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**LASERS IN MEDICAL APPLICATIONS : R&D MAPPING**

by

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### ABSTRACT

A study of the MEDLINE CDROM database, for the period 1969-2000 was undertaken. The purpose was, to identify core areas of research and development, in the field of applications of lasers to humans, along with other bibliometric indicators of research. A total of 34,833 records were retrieved, downloaded and analysed. The results indicate a steady increase in the number of publications every year, from 1970 onwards, with 1997 (2767 articles) and 1998 (2914 articles) being the most productive years. The most prolific contributors were J. Haut, with 95 publications to his credit, followed by M. Landthaler (82), G. Coscas (79), S.G. Bown (73) and P. Bjerring (70). Collaboration among the authors was high, with a maximum of 15 contributors observed in a few articles. The top ranking journal in the field was *Ophthalmology*, which published 769 articles starting from 1978. USA was way ahead as the country with the highest journal productivity (around 40% of the total number of records), followed by UK and Germany. A total of 103 articles were published from India. English was the preferred language of publication, with 75% of the records being published in English language. In the use of lasers for humans, maximum number of records were found for adult and middle aged populations. Research focussed on the eye and its various diseases. Lasers were found to be used for therapeutic purposes, in surgery and in the diagnosis of diseases. Carbondioxide laser was most frequently used for medical applications. Though there were quite a few references on the adverse effects of lasers, the therapeutic effects far outweighed them.

**Keywords** : MEDLINE (1969-2000), Content analysis, Research indicators, Applications of lasers, Medicine, Bibliometrics, Author productivity, Journal productivity, Language of publications, Types of lasers used in Medicine, Core areas of research in laser applications to humans

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### **1 Introduction**

Current Awareness Services (CAS) and Selective Dissemination of Information (SDI) form the backbone of Library / Documentation Services. As part of CAS, information professionals continue to provide researchers and users with state of the art reviews, information digests, literature reviews and more recently, mapping of subject domains through content organization. Rapid advances in the field of computerization, have led to the proliferation of several national and international databases in various subject disciplines. This in turn, has facilitated the work of information providers, who now have access to digital information at their finger tips, for easier content management and organization. In the present diffuse internet age, the importance of structured databases such as INIS, MEDLINE, BIOSIS, etc. can be easily recognized and appreciated.

The following studies briefly highlight recent research trends in content organization. Trofimenko's [1] study tracked the evolution and development of Nuclear Physics during a 50 year period. A macrolevel analysis of research in Physics, was undertaken by Bhattacharya [2]. In the field of Biomedical Sciences, Satyanarayana [3] made a comparative study of three CDROM databases and in Life Sciences, Arunachalam [4] analysed the BIOSIS database to map India's contribution. Other mapping studies include, mapping of Science in India as published in SCI by Basu and Nagpaul [5] ; mapping of Chemistry and Chemical Engineering in India as seen in the CA database by Mehta [6] ; and in the field of Earth Sciences, Sahu [7] analysed the Georef CDROM database to map India's contribution. Study of a single journal for a ten year period to map the development of Tobacco research in India was undertaken by Suryanarayana [8]. Jain and Garg [9] provided a scientometric model of laser (Light Amplification by Simulated Emission of Radiation) research in India. Studies on Neem research in India, and on Accidents and Trauma were undertaken by Kalyane [10,11]. Gu and Zainab [12] made searches on COMPENDEX, IEL and INSPEC CDROM databases for contributions made by the Malaysian researchers in the field of Computer Science and Information Technology. In the field of Library and Information Science, one of the earliest studies was by Kalervo and Vakkari [13] which highlighted trends in international research in 37 core journals, during 1985. Similar studies were undertaken by Atkins [14] and Kajberg [15].

As far as the Department of Atomic Energy is concerned, work on biomedical applications of lasers is being carried out at the Biomedical Applications Section of the Centre for Advanced Technology (CAT), Indore.

**Objectives :** The present study on medical applications of lasers to humans intends to :

- document the growth of publications,
- note author productivity,
- identify core journals and their countries of publications,
- check language-wise scatter of publications,
- trace specific applications of lasers,
- mark types of lasers used in medical research, and
- identify core areas in the field of applications of lasers to human beings.

## **2 Materials and methods**

The MEDLINE database available on CD-ROM was used to quantify the R&D status in applications of lasers to humans. MEDLINE is one of the major databases in the field of Biomedical literature. The study covers the period from Jan. 1969 to Dec. 2000. Humphrey [16] and O'Rourke [17] have extensively studied the file structure and hierarchical relationships of the Medical Subject Headings (MeSH) of MEDLINE.

The formulation of search queries for each CD-ROM disk, was as follows:

#1 = year of publication

#2 = #1 and laser\*

#3 = #2 and human\* (“Human” is a special descriptor or check tag, which appears in the TG field of each record ).

Searches on MEDLINE (through the PC-SPIRS interface) yielded 34,833 records. Each record was represented by several fields. Five of these fields namely author, source, country of publication, language of publication and Medical Subject Headings (MeSH), were selected. The author and MeSH fields displayed more than one postings and index terms respectively, which were separated from each other, by a semi colon. This data was then downloaded on to the PC, yearwise, into separate files. Thus, 31 files each, were made for 31 years for author, source, country, language and MeSH fields. (i.e. a total of 155 files).

Four separate programs were written in C language to facilitate the content analysis of the five fields. The first program REPLACE.EXE converted each semi colon separator in the author and MeSH fields into a new line. The second program COUNTWORD.EXE counted the frequency of occurrence of each term within a field. The third program MERGE.EXE merged the data of all the 31 files of each field into a single data file. Thus the five data files (author total, source total, country total, language total, and MeSH total) contained data on individual terms and their total frequencies of occurrence for all the 31 years. The fourth program SORT.EXE sorted the terms of each data file both alphabetically and numerically.

The Content analysis method used in the study, is a well documented [18-24] qualitative as well as quantitative research method. It is primarily concerned with the study of basic concept categories, which occur in any text or document. The researcher searches for structures and patterned regularities in the text and makes inferences on the basis of these regularities.

### 3 Results and discussion

#### 3.1 Content analysis of the major fields of the MEDLINE CDROM database

**3.1.1 Growth of publications :** In a 31 year period (1970-2000), a total of 34,833 records, all journal articles, were retrieved during the search. The search did not display any records for the year 1969. The years 1997 and 1998 were the most productive years, with 2767 and 2914 articles published respectively. But, in the percentage of publications found specifically for humans, the years 1985 (74.9%) and 1986 (75.6%) were most productive. Table 1 provides the yearwise breakup of journal articles as retrieved from the MEDLINE CDROM database and Figure 1 gives the percentage of records found on medical applications of lasers to humans. Figure 2 provides data on the total number of publications, multi-authored publications and single authored publications in the field.

Table 1 : Yearwise frequency of publications as retrieved from the MEDLINE CDROM database

Year	Number of records on lasers		
	General	Used for humans	% Used for humans
1970	175	070	40.0
1971	198	074	37.3
1972	241	088	36.5
1973	252	106	42.6
1974	317	155	48.8
1975	352	158	44.8
1976	427	206	48.2
1977	427	226	52.1
1978	440	235	53.4
1979	534	332	62.1
1980	579	363	62.6
1981	737	477	64.7
1982	812	577	71.0
1983	1106	798	72.1
1984	1467	1072	73.0
1985	1654	1240	74.9
1986	1661	1256	75.6
1987	1831	1314	71.7
1988	1973	1424	72.1
1989	2340	1720	73.5
1990	2653	1943	73.2
1991	2671	1883	70.4
1992	2765	1915	69.2
1993	3106	2085	67.1
1994	3120	2093	67.0
1995	3384	2213	65.3
1996	1733	1176	67.8
1997	4269	2767	64.8
1998	4503	2914	64.7
1999	3202	2074	64.7
2000	2980	1879	63.5
Total	51,909	34,833	67.1



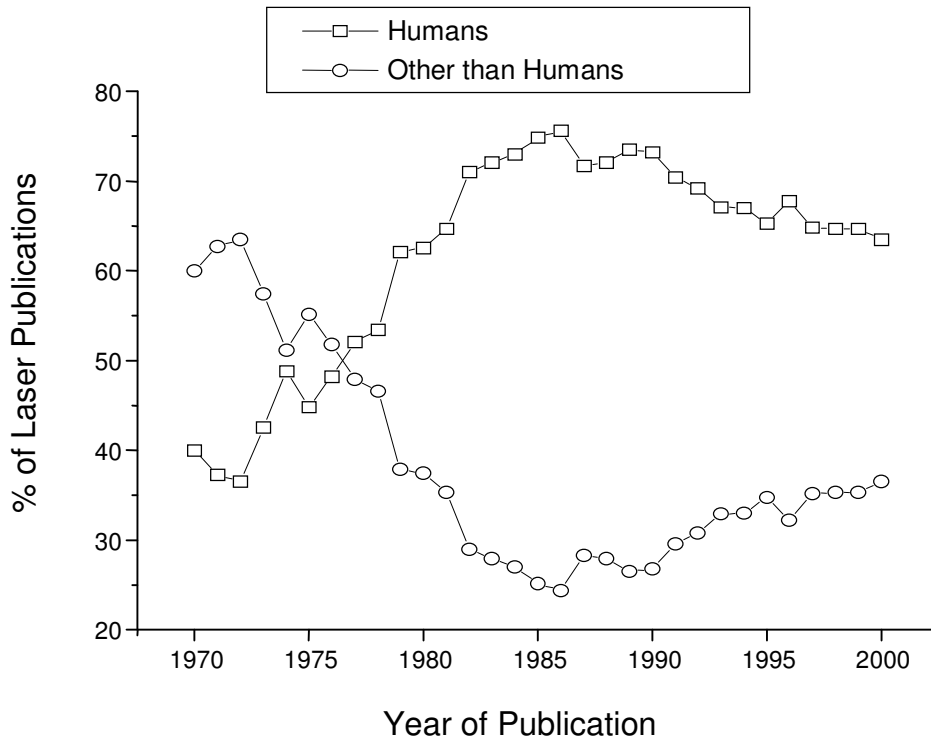


Fig 1 : Yearwise percentage of publications on lasers for humans and other than humans as retrieved from MEDLINE CDROM database

