Sl. No.	Categories	Types of isolates covered	No. of Isolate Covered (%)
1	Organism	Animal, species, microorganism including bacteria, virus and other single-celled life form.	173 (15.54)
2	Organ and its Part	Any organ, part of organ, organic systems of human body, cell and its types, part of cells, and so forth.	113 (10.15)
3	Raw Material	Natural elements like water, minerals, ion of minerals, metal, salt, and so forth.	38 (3.41)
4	Substance and Bio-substance	Vitamin, enzyme, protein, lipid, glucose, carbohydrate, drug, molecular complex, cholesterol, antioxidant, chemical substance, waste or breakdown product of human body like ammonia, urea, creatinine, and so forth.	235 (21.12)
5	Property	Terms indicate any disease, disease symptom, quality or conditions or specific features or behaviour of cell or organ or organism and so forth; also includes general property (e.g., hit, light, noise, etc.).	288 (25.88)
6	Measure	Any unit or subunit or terms of measurement.	24 (2.16)
7	Structure	Terms indicate structure and shape like concepts. For example, ring, crystalline, scaffolding, cluster, and so forth.	35 (3.14)
8	Agent, Tool and Equipment	Includes those work or used as agent, tools, and equipment. As for example database, biochips, camera, microscope, and so forth.	88 (7.91)
9	Process and Method	Indicate domain specific process and method like culturing, coating, lymphangiogenesis, angiogenesis, and so forth. Also includes general process like classification, condensation, computation, and so forth.	38 (3.41)
10	Action and Operation	Terms indicate action or operation like tagging, mapping, counting, analysis, and so forth.	32 (2.88)
11	Space	Any area or space.	1 (0.09)
12	Time	Time.	1 (0.09)
13	Others	Domain name, research approach, community name, and so forth.	47 (4.22)
Total			1113 (100.00)

Proposed Standard Categories for CB

All the isolates are categorized in the Table 7 to form standard categories of CB. Forty seven isolates are kept under “Others,” which covers name of disciplines, like proteomics, pathology, homology, pharmacology, and so forth; name of race, community or population, like African; term related to research work, like hypothesis, approach, and so forth. Words indicate name of discipline can be eliminated from here, because it indicates separate disciplines that may be within same array of CB. And the remaining isolate types from ‘Others’ may come under common isolates. So, from this context present study proposes following standard categories for CB domain.

1. Organism
2. Organ and its Part
3. Raw Material
4. Substance and Bio-substance
5. Property
6. Measure
7. Structure
8. Agent, Tool and Equipment
9. Process and Method
10. Action and Operation
11. Space
12. Time

CONCLUSION

The concept of Ranganathan’s Fundamental Category is extensive in nature and he attempted to include all the isolates of universe of subjects within a framework of only Five Fundamental Categories through introducing the concept of Round and Level. It is clear from the study that

out of the nine categories which Vickery proposed to be applicable in general to all discipline, most of the categories are applicable to the domain of CB. The pervasive aim of this paper was to compile a list of standard categories for the domain of CB. Twelve categories listed above fulfil the purpose. As CB is very much interconnected to some other fields like molecular biology, medical biology, genetics, molecular genetics, immunology, and so forth; so, this category list can be helpful to form the standard category list of that concerned domains.

REFERENCES

1. Bhattacharyya, G. (1981). *Subject Indexing Language: its theory and practice* [Paper presentation]. DRTC Refresher Seminar – 13, New Developments in LIS in India of the Indian Statistical Institute, Documentation Research & Training Centre, Bangalore.
2. Bliss Classification Association. (2015a, September 15). *The Bliss Bibliographic Classification: History & description*. <https://www.blissclassification.org.uk/bchist.shtml>
3. Bliss Classification Association. (2015b, September 15). *The Bliss Bibliographic Classification: Using the scheme*. <https://www.blissclassification.org.uk/bcclass.shtml>
4. Broughton, V., & Aida, S. (2007). Building a faceted classification for the humanities: Principles and procedures. *Journal of Documentation*, 63(5), 727-754.
5. Cell Biology. (n.d.). In *Wikipedia*. https://en.wikipedia.org/wiki/Cell_biology
6. Deokattey, S., Neelameghan, A., & Kumar, V.