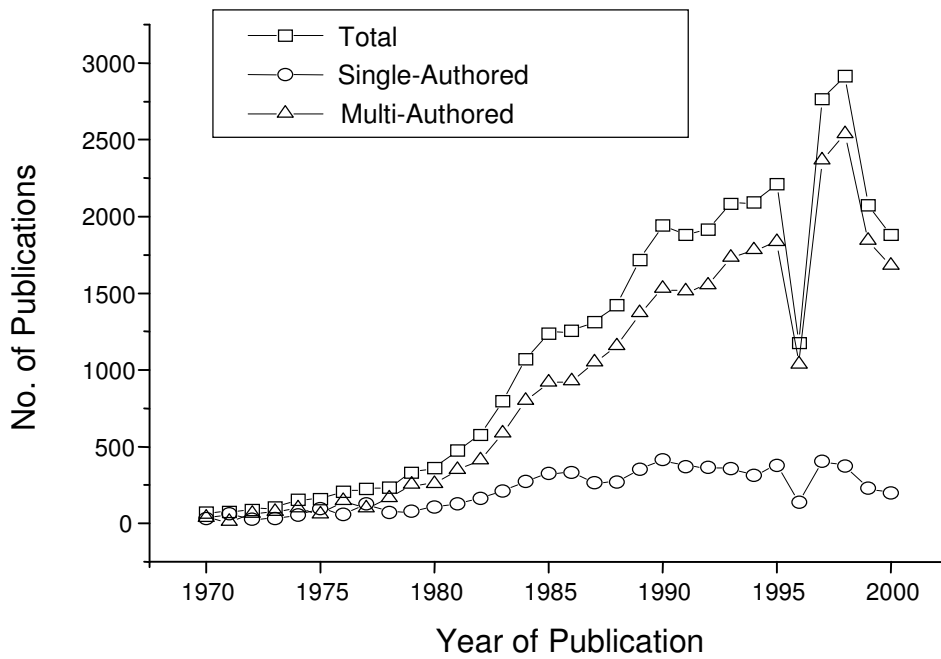


Fig 2 : Total no. of publications, multi-authored publications and single authored publications on medical applications of lasers to humans

Collaboration among the authors was found to be quite high. As many as 15 authors were seen for a single journal article indicating the emergence of mega-authorship trend. The collaboration coefficient indicates the ratio of the number of collaborative papers to the total number of papers, published in a domain, during a fixed period of time. Figure 3 provides the collaboration coefficient trend.

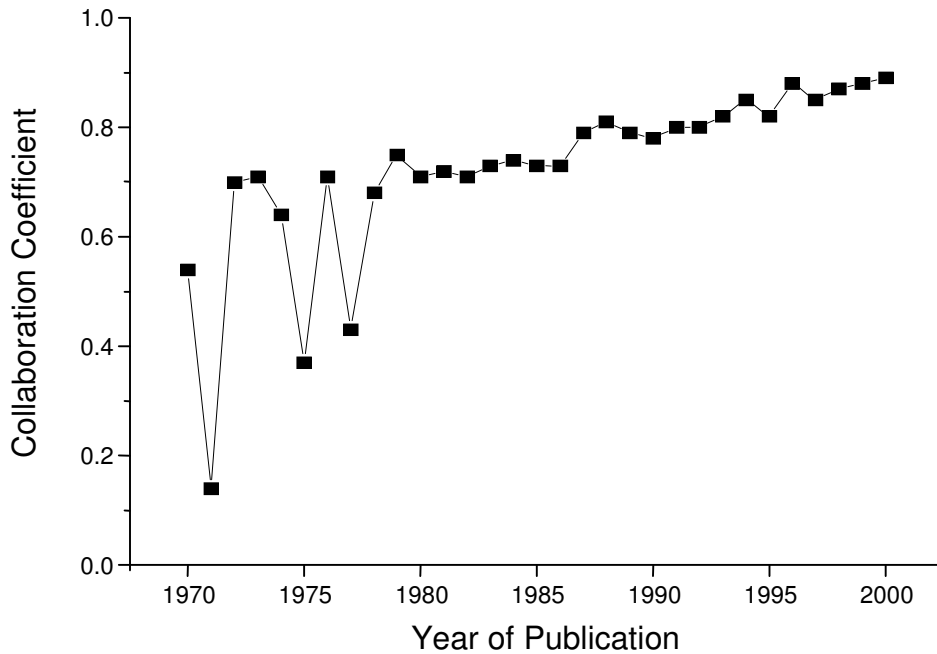


Fig 3 : Yearwise collaboration coefficients of authorship patterns in publications on medical applications of lasers for humans

**3.1 2 Author productivity :** Individual contributors in the field of medical applications of lasers were found to be 65,407. Table 2 provides data on productivity of authors, observed values, expected values ( $\alpha = 2$ ) as per Lotka's Law ( Appendix 1) and modified Lotka values ( $\alpha = 2.3$ ) by both graphical as well as mathematical methods. According to Gupta [25], Potter [26], Kalyane and Sen [27], the value of  $\alpha$  is modified to fit in or come closer to the ideal Lotka value of 2. Various subject disciplines have shown significant differences in the observed and expected values. Figure 4 gives a graphical representation of Table 2.

Table 2 : Productivity of authors observed, expected ( $\alpha = 2$ ) as per Lotka's Law and modified ( $\alpha=2.3$ ) Lotka's Law, ( when all authors were counted ) in the field of medical applications of lasers

No. of papers	No. of authors			No. of papers	No. of authors		
	Observed	Expected ( $\alpha = 2$ )	Modified ( $\alpha=2.3$ )		Observed	Expected ( $\alpha = 2$ )	Modified ( $\alpha=2.3$ )
1	46436	46436	46436	33	11	42	14
2	9548	11609	9427	34	10	40	13
3	3672	5159	3710	35	03	37	13
4	1855	2902	1914	36	07	35	12
5	1061	1857	1145	37	01	33	11
6	679	1289	759	38	04	32	10
7	426	947	528	40	01	29	09
8	359	725	388	41	04	27	09
9	237	573	296	42	04	26	08
10	192	464	232	44	01	23	07
11	147	383	186	45	01	22	07
12	117	322	152	46	03	21	06
13	92	274	127	47	03	21	06
14	87	236	107	48	02	20	06
15	57	206	91	49	02	19	06
16	66	181	78	50	02	18	05
17	38	160	68	51	01	17	05
18	43	143	60	53	01	16	05
19	29	128	53	54	02	15	04
20	22	116	47	55	01	15	04
21	29	105	42	57	01	14	04
22	24	95	37	60	01	12	03
23	14	87	34	61	01	12	03
24	23	80	31	64	01	11	13
25	11	74	28	65	02	10	03
26	14	68	25	67	01	10	02
27	14	63	23	69	02	09	02
28	10	99	21	70	01	09	02
29	06	55	20	73	01	08	02
30	07	51	18	79	01	07	02
31	06	48	17	82	01	06	02
32	08	45	16	95	01	05	02

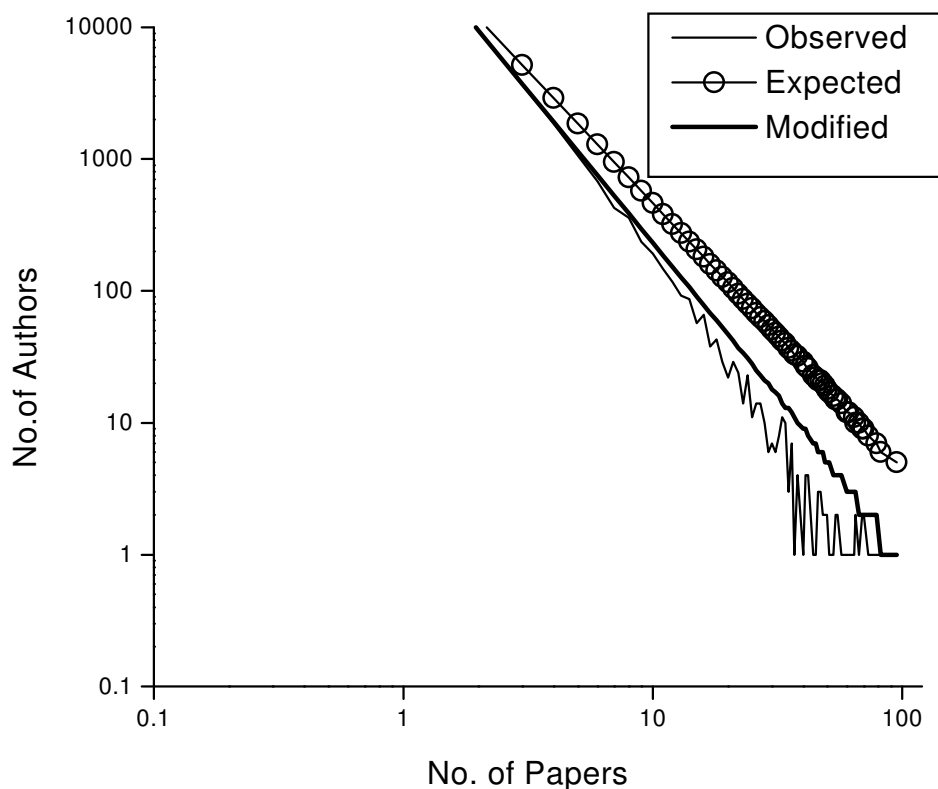


Fig. 4 Author productivity observed values, expected ( $\alpha = 2$ ) values as per Lotka' s law and modified( $\alpha = 2.3$ ) Lotka' s law values for publications on medical applications of lasers

The most prolific author was J. Haut who published 95 papers within a span of 25 years. Table 3 presents details of the ten most prolific authors and Appendix 2 provides addresses of these ten authors. Figure 5 depicts the productivity of the five leading authors.

Table 3 : The most productive authors in the field of medical applications of lasers

No. of papers	Name of the author/s
95	J. Haut
82	M. Landthaler
79	G. Coscas
73	S.G. Bown
70	P. Bjerring
69 each	J. Marshall and D.B. Apfelberg
67	T. Seiler
65 each	R.R. Anderson and S.M. Shapshay

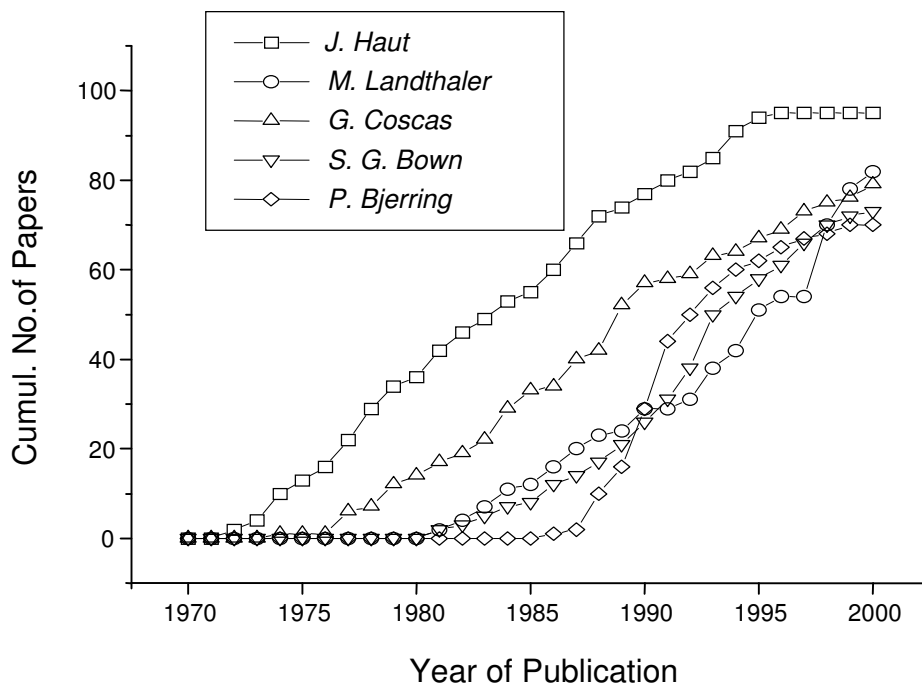


Fig. 5 : Publication productivity of the five leading authors in the field of medical applications of lasers

**3.1.3 Journal productivity :** All the articles on the subject of medical applications of lasers were found to be scattered in 2799 journal titles. Division of the entire data into three equal Bradford zones as shown in Table 4, gave the following results. Instead of following the normal Bradford Law (Appendix 3) of  $1 : n : n^2$ , the ratio turned out to be  $59 : 130 : 2610$  ; i.e.  $1 : n : n^{10}$ . The first zone showed 59 journals with 11687 articles; the second zone displayed 130 journals with 11611 articles. Thus, within these two zones the Bradford multiplier was found to be 2.2. But, in the third zone, scattering was found to be very high, with 2610 journals publishing 11535 articles. There have been cases of non-conformity to the Bradford Law. Lancaster et al [28] and Bonitz [29] have also reported unequal Bradford distributions in their respective studies. The data thus followed Garfield's Law of Concentration (Appendix 4) with 23298 articles, (i.e. 66.8% of the entire records) being published in only 189 journals (i.e. 6.75% of all journal titles), providing strategy for subscription of journals in a library. Further, this data guides prospective authors in channelizing their research output. More than 50 journal titles were devoted exclusively to Ophthalmology. Other subject titles covered were on Cardiology, Otorhinolaryngology, Dermatology, Surgery and Gynaecology and Obstetrics. Appendix 5 lists additional journal titles and the number of articles published in them. Figure 6 provides cumulative frequencies of the five top ranking journals. Table 5 gives the publication productivity of the ten leading journals.

Table 4 : Bradford distribution of articles in journals on lasers in medical applications as retrieved from the MEDLINE CDROM database

Zone	No. of articles	No. of journals
First	11687	59
Second	11611	130
Third	11535	2610

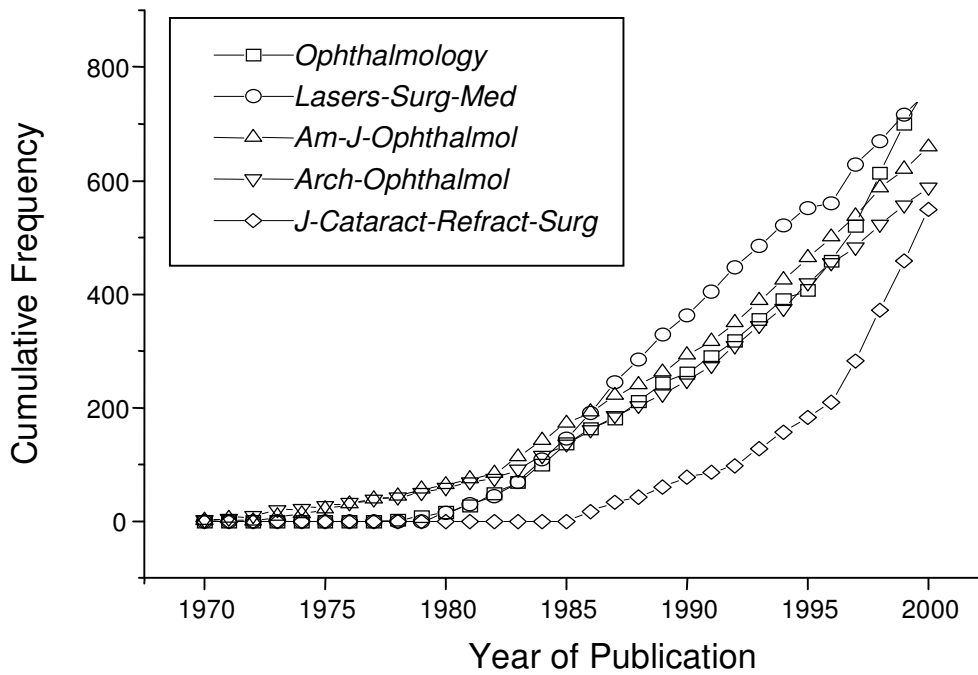


Fig. 6 : Publication productivity for medical applications of lasers in five top ranking journals

Table 5 : The most productive journals in the field of medical applications of lasers (1970-2000)

Journal Title	No. of Articles
<i>Ophthalmology</i>	769
<i>Lasers in Surgery and Medicine</i>	758
<i>American Journal of Ophthalmology</i>	658
<i>Archives of Ophthalmology</i>	588
<i>Journal of Cataract and Refractive Surgery</i>	549
<i>Klin Monatsblaetter fuer Augenheilkunde and Augenarztliche Fortbildung</i>	386
<i>British Journal of Ophthalmology</i>	358
<i>Journal of Refractive Surgery</i>	329
<i>Bulletin of the Society of Ophthalmology France</i>	289
<i>Ophthalmic Surgery</i>	285
(truncated, continued as Appendix 5)	

3.1.4 **Country of publication of journals** : The United States of America was the publisher of the highest number of journal articles in the field. UK and Germany ranked second and third respectively. Table 6 provides details of the publishing leaders in the field. Among the Indian journals, the top ranking title was *Indian Journal of Ophthalmology*. India published 103 articles starting from 1982. Figure 7 provides cumulative frequencies of the Indian publications.

Table 6 : The most productive countries in the field of medical applications of lasers

Country	No. of published articles	Percentage
USA	16705	47.9
UK	3590	10.3
Germany, E.	1983	5.6
France	1488	4.2
USSR	1455	4.1
Germany, W.	1100	3.1
Switzerland	1028	2.9
Japan	1019	2.9
Netherlands	912	2.6
Russia	628	1.1

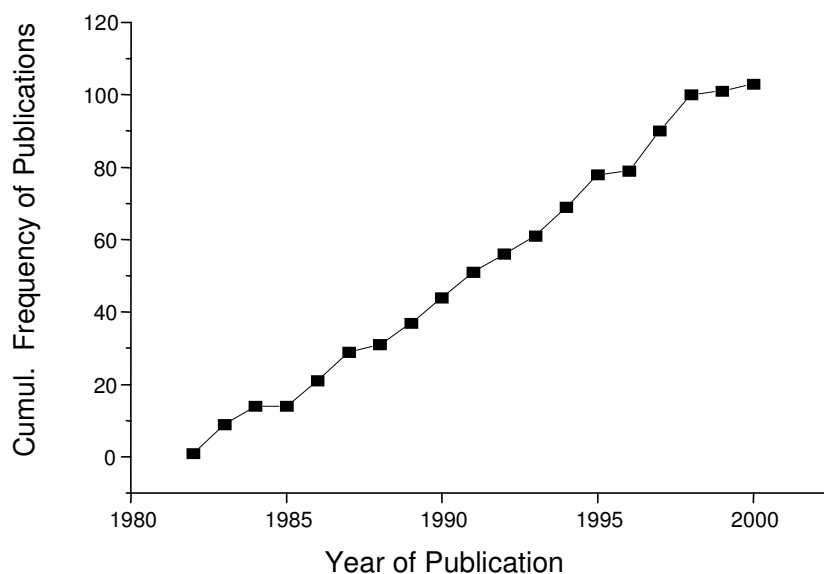


Fig. 7 Cumulative frequency of the Indian publications for medical applications of lasers

3.1.5 **Language of publications** : English language dominated the scene with 75.5% of the total number of records being published in English. Table 7 provides the breakup of the language field.

Table 7 : Language-wise breakup of publications in the field of medical applications of lasers

Language	No. of records	Percentage
English	26323	75.56
German	2202	6.32
Russian	2189	6.28
French	1639	4.75
Japanese	749	2.15
Others	1731	4.96

3.2 **Content analysis of MeSH descriptors** : A total of 38,991 individual MeSH descriptors were obtained from all the records. These descriptors which form part of the controlled vocabulary of MEDLINE, are used to describe the subject contents of records.