- (2010). A method for developing a domain ontology: A case study for a multidisciplinary subject. *Knowledge Organization*, 37(3), 173-184. <https://doi.org/10.5771/0943-7444-2010-3-173>
7. Ferreira, A. C., Maculan, B. C. M. S., & Naves, M. M. L. (2017). Ranganathan and the faceted classification theory. *Transinformação*, 29(3), 279-295. <https://doi.org/10.1590/2318-08892017000300006>
8. Foskett, D. J. (1960). Documentation in occupational safety and health. *Reveu de la Documentation*, 27(3), 102-107.
9. Giunchiglia, F., & Dutta, B. (2011, March). *DERA: a Faceted Knowledge Organization Framework* [Paper submitted]. International Conference on Theory and Practice of Digital Libraries 2011 (TDPL'2011), Trento, Italy. <http://eprints.biblio.unitn.it/2104/1/techRep457.pdf>
10. Gnoli, C. (2008). Categories and facets in integrative levels. *Axiomathes*, 18(2), 177-192. <https://doi: 10.1007/s10516-007-9022-z>
11. Grolier, E. de. (1962). *A study of general categories applicable to classification and coding in documentation*. UNESCO.
12. Hjørland, B. (2008). What is knowledge organization (KO)?. *Knowledge Organization*, 35(2/3), 86-101.
13. Karp, G. (2014). *Cell biology*(7th ed.). Wiley.
14. Kumar, K. (1988). *Theory of classification* (4th rev. ed.). Vikas Publishing House.
15. Lalande, A. (1999). *Vocabulário técnico e crítico da filosofia*. Martins Fontes.
16. Li, Y., & Belkin, N. J. (2008). A faceted approach to conceptualizing tasks in information seeking. *Information Processing and Management*, 44, 1822-1837.
17. Lima, G. A. B., & Raghavan, K. S. (2014). Categories in knowledge organization. In W. Babik (ed.), *Knowledge organization in the 21st century: between historical patterns and future prospects: Proceedings of the Thirteenth International ISKO Conference, 19-22 May 2014 (pp. 88-95)*. Ergon Verlag.
18. Pandey, R. C. (1996). *Linguistic analysis and its application in information retrieval tools* [Doctoral dissertation, North-Eastern Hill University], Shodhganga: a reservoir of Indian thesis. <http://hdl.handle.net/10603/61076>
19. Panigrahi, P. (2007). Facet analysis techniques for automatic classification systems: A study for colon classification. *SRELS Journal of Information Management*, 44(4), 309-332.
20. Parkhi, R. S. (1968). *Library classification: Evolution of a dynamic theory*. Vikas Publishing House.
21. Ranganathan, S. R. (1944). *Library Classification: Fundamentals and procedure*.

- With 1008 graded examples and exercises.
Madras Library Association.
22. Ranganathan, S. R. (1967). *Prolegomena to library classification* (3rd ed.). Sarada Ranganathan Endowment for Library Science.
23. Ranganathan, S. R. (1987). *Colon classification* (7th ed.). Sarada Ranganathan Endowment for Library Science.
24. Ranganathan, S. R. (1991). *Elements of library classification: Based on lectures delivered at the University of Bombay in December 1944 and in the schools of librarianship in Great Britain in December 1956* (B. I. Palmer, Ed.). Sarada Ranganathan Endowment for Library Science.
25. Satija, M. P. (2000). Library classification: An essay in terminology. *Knowledge Organization*, 27(4), 221-229. <https://doi.org/10.5771/0943-7444-2000-4-221>
26. Seetharama, S. (1972). Categorisation of isolate ideas: A comparative study. *Library Science*, 9(4), 473-498.
27. Shiri, A. (2014). Making sense of big data: A facet analysis approach. *Knowledge Organization*, 41(5), 357-368. <https://doi.org/10.5771/0943-7444-2014-5-357>
28. The University of Queensland. (2018, January 25). *Introduction to cell biology*. <https://di.uq.edu.au/community-and-alumni/sparq-ed/cell-and-molecular-biology-experiences/introduction-cell-biology>
29. Vickery, B. C. (1959). *Classification and indexing in science*. Butterworths.
30. Vickery, B. C. (1975). *Classification and indexing in science* (3rd ed.). Butterworths.