Each record may be represented by 10-15 such descriptors. Since this is comparatively a large volume of data, the Cluster approach was found to be suitable for analysis. Thus, six different criteria were used to form clusters, based on the hierarchical tree structure of MeSH [30 - 31]. These are :

- 1 Human anatomy (dealt in detail)
- 2 Human developmental stages
- 3 Diseases afflicting the human body
- 4 Diagnostic methods, techniques and equipment
- 5 Therapeutic methods, techniques and equipment
- 6 Specific applications of lasers

**3.2.1 Human anatomy** : The human body was grouped into twelve broad systems or clusters, on the basis of different functions, performed by each system. The systems along with the number of descriptors identified for each one of them, during 1970-2000 are as follows : Digestive system (2422) , Sense organs (1348) , Human physiology (1265), Urinogenital system (1225) , Nervous system (975) , Cells and cell structure (957) , Musculoskeletal system (943) , Cardiovascular system (910) , Respiratory system (725), Tissues and embryonic structures (464) , Body fluids and related substances (165) , Endocrine system (151).

These clusters provided a listing of the five top ranking descriptors within each system, along with their frequencies of occurrence, as given in Table 8. A partial listing of each system, along with the the number of descriptors allotted to each system and their frequencies of occurrence, is given in Appendices 6-17.

Table 8 : System-wise frequencies of five top ranking descriptors for laser applications to humans during 1970-2000 as retrieved from the MEDLINE CDROM database

System / Descriptors	Frequency	System / Descriptors	Frequency
<b>Digestive System</b>		<b>Musculoskeletal System</b>	
Oesophageal-Neoplasms-Surgery	249	Leg-Blood-Supply	293
Gastro-intestinal-hemorrhage-Surgery	186	Fingers-Blood-Supply	144
Gastrosocopy	175	Thoracoscopy	90
Oesophagoscopy	162	Foot-Blood-Supply	83
Stomach-Neoplasms-Surgery	159	Palate-Soft-Surgery	75
(truncated, continued as Appendix 6)		(truncated, continued as Appendix 12)	
<b>Sense Organs</b>		<b>Cardiovascular System</b>	
Cornea-Surgery	1282	Microcirculation	270
Fundus Oculi	752	Laser-Angioplasty	233
Retinal-Detachment-Surgery	587	Microcirculation-Physiology	179
Iris-Surgery	551	Microcirculation-Drug-effects	135
Cornea-Pathology	440	Retinal-Vessels	130
(truncated, continued as Appendix 7)		(truncated, continued as Appendix 13)	
<b>Human Physiology</b>		<b>Respiratory System</b>	
Skin-Blood-Supply	1200	Laryngeal-Neoplasms-Surgery	435
Skin-Neoplasms-Surgery	529	Bronchoscopy	335
Skin-Pathology	299	Lung-Neoplasms-Surgery	225
Leg-Blood-Supply	293	Bronchial-Neoplasms-Surgery	220
Skin-Surgery	269	Laryngoscopy	193
(truncated, continued as Appendix 8)		(truncated, continued as Appendix 14)	
<b>Urinogenital System</b>		<b>Tissues and Embryonic Structures</b>	
Cervix-Neoplasms-Surgery	339	Epithelium-Pathology	114
Prostatic Hyperplasia-Surgery	277	Cicatrix-Surgery	101
Cervix-Neoplasms-Surgery	189	Cicatrix-Etiology	98
Prostatectomy-Method	179	Gastric-Mucosa-Blood-Supply	78
Bladder-Neoplasms-Surgery	158	Cicatrix-Pathology	75
(truncated, continued as Appendix 9)		(truncated, continued as Appendix 15)	
<b>Nervous System</b>		<b>Body Fluids and Related Substances</b>	
Brain-Neoplasms-Surgery	78	Exudates and Transudates	85
Nerve-Fibres-Pathology	79	Aqueous Humor-Metabolism	74
Meningioma-Surgery	65	Aqueous Humor-Cytology	43
Optic-Nerve-Pathology	64	Blood	38
Brain-Pathology	55	Aqueous Humor-Physiology	37
(truncated, continued as Appendix 10)		(truncated, continued as Appendix 16)	
<b>Cells and Cell Structure</b>		<b>Endocrine System</b>	
Cells-Cultured	409	Adrenal-Cortex-Hormones-Therapeutic use	48
Cell-Line	359	Pituitary-Neoplasms-Surgery	18
Cell-Count	172	Thyroid-Neoplasms-Surgery	13
Hela Cells	112	Thyroid-Neoplasms-Pathology	10
Cell-Division	89	Adrenal-Cortex-Hormones-Admn	06
(truncated, continued as Appendix 11)		(truncated, continued as Appendix 17)	

3.2.2 **Human developmental stages** : The next criterion for clustering was based on the number of studies undertaken for different age groups of human beings as given in Table 9.

Table 9 : Human developmental stages and frequencies of occurrence of descriptors on medical applications of lasers from the MEDLINE CDROM database during 1970-2000

Adults	Frequency	Children	Frequency
Adults	11269	Child	1949
Middle Age	11152	Child-preschool	1028
Aged	8155	Infants	800
Adolescence	3101	Infant-newborn	570
Aged 80 & over	2568	Infant-premature	45

3.2.3 **Diseases afflicting the human body** : Clustering of descriptors under the heading of diseases showed that the number of descriptors for neoplasms were the highest (2361), followed by Diseases in general (1381) , Diabetes (162) , AIDS (44) and Myopia (23) .

There were more than fifty types of neoplasms affecting different parts of the human body. The following were among the most frequently occurring types of neoplasms as seen in Table 10.

Table 10 : Frequencies of occurrence of descriptors on neoplasms in the human body as retrieved from the MEDLINE CDROM database

Types of neoplasms	Frequency
Skin-Neoplasms	529
Laryngeal-Neoplasms	435
Cervix-Neoplasms	339
Esophageal-Neoplasms	249
Lung-Neoplasms	225

The MeSH descriptors for Diseases in general, afflicting different parts of the human anatomy are given in Table 11.

Table 11 : Frequencies of occurrence of descriptors on diseases in general as retrieved from the MEDLINE CDROM database for medical applications of lasers

Diseases	Frequency
Retinal-Diseases	1178
Eye-Diseases	539
Skin-Diseases	455
Lung-Diseases	194
Iris-Diseases	186

**3.2.4 Diagnostic methods, techniques and equipment :** There were several descriptors for various diagnostic techniques such as Laser lithotripsy, Differential diagnosis, Confocal microscopy, Biopsy, Computer assisted image processing etc. The five top ranking diagnostic methods are given in Table 12.

Table 12 : Frequencies of occurrence of descriptors of top ranking diagnostic methods on medical applications of lasers as retrieved from the MEDLINE CDROM database

Diagnostic method	Frequency
Lasers-Diagnostic-use	1489
Laser-Doppler-Flowmetry	1176
Fluorescein-Angiography	1077
Prognosis	804
Endoscopy	580

**3.25 Therapeutic methods, techniques and equipment :** The maximum number of records were found on the use of lasers for therapeutic purposes (7021). This was followed by laser surgery (6168). Surgery was performed for the removal of neoplasms and for the treatment of the diseases of the eye such as Corneal diseases, Myopia, Retinal detachment and Iris diseases. Radiotherapy was the third most frequently used therapeutic method, followed by Combined Modality Therapy and Photochemotherapy. Table 13 provides the details.

Table 13: Frequencies of occurrence of top ranking descriptors on therapeutic methods as retrieved from the MEDLINE CDROM database on medical applications of lasers

Therapeutic method	Frequency
Lasers-Therapeutic-Use	7021
Lasers-Surgery	6168
Radiotherapy	2671
Combined - Modality - Therapy	1096
Photochemotherapy	875

3.2.6 **Specific Applications of Lasers** : A total of 55 different applications of lasers were found in the entire data of MeSH content descriptors. Table 14 provides a listing.

Table 14 : Frequencies of occurrence of descriptors on medical applications of lasers for humans as retrieved from the MEDLINE CDROM database during 1970-2000

Freq. MeSH descriptor	Freq. MeSH descriptor
7021 Lasers-therapeutic-use	33 Lasers-utilization
6168 Laser-Surgery	23 Laser-Doppler-Flowmetry-standards
3895 Lasers-	23 Laser-Doppler-Flowmetry-statistics-and-numerical-data
2134 Laser-Surgery-methods	22 Laser-Surgery-contraindications
1489 Lasers-diagnostic-use	22 Lasers-history
1319 Laser-Surgery-instrumentation	19 Laser-Surgery-utilization
1201 Laser-Surgery-adverse-effects	17 Laser-Surgery-history
1176 Laser-Doppler-Flowmetry	15 Laser-Surgery-psychology
1154 Laser-Coagulation	13 Laser-Surgery-mortality
1154 Lasers-adverse-effects	10 Laser-Surgery-education
482 Laser-Excimer-Photorefractive Keratectomy	9 Laser-Coagulation-economics
426 Laser-Desorption-Mass-matrix-assisted-Spectrometry	9 Laser-Surgery-rehabilitation
327 Laser-Coagulation-methods	7 Laser-Coagulation-trends
307 Lasers-methods	6 Laser-Coagulation-standards
233 Laser-angioplasty	6 Laser-Surgery-classification
194 Laser-Coagulation-adverse-effects	5 Laser-Coagulation-statistics-and-numerical-data
191 Lasers-instrumentation	4 Laser-Coagulation-classification
170 Laser-Coagulation-instrumentation	3 Laser-Coagulation-nursing
126 Laser-Doppler-Flowmetry-methods	2 Laser-Coagulation-rehabilitation
119 Laser-angioplasty-instrumentation	2 Laser-Doppler-Flowmetry-utilization
114 Laser-Doppler-Flowmetry-instrumentation	1 Laser-Coagulation-contraindications
108 Laser-assisted-balloon-angioplasty	1 Laser-Coagulation-history
101 Laser-Surgery-nursing	1 Laser-Coagulation-mortality
99 Laser-Surgery-standards	1 Laser-Coagulation-utilization
90 Laser-Surgery-trends	1 Laser-Doppler-Flowmetry-classification
84 Laser-Surgery-economics	1 Laser-Doppler-Flowmetry-economics
80 Lasers-standards	1 Laser-Doppler-Flowmetry-nursing
45 Lasers-classification	1 Laser-Doppler-Flowmetry-trends
39 Laser-Surgery-statistics-and-numerical-data	

**3.2.7 Types of lasers used in medical research :** Among the various types of lasers used in Medicine, gas lasers were found to be used predominantly, and Carbon dioxide laser was among the most widely used lasers. Table 15 displays the use of gas lasers.

Table 15 : Frequencies of occurrence of descriptors on types of gas lasers used in the field of medical applications of lasers

Gas lasers	Frequency
Carbon dioxide	1210
Argon	874
Helium	190
Neon	169
Krypton	87

**3.2.8 Core subject areas :** Analysis of the MeSH data gave the following results. A total of 38,991 individual descriptors were obtained. These descriptors were clustered into broad categories based on the hierarchical tree structure of MeSH. Maximum number of studies were found for adult and middle aged populations who together, accounted for 64.3% of the total human population. Other target groups in descending order include studies on aged, adolescents, aged 80 and over and lastly, infants and children.

With respect to studies on human anatomical parts, the organ eye, found the highest favour, with extensive studies on various parts of eye, it's diseases and treatment. Studies on skin and skin diseases followed. Among the types of diseases afflicting humans, the maximum number of descriptors were found for neoplasms, followed by Diseases (general), Diabetes, AIDS and Myopia.

As far as the use of lasers for humans was concerned, more than 50 individual MeSH descriptors were obtained. The highest number of records were found on therapeutic uses of lasers. Second was laser surgery. Within surgery, eye surgery topped the list, followed by surgery for the removal of neoplasms or tumours. Third was the use of lasers as diagnostic tools, fourth was applications of lasers in laser-doppler flowmetry and lastly lasers used in coagulation.

#### **4 Conclusions**

Lasers have been used for a variety of applications. The results indicate, that eye has emerged as the single most widely studied human organ meriting a total of 395 MeSH descriptors. Its various diseases have also been heavily targeted for study. Damage to the retina, due to Diabetes, is quite common among developing countries and therefore, lasers have been used for diabetic retinopathy surgery. In the study of cardiovascular system, lasers have been beneficial for laser assisted balloon angioplasty. Lasers play a major role in surgery too, (surgery-general, resulted in a total of 1876 descriptors) especially for the removal of neoplasms (tumours). Though there have been cases of adverse effects of lasers, the beneficial effects far outweigh the adverse effects.

This study attempted to trace through statistical indicators, the development and evolution of a particular subject area. The discrepancy in the observed and expected values for author productivity probably indicates the following : all databases are selective to a large extent. Their coverage of publications, over a period of years, cannot be considered as an ideal, for the evolution and development of a subject area. Databases in general, including MEDLINE, give more importance to journal articles, at the expense of other primary research material, like institutional R&D Reports, Theses and Dissertations, Patents, Monographs etc. In slow growing or relatively static subject areas, there exists a predominance of select researchers and laboratories, with the result, that new authors are seen lesser than usual and even collaboration among authors gets progressively reduced.

In the case of journal productivity, there was a marked deviation from the Bradford's Law. This could be due to the fact, that the subject of study is interdisciplinary and multidisciplinary in nature. Moreover, a longer time frame is required for a subject to attain stability and evolve its own publication trends.

The MeSH terminology, was found to be highly indicative and representative of the research work undertaken on a subject, since each frequency count is directly proportional to the number of research articles published on a specific subject. The tree structure further enhanced and pinpointed the hierarchical linkages between broader and narrower subject fields, providing scope for macro as well as microlevel analysis.

As far as the practical aspects of this study are concerned, the list of core journals could become the basis for subscription of journals in a library. Researchers working in this field could channelize their research output through these journals. Core subject areas, identified in the study, could be of interest to researchers, in their future research activities. The various types of lasers could be considered for diagnostic and therapeutic purposes.

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## Appendix 1

Lotka's Inverse Square Law of Scientific Productivity : The first empirical analysis of a collection of publications for the purpose of studying scientific output was carried out by Alfred I. Lotka in 1926. According to this law, there exists a correlation between the authors of scientific papers and their number of contributions. Lotka's Law describes the frequency of publication by authors in a given field. It states that the number (of authors) making  $n$  contributions is about  $1/n^2$  of those making one; and the proportion of all contributors, that make a single contribution, is about 60 percent. This means that out of all the authors in a given field, 60 percent will have just one publication, and 15 percent will have two publications ( $1/2^2$  times 60). 7 percent of authors will have three publications ( $1/3^2$  times 60), and so on. According to Lotka's Law of scientific productivity, only six percent of the authors in a field will produce more than 10 articles. Lotka's Law, when applied to large bodies of literature over a fairly long period of time, can be accurate in general, but not statistically exact.

Lotka counted the number of scientists who were listed as authors of one, two, three... papers in Chemical Abstracts for the period 1907-1916. After smoothing out the statistical data, he obtained the following dependence. Mathematically it stands as

$$n_i = n_1/i^2, i = 1, 2, 3, \dots, i_{\max}$$

where  $n_1$  is the number of scientists who wrote one paper (single paper authors) and  $i_{\max}$  is the maximum productivity of a scientist.

$$\text{or } y_n = k/n^\alpha$$

where  $k$  and  $\alpha$  are the constants for a set of data  $n$  (number of contributions) = 1, 2, 3, .....  $m_{\max}$   $y_n$  = number of authors contributing  $n$  papers each.

It has been observed that certain subject disciplines do not strictly adhere to Lotka's Law i.e. the  $\alpha$  value will not be 2. Therefore to what extent author productivity confirms to his law has to be tested. So, the values of  $\alpha$  are altered so as to fit or come closer to the ideal Lotka values.

## Appendix 2

Addresses of the ten leading authors in the field of medical applications of lasers, as identified and taken from the MEDLINE CDROM database

J. Haut	Service d'Ophthalmologie, Centre Hospitalier National d'Ophthalmologie des Quinze -Vingts, Paris, France
M. Landthaler	Dept. of Dermatology, Univ. of Regensburg, Germany
G. Coscas	Clinique Ophthalmologique, Universitaire de Creteil, Univ. Paris XII, Creteil, France
S. G. Bown	National Medical Laser Centre, Dept. of Surgery, Univ. College, London Medical School, London UK
P. Bjerring	Dept. of Dermatology, Univ. Hospital of Aarhus, Denmark
J. Marshall	Dept. of Ophthalmology, UMDS, St. Thomas's Hospital, London, UK
D.B. Apfelberg	Dept. of Plastic Surgery, Stanford Univ. Medical Center, California, USA
T.Seiler	Dept. of Ophthalmology, Univ. Hospital of the Technical University of Dresden, Germany
R.R. Anderson	Wellman Laboratories, Boston, Massachusetts 02114, USA
S.M. Shapshay	Dept. of Otolaryngology, Head & Neck Surgery, Lahey Clinic Medical Center, Burlington, Massachusetts 01805, USA

### Appendix 3

Bradford's Law of Scattering : Bradford's Law serves as a general guideline to librarians in determining the number of core journals in any given field. It states that journals in a single field can be divided into three parts, each containing approximately, the same number of articles: 1) a core of journals on the subject, relatively few in number, that produces approximately one-third of all the articles, 2) a second zone, containing the same number of articles as the first, but a greater number of journals, and 3) a third zone, containing the same number of articles as the second, but a still greater number of journals. The mathematical relationship of the number of journals in the core to the first zone is a constant  $n$  and to the second zone the relationship is  $n^2$ . Bradford expressed this relationship as  $1 : n : n^2$ . Bradford formulated his law after studying a bibliography of Geophysics, covering 326 journals in the field. He discovered that 9 journals contained 429 articles, 59 contained 499 articles, and 258 contained 404 articles. So it took 9 journals to contribute one-third of the articles, 5 times 9, or 45, to produce the next third, and 5 times 5 times 9, or 225, to produce the last third. According to the Law of Scattering, if  $T_x$  represents the number of journals having  $x$  references, ;  $T_{2x}$  the total number of journals having  $2x$  references and  $T_{3x}$  the total number of journals having  $3x$  references,... etc. then

$$T_x : T_{2x} : T_{3x} = 1 : n : n^2$$

where  $n$  may be any number depending on the value chosen for  $x$ .

### Appendix 4

Garfield's Law of Concentration : According to Eugene Garfield, the father of Science Citation Index (SCI), "a basic concentration of journals is the common core or nucleus of all fields ". It means the tail of literature of one discipline may form the cores or nuclei of the literature of other disciplines. There is a substantial amount of overlap of disciplines, and consequently of journals, especially in Science. With the result that the core of the entire scientific literature may be concentrated in just around 1000 journals.

This can be substantiated by the fact that only 250 journals published around half of the 3.85 million references, printed in the SCI, for the year 1969.

Appendix 5 : Additional list of journals in the field of medical applications of laser  
(continued from Table 5)

Frequency	Journal title	Frequency	Journal title
267	Dermatol-Surg	75	J-Photochem-Photobiol-B
235	Laryngoscope	74	Int-Ophthalmol
217	J-Fr-Ophtalmol	74	HNO
206	J-Urol	72	Br-J-Surg
188	Retina	71	Laryngorhinootologie
186	Vestn-Oftalmol	70	Trans-Ophthalmol-Soc-U-K
186	Khirurgiia-Mosk	70	Phys-Med-Biol
171	Ophthalmologe	69	Photochem-Photobiol
168	Klin-Khir	69	Nippon-Rinsho
166	J-Dermatol-Surg-Oncol	68	Ugeskr-Laeger
165	Ann-Otol-Rhinol-Laryngol	67	Ter-Arch
164	Plast-Reconstr-Surg	66	Trans-Am-Ophthalmol-Soc
161	Invest-Ophthalmol-Vis-Sci	66	Vrach-Delo
156	Gastrointest-Endosc	65	J-Immunol-Methods
154	Cytometry	65	Hautarzt
150	Graefes-Arch-Clin-Exp-Ophthalmol	65	Surv-Ophthalmol
146	J-Biol-Chem	65	Med-Phys
146	Endoscopy	65	Fortschr-Med
145	Klin-Oczna	65	Br-J-Urol
144	Chest	64	Anal-Biochem
143	J-Am-Acad-Dermatol	64	Chung-Hua-Yen-Ko-Tsa-Chih
139	Eye	64	Ned-Tijdschr-Geneskd
137	Ophthalmic-Surg-Lasers	64	Am-Heart-J
135	Obstet-Gynecol	64	Angiology
129	Arch-Dermatol	63	Otolaryngol-Clin-North-Am
129	Urology	62	Cesk-Oftalmol
127	Ann-Ophthalmol	61	Can-J-Ophthalmol
127	Nippon-Ganka-Gakkai-Zasshi	61	Gan-To-Kagaku-Ryoho
123	Fortschr-Ophthalmol	61	J-Refract-Corneal-Surg
122	Ophthalmologica	60	Int-J-Microcirc-Clin-Exp
122	Br-J-Dermatol	59	Jpn-J-Ophthalmol
122	Otolaryngol-Head-Neck-Surg	59	Cornea
119	Lancet	58	JAMA
118	Bull-Soc-Belge-Ophtalmol	58	Klin-Med-Mosk
116	Int-Ophthalmol-Clin	58	Probl-Tuberk
115	Refract-Corneal-Surg	58	Anesthesiology
111	Acta-Ophthalmol-Copenh	58	Eur-Urol
110	Ann-Thorac-Surg	58	Contact-Dermatitis
108	J-Reprod-Med	58	J-Glaucoma
103	Am-J-Obstet-Gynecol	56	Neurosurgery
101	Ann-Plast-Surg	55	J-Am-Intraocul-Implant-Soc
100	Vopr-Kurortol-Fizioter-Lech-Fiz-Kult	54	Biochim-Biophys-Acta
99	Br-J-Obstet-Gynaecol	54	J-Histochem-Cytochem
98	J-Am-Coll-Cardiol	54	Gut
97	Sov-Med	53	Am-J-Gastroenterol
97	Fertil-Steril	53	Cathet-Cardiovasc-Diagn
97	J-Laryngol-Otol	53	Dermatol-Clin
96	Radiology	53	Adv-Otorhinolaryngol
96	Vestn-Otorinolaringol	53	Rapid-Commun-Mass-Spectrom
96	J-Invest-Dermatol	52	Gastroenterology
92	Clin-Chem	52	J-Thorac-Cardiovasc-Surg
92	Stomatologiia-Mosk	52	Vestn-Khir-Im-I-I-Grek
92	Electrophoresis	51	Med-Biol-Eng-Comput
91	J-Endourol	51	Presse-Med
90	Oftalmol-Zh	51	Microvasc-Res
86	Am-J-Cardiol	51	J-Vasc-Surg
85	Biochemistry	50	Med-Tekh
84	Acta-Derm-Venereol	49	Am-J-Surg
84	Anal-Chem	49	Br-J-Plast-Surg
81	Acta-Ophthalmol-Scand	49	Urol-Nefrol-Mosk
80	Vestn-Khir	49	Indian-J-Ophthalmol
80	J-Clin-Laser-Med-Surg	49	Ann-Acad-Med-Singapore
79	Circulation	49	BMJ
78	Arch-Otolaryngol-Head-Neck-Surg	48	IEEE-Trans-Biomed-Eng
76	AORN-J	48	Prog-Clin-Biol-Res
75	Proc-Natl-Acad-Sci-U-S-A	48	Urologe-A
75	Dtsch-Med-Wochenschr	48	Gynecol-Oncol
75	Aust-N-Z-J-Ophthalmol	48	J-Appl-Physiol

(truncated)

Appendix 6 : Digestive system (continued from Table 8)

Freq.	Descriptor	Freq.	Descriptor
138	Esophageal-Neoplasms-complications	32	Sigmoid-Neoplasms-surgery
138	Rectal-Neoplasms-surgery	30	Cardia-
131	Gastrointestinal-Hemorrhage-etiology	30	Dental-Pulp-Cavity-radiation-effects
126	Dental-Enamel-radiation-effects	29	Gingiva-blood-supply
122	Esophageal-Neoplasms-therapy	28	Molar-
117	Dentin-radiation-effects	28	Mouth-Diseases-radiotherapy
107	Mouth-Neoplasms-surgery	28	Rectal-Diseases-surgery
103	Gastrointestinal-Neoplasms-surgery	27	Anus-Neoplasms-surgery
99	Gastrointestinal-Hemorrhage-therapy	27	Colonic-Polyps-surgery
97	Uvula-surgery	27	Gastrosocopy-methods
93	Esophageal-Neoplasms-pathology	27	Palate-surgery
88	Esophageal-Neoplasms-drug-therapy	27	Stomach-Neoplasms-radiotherapy
87	Dentin-ultrastructure	27	Mouth-Mucosa-pathology
86	Mouth-Diseases-surgery	27	Pharyngeal-Diseases-surgery
78	Gastric-Mucosa-blood-supply	27	Rectal-Neoplasms-pathology
77	Esophageal-Neoplasms-radiotherapy	26	Dental-Enamel-drug-effects
77	Gastrointestinal-Diseases-surgery	26	Dental-Models
75	Dental-Enamel-ultrastructure	26	Intestinal-Obstruction-etiology
75	Palate-Soft-surgery	26	Pharyngeal-Neoplasms-surgery
74	Stomach-Neoplasms-pathology	25	Colon-blood-supply
71	Colonic-Neoplasms-surgery	25	Colonic-Diseases-surgery
67	Esophageal-Stenosis-etiology	25	Esophagoscopy-instrumentation
63	Pharynx-surgery	25	Intestinal-Mucosa-blood-supply
62	Esophageal-Stenosis-surgery	25	Intestinal-Mucosa-pathology
62	Esophageal-Stenosis-therapy	25	Tooth-radiation-effects
60	Common-Bile-Duct-Calculi-therapy	24	Esophagus-
58	Esophageal-Neoplasms-mortality	24	Liver-metabolism
58	Liver-Neoplasms-secondary	24	Periodontal-Diseases-surgery
55	Colonic-Neoplasms-pathology	24	Rectum-surgery
53	Colonoscopy-	24	Tooth-Root-ultrastructure
50	Liver-Neoplasms-surgery	23	Bicuspid-
49	Dental-Caries-prevention-and-control	23	Dental-Caries-pathology
48	Dental-Pulp-blood-supply	23	Dental-Enamel-chemistry
48	Stomach-Neoplasms-therapy	23	Dental-Restoration-Permanent-methods
46	Intestinal-Polyps-surgery	23	Esophageal-and-Gastric-Varices-surgery
46	Liver-Neoplasms-therapy	23	Gastrointestinal-System-surgery
45	Duodenoscopy-	22	Dental-Bonding-methods
45	Liver-surgery	22	Dental-Caries-diagnosis
43	Dental-Cavity-Preparation-instrumentation	22	Gastrectomy-
43	Intestinal-Obstruction-surgery	22	Gastrectomy-methods
42	Esophagus-surgery	22	Gastrointestinal-Diseases-diagnosis
42	Gastrointestinal-Hemorrhage-diagnosis	22	Bile-Duct-Diseases-therapy
42	Stomach-Ulcer-complications	22	Liver-Cirrhosis-complications
41	Common-Bile-Duct-Calculi-surgery	22	Tongue-Neoplasms-pathology
41	Esophagus-pathology	22	Vater' sAmpulla-surgery
41	Mouth-Neoplasms-pathology	21	Dental-Instruments
41	Tongue-Neoplasms-surgery	21	Dental-Pulp-physiology
40	Dental-Caries-therapy	21	Gastrointestinal-Neoplasms-drug-therapy
40	Gastric-Mucosa-pathology	21	Dentin-Permeability-radiation-effects
39	Dental-Bonding	21	Liver-Diseases-surgery
38	Dental-Cavity-Preparation-methods	21	Liver-cytology
38	Duodenal-Ulcer-complications	21	Stomach-Diseases-surgery
36	Dental-Equipment	21	Stomach-pathology
36	Stomach-blood-supply	20	Dental-Restoration-Permanent
35	Dental-Pulp-radiation-effects	20	Digestive-System-Neoplasms-surgery
34	Esophageal-Neoplasms-diagnosis	20	Esophagectomy-
34	Stomach-Neoplasms-complications	20	Gastric-Mucosa-metabolism
33	Esophageal-and-Gastric-Varices-therapy	20	Dentin-Sensitivity-radiotherapy
33	Stomach-Neoplasms-drug-therapy	20	Stomach-Neoplasms-diagnosis
33	Stomach-Ulcer-surgery	20	Stomach-Ulcer-radiotherapy
33	Stomach-surgery	20	Tooth-anatomy-and-histology
33	Mouth-Mucosa-surgery	19	Colon-pathology
33	Tooth-Root-radiation-effects	19	Dental-Enamel-pathology
32	Esophagoscopy-methods	19	Gastrointestinal-Neoplasms-therapy
32	Liver-Neoplasms-pathology	19	Dentistry-Operative-instrumentation
32	Liver-pathology	19	Incisor-
32	Duodenal-Ulcer-surgery	19	Liver-Neoplasms-diagnosis

(truncated)

Appendix 7 : Sense organs (continued from Table 8)

Freq.	Descriptor	Freq.	Descriptor
432	Retinal-Diseases-surgery	67	Retinal-Diseases-physiopathology
404	Choroid-blood-supply	66	Retinal-Vein-Occlusion-surgery
328	Retinal-Detachment-etiology	64	Eye-radiation-effects
281	Eye-Diseases-surgery	64	Iris-pathology
261	Macular-Degeneration-surgery	63	Cornea-ultrastructure
258	Retina-pathology	61	Eye-Neoplasms-surgery
252	Retina-surgery	61	Eyelids-surgery
212	Corneal-Topography	61	Retinal-Vessels-physiopathology
197	Macular-Degeneration-complications	61	Sclera-
186	Cornea-physiopathology	60	Corneal-Transplantation-adverse-effects
181	Ciliary-Body-surgery	59	Eye-Diseases-diagnosis
171	Retinal-Diseases-etiology	59	Iris-blood-supply
160	Retinal-Perforations-surgery	58	Retinal-Neovascularization-etiology
159	Macula-Lutea	58	Vitreous-Body-pathology
159	Retinal-Diseases-diagnosis	56	Eye-Enucleation
156	Vitreous-Body-surgery	56	Retinal-Vein
152	Corneal-Transplantation-methods	55	Ciliary-Body-pathology
143	Macula-Lutea-surgery	55	Macular-Degeneration-etiology
138	Corneal-Diseases-surgery	55	Retinal-Perforations-complications
130	Retinal-Vessels	54	Macula-Lutea-blood-supply
127	Lens-Crystalline-surgery	53	Eye-Injuries-prevention-and-control
125	Retinal-Vessels-surgery	53	Retina-physiology
122	Macula-Lutea-pathology	53	Vitreous-Hemorrhage-surgery
120	Sclera-surgery	52	Cornea-anatomy-and-histology
119	Retinal-Diseases-pathology	52	Retina-radiation-effects
118	Retinal-Hemorrhage-etiology	51	Retinal-Vein-Occlusion-complications
116	Choroid-surgery	51	Retinal-Vein-surgery
115	Retinal-Detachment-prevention-and-control	50	Eye-Diseases-complications
112	Retinal-Neovascularization-surgery	50	Uveal-Diseases-surgery
108	Corneal-Diseases-etiology	49	Eye-blood-supply
106	Corneal-Transplantation	48	Eye-Diseases-therapy
105	Lens-Implantation-Intraocular	48	Retinal-Detachment-physiopathology
105	Retinal-Diseases-complications	47	Eye-Injuries-complications
105	Retinal-Hemorrhage-surgery	47	Retinal-Perforations-pathology
105	Vitreous-Body	46	Lacrimal-Duct-Obstruction-surgery
103	Retinal-Vessels-pathology	46	Retinal-Diseases-therapy
100	Eye-Injuries-etiology	45	Choroid-Neoplasms-pathology
100	Macular-Degeneration-diagnosis	44	Anterior-Eye-Segment-surgery
97	Macular-Edema-Cystoid-surgery	44	Choroidal-Neovascularization-etiology
95	Retina-injuries	44	Choroidal-Neovascularization-surgery
94	Retinal-Detachment-diagnosis	44	Corneal-Opacity-surgery
91	Pupil-	43	Eyelid-Diseases-surgery
90	Retinopathy-of-Prematurity-surgery	43	Anterior-Chamber
89	Choroid-pathology	43	Aqueous-Humor-cytology
89	Scleral-Buckling	43	Corneal-Stroma-pathology
88	Eye-surgery	43	Retinal-Detachment-therapy
88	Corneal-Opacity-etiology	42	Choroid-
88	Macular-Edema-Cystoid-etiology	41	Eye-Proteins-metabolism
87	Eye-Diseases-etiology	40	Lens-Crystalline-pathology
86	Cornea-physiology	39	Corneal-Opacity-pathology
86	Retinal-Detachment-complications	39	Retinal-Hemorrhage-diagnosis
85	Corneal-Stroma-surgery	37	Eye-Movements
84	Anterior-Chamber-surgery	37	Aqueous-Humor-physiology
83	Corneal-Diseases-pathology	37	Cornea-radiation-effects
81	Macular-Degeneration-physiopathology	36	Cornea-drug-effects
79	Retinal-Vessels-physiology	35	Macular-Degeneration-therapy
77	Cornea-injuries	35	Retina-blood-supply
77	Retina-physiopathology	35	Retinal-Perforations-diagnosis
77	Retinal-Degeneration-surgery	35	Uveal-Diseases-etiology
76	Iris-Diseases-surgery	34	Corneal-Dystrophies-Hereditary-surgery
76	Retinal-Perforations-etiology	34	Iris-Diseases-etiology
75	Retinal-Detachment-pathology	34	Macula-Lutea-physiopathology
74	Aqueous-Humor-metabolism	34	Retina-anatomy-and-histology
73	Anterior-Chamber-pathology	34	Retinal-Neovascularization-diagnosis
73	Macular-Degeneration-pathology	34	Sclera-pathology
70	Eye-Protective-Devices	32	Eye-Diseases-pathology
70	Choroid-Neoplasms-surgery	32	Macular-Edema-Cystoid-physiopathology
68	Eyeglasses-		

(truncated)

Appendix 8 : Human physiology (continued from Table 8)

Freq.	Descriptor	Freq.	Descriptor
236	Skin-Diseases-surgery	25	Knee-Joint
213	Skin-Neoplasms-pathology	25	Pelvic-Neoplasms-surgery
172	Skin-drug-effects	24	Breast-Neoplasms-drug-therapy
167	Skin-radiation-effects	24	Breast-Neoplasms-genetics
144	Fingers-blood-supply	24	Breast-Neoplasms-metabolism
136	Skin-Temperature	24	Dermatitis-Contact-etiology
126	Facial-Neoplasms-surgery	24	Neck-surgery
122	Skin-innervation	24	Skin-Diseases-etiology
107	Mouth-Neoplasms-surgery	24	Skin-Neoplasms-secondary
104	Forearm-blood-supply	24	Skin-Physiology
101	Skin-Neoplasms-radiotherapy	23	Arm-
99	Face-surgery	23	Neck-
93	Head-and-Neck-Neoplasms-surgery	23	Skin-Temperature-drug-effects
91	Body-Temperature	23	Skin-anatomy-and-histology
89	Skin-Aging	23	Toes-blood-supply
86	Mouth-Diseases-surgery	22	Face-blood-supply
83	Foot-blood-supply	22	Skin-Absorption
79	Skin-metabolism	22	Skin-Aging-pathology
73	Skin-physiology	22	Skin-Pigmentation-radiation-effects
71	Skin-Neoplasms-therapy	21	Breast-Neoplasms-therapy
70	Breast-Neoplasms-pathology	21	Facial-Dermatoses-pathology
68	Skin-Neoplasms-drug-therapy	21	Hair-transplantation
68	Skin-Transplantation	21	Skin-chemistry
68	Skin-injuries	20	Dermatitis-Allergic-Contact-etiology
68	Skin-physiopathology	20	Hair-Removal
65	Skin-Temperature-physiology	20	Skin-Neoplasms-etiology
64	Face-	19	Facial-Neoplasms-radiotherapy
63	Hair-Removal-methods	19	Leg-Ulcer-therapy
60	Breast-Neoplasms-surgery	19	Mouth-Neoplasms-drug-therapy
56	Skin-Pigmentation	19	Nose-surgery
52	Facial-Dermatoses-surgery	19	Skin-
49	Skin-Neoplasms-diagnosis	19	Skin-Diseases-diagnosis
48	Hand-blood-supply	18	Body-Temperature-Regulation
47	Skin-Diseases-pathology	18	Hip-Prosthesis
44	Forearm-	18	Mouth-Mucosa-radiation-effects
43	Skin-Diseases-therapy	18	Skin-Diseases-Vascular-surgery
42	Head-and-Neck-Neoplasms-pathology	18	Skin-Neoplasms-blood-supply
41	Mouth-Neoplasms-pathology	17	Body-Temperature-radiation-effects
40	Leg-	17	Skin-Neoplasms-physiopathology
39	Nose-Neoplasms-surgery	16	Extremities-blood-supply
39	Skin-cytology	16	Facial-Dermatoses-etiology
38	Skin-ultrastructure	16	Leg-Ulcer-surgery
37	Hand-	16	Lip-surgery
37	Skin-Diseases-radiotherapy	16	Mouth-Diseases-therapy
37	Skin-Tests	16	Skin-Tests-methods
36	Head-and-Neck-Neoplasms-drug-therapy	16	Sweating-physiology
36	Skin-ultrasonography	15	Body-Mass-Index
34	Facial-Neoplasms-pathology	15	Body-Weight
34	Skin-transplantation	15	Breast-surgery
33	Foot-Diseases-surgery	15	Cheek-
33	Head-and-Neck-Neoplasms-radiotherapy	15	Epidermis-metabolism
33	Head-and-Neck-Neoplasms-therapy	15	Foot-Dermatoses-surgery
33	Mouth-Mucosa-surgery	15	Hand-innervation
32	Body-Temperature-Regulation-physiology	15	Mouth-Neoplasms-diagnosis
32	Body-Temperature-physiology	15	Nail-Diseases-surgery
32	Lip-Neoplasms-surgery	15	Shoulder-Joint-surgery
31	Epidermis-pathology	15	Skin-Diseases-physiopathology
31	Fingers-	14	Body-Water-metabolism
29	Abdomen-surgery	14	Breast-pathology
28	Knee-Joint-surgery	14	Cleft-Palate-surgery
28	Mouth-Diseases-radiotherapy	14	Dermatitis-Irritant-etiology
27	Breast-Neoplasms-diagnosis	14	Facial-Dermatoses-radiotherapy
27	Breast-Neoplasms-radiotherapy	14	Fingers-surgery
27	Face-anatomy-and-histology	14	Leg-Ulcer-physiopathology
27	Mouth-Mucosa-pathology	14	Leg-surgery
26	Head-and-Neck-Neoplasms-diagnosis	14	Nails-blood-supply
26	Nose-Diseases-surgery	14	Nose-Neoplasms-pathology
26	Skin-Neoplasms-complications	14	Skin-Aging-physiology
26	Skin-Neoplasms-congenital	13	Abdominal-Neoplasms-surgery
25	Arm-blood-supply		(truncated)



## Appendix 9 : Urinogenital system (continued from Table 8)

Freq.	Descriptor	Freq.	Descriptor
153	Endometriosis-surgery	23	Urinary-Calculi-chemistry
150	Ureteral-Calculi-therapy	22	Genital-Neoplasms-Male-surgery
132	Genital-Diseases-Female-surgery	22	Ureteral-Obstruction-surgery
119	Cervix-Dysplasia-surgery	22	Urologic-Neoplasms-surgery
104	Genital-Neoplasms-Female-surgery	22	Vaginal-Diseases-surgery
103	Endometrium-surgery	21	Penile-Neoplasms-therapy
99	Cervix-Uteri-pathology	21	Ureterscopy-methods
94	Vulvar-Neoplasms-surgery	21	Vagina-surgery
86	Cervix-Uteri-surgery	21	Vaginal-Neoplasms-pathology
81	Penile-Neoplasms-surgery	20	Kidney-Failure-Chronic-therapy
76	Urinary-Calculi-therapy	20	Prostatic-Hyperplasia-diagnosis
74	Prostatic-Hyperplasia-therapy	20	Urethra-
72	Bladder-Neoplasms-pathology	20	Urinary-Calculi-surgery
70	Cervix-Neoplasms-diagnosis	20	Urodynamics-physiology
70	Vaginal-Neoplasms-surgery	19	Cervix-Neoplasms-epidemiology
69	Vaginal-Smears	19	Cervix-Neoplasms-radiotherapy
68	Bladder-Neoplasms-drug-therapy	19	Uterine-Hemorrhage-etiology
68	Prostatectomy-	19	Uterine-Neoplasms-pathology
66	Uterine-Neoplasms-surgery	19	Urinary-Retention-etiology
63	Urodynamics-	19	Vulva-pathology
61	Kidney-Calculi-therapy	19	Vulvar-Neoplasms-therapy
58	Fallopian-Tubes-surgery	18	Kidney-Calculi-surgery
55	Prostatic-Hyperplasia-complications	18	Ovarian-Cysts-surgery
53	Cervix-Dysplasia-pathology	18	Urography-
52	Prostatic-Hyperplasia-physiopathology	18	Vaginal-Neoplasms-therapy
51	Prostate-pathology	17	Genital-Diseases-Female-diagnosis
50	Prostatic-Neoplasms-surgery	17	Genital-Diseases-Female-therapy
48	Bladder-Neck-Obstruction-surgery	17	Ovarian-Diseases-surgery
48	Urologic-Diseases-surgery	17	Urination-Disorders-etiology
47	Vulvar-Neoplasms-pathology	17	Vulva-surgery
46	Endometriosis-complications	16	Cervix-Neoplasms-drug-therapy
44	Fallopian-Tube-Diseases-surgery	16	Cervix-Uteri-cytology
44	Ureterscopy-	16	Endometrium-pathology
44	Urethral-Stricture-surgery	16	Genital-Neoplasms-Female-drug-therapy
41	Prostatectomy-instrumentation	16	Ovarian-Neoplasms-drug-therapy
41	Prostatic-Hyperplasia-pathology	16	Penis-surgery
40	Cervix-Neoplasms-therapy	16	Urination-
40	Uterus-surgery	15	Cervix-Neoplasms-complications
36	Bladder-Neck-Obstruction-etiology	15	Kidney-pathology
36	Sperm-Motility	15	Kidney-surgery
36	Uterine-Hemorrhage-surgery	15	Prostatic-Diseases-surgery
35	Bladder-Neoplasms-diagnosis	15	Ureterscopy-instrumentation
35	Kidney-Neoplasms-surgery	15	Uterus-pathology
35	Urethral-Neoplasms-surgery	15	Urogenital-Neoplasms-surgery
34	Endometriosis-pathology	14	Bladder-Neoplasms-radiotherapy
34	Penile-Neoplasms-pathology	14	Kidney-metabolism
34	Prostatic-Neoplasms-pathology	14	Prostate-radiation-effects
34	Urinary-Catheterization	14	Sperm-Motility-drug-effects
33	Bladder-Neoplasms-therapy	14	Ureteral-Calculi-chemistry
33	Ovarian-Neoplasms-surgery	14	Ureteral-Obstruction-etiology
33	Vulvar-Diseases-surgery	14	Vagina-pathology
31	Cervix-Diseases-surgery	13	Bladder-Calculi-therapy
30	Endometriosis-diagnosis	13	Endometrium-drug-effects
30	Prostatic-Hyperplasia-ultrasonography	13	Genital-Neoplasms-Male-therapy
30	Urethra-surgery	13	Kidney-Diseases-surgery
29	Ureteral-Neoplasms-surgery	13	Kidney-Failure-Chronic-complications
28	Bladder-surgery	13	Kidney-Neoplasms-pathology
28	Prostatectomy-adverse-effects	13	Ovary-pathology
27	Uterus-blood-supply	13	Prostate-Specific-Antigen-blood
26	Bladder-pathology	13	Sperm-Count
26	Endometriosis-therapy	13	Ureter-injuries
26	Uterine-Diseases-surgery	13	Urethral-Diseases-surgery
25	Cervix-Dysplasia-diagnosis	13	Urethral-Obstruction-surgery
24	Genital-Neoplasms-Female-therapy	13	Uterine-Neoplasms-complications
24	Ovary-surgery	13	Uterus-abnormalities
24	Prostate-surgery	12	Bladder-Diseases-surgery
23	Genital-Neoplasms-Female-pathology	12	Genital-Diseases-Male-surgery
23	Kidney-Transplantation	12	Genitalia-Female-surgery
23	Ovarian-Neoplasms-pathology		

(truncated)

Appendix 10 : Nervous system (continued from Table 8)

Freq.	Descriptor	Freq.	Descriptor
52	Meningeal-Neoplasms-surgery	9	Cerebrospinal-Fluid-Proteins-analysis
49	Brain-metabolism	9	Cerebrovascular-Disorders-etiology
49	Sympathetic-Nervous-System-physiology	9	Nerve-Block-methods
47	Spinal-Cord-Neoplasms-surgery	9	Nerve-Tissue-Proteins-metabolism
42	Brain-Neoplasms-pathology	9	Optic-Nerve-abnormalities
39	Brain-Diseases-surgery	9	Spinal-Cord-Injuries-complications
39	Brain-blood-supply	9	Spinal-Nerve-Roots-surgery
39	Cerebrovascular-Circulation	8	Autonomic-Nervous-System-Diseases-etiology
39	Nerve-Fibers-physiology	8	Brain-Diseases-etiology
34	Brain-Neoplasms-therapy	8	Brain-Injuries-physiopathology
33	Brain-physiology	8	Brain-radiography
32	Optic-Nerve-blood-supply	8	Central-Nervous-System-Diseases-surgery
31	Brain-surgery	8	Cerebral-Cortex-ultrastructure
30	Brain-Neoplasms-radiography	8	Cerebrovascular-Disorders-therapy
30	Cerebrovascular-Circulation-physiology	8	Mechanoreceptors-physiology
27	Brain-Neoplasms-secondary	8	Meningeal-Neoplasms-radiography
26	Nerve-Block	8	Nerve-Fibers-Myelinated-physiology
25	Brain-Chemistry	8	Nerve-Tissue-Protein-S-100-analysis
25	Sympathetic-Nervous-System-physiopathology	8	Nervous-System-Diseases-therapy
24	Brain-Mapping	8	Optic-Nerve-Diseases-surgery
24	Brain-Neoplasms-diagnosis	8	Optic-Nerve-physiology
23	Optic-Nerve-Diseases-diagnosis	8	Pressoreceptors-physiology
22	Cerebral-Angiography	8	Somatosensory-Cortex-physiopathology
22	Optic-Nerve-anatomy-and-histology	8	Spinal-Cord-Diseases-surgery
21	Autonomic-Nerve-Block	8	Spinal-Cord-physiology
19	Brain-Neoplasms-radiotherapy	7	Autonomic-Nervous-System-Diseases-diagnosis
19	Brain-physiopathology	7	Brain-Neoplasms-mortality
17	Autonomic-Nervous-System-physiology	7	Cerebral-Hemorrhage-etiology
17	Brain-Neoplasms-drug-therapy	7	Cerebral-Revascularization-methods
17	Nerve-Fibers	7	Cerebral-Ventricles-pathology
17	Peripheral-Nerves-surgery	7	Cerebrovascular-Disorders-diagnosis
17	Spinal-Cord-Neoplasms-diagnosis	7	Hippocampus-metabolism
16	Autonomic-Nervous-System-physiopathology	7	Hippocampus-pathology
16	Cerebrovascular-Circulation-drug-effects	7	Median-Nerve-physiopathology
15	Cerebral-Ventricle-Neoplasms-surgery	7	Meningeal-Neoplasms-pathology
15	Cerebral-Ventricles-surgery	7	Meningioma-pathology
14	Autonomic-Nervous-System-Diseases-	7	Meningioma-radiography
14	Brain-ultrastructure	7	Nervous-System-Neoplasms-surgery
14	Cerebral-Hemorrhage-surgery	7	Optic-Neuritis-surgery
14	Nerve-Fibers-ultrastructure	7	Spinal-Cord-Neoplasms-pathology
14	Optic-Nerve-Diseases-etiology	7	Spinal-Cord-physiopathology
13	Brain-Neoplasms-metabolism	7	Sympathetic-Nervous-System-drug-effects
13	Brain-cytology	7	Visual-Cortex-physiology
13	Cerebral-Cortex-physiology	6	Brain-Diseases-metabolism
13	Cerebrovascular-Disorders-physiopathology	6	Brain-Diseases-physiopathology
13	Nerve-Fibers-drug-effects	6	Brain-Neoplasms-ultrastructure
13	Nerve-Tissue-Proteins-analysis	6	Brain-Stem-surgery
13	Optic-Nerve-Diseases-pathology	6	Cerebral-Ventricles
13	Spinal-Neoplasms-surgery	6	Cerebrovascular-Circulation-radiation-effects
12	Brain-anatomy-and-histology	6	Cerebrovascular-Disorders-radiotherapy
12	Brain-drug-effects	6	Median-Nerve-physiology
12	Optic-Nerve-Diseases-complications	6	Meningioma-diagnosis
12	Somatosensory-Cortex-physiology	6	Nerve-Fibers-chemistry
11	Brain-Diseases-pathology	6	Nerve-Tissue-Proteins-genetics
11	Cerebellar-Neoplasms-surgery	6	Nervous-System-Diseases-physiopathology
11	Cerebral-Cortex-blood-supply	6	Nervous-System-radiation-effects
11	Cerebral-Cortex-physiopathology	6	Optic-Nerve-physiopathology
11	Nervous-System-Diseases-surgery	6	Optic-Neuritis-parasitology
11	Optic-Nerve-Diseases-physiopathology	6	Photoreceptors-pathology
11	Peripheral-Nerves-physiology	6	Photoreceptors-physiology
11	Spinal-Cord-pathology	6	Spinal-Cord-surgery
11	Trigeminal-Neuralgia-therapy	6	Spinal-Nerve-Roots
10	Brain-Diseases-diagnosis	5	Brain-
10	Brain-radiation-effects	5	Brain-Ischemia-physiopathology
10	Cerebral-Aneurysm-surgery	5	Brain-Neoplasms-complications
10	Cerebral-Cortex-pathology	5	Brain-growth-and-development
10	Spinal-Cord-Injuries-physiopathology	5	Cerebral-Ventricle-Neoplasms-pathology
10	Spinal-Cord-blood-supply	5	Cerebrovascular-Disorders-complications
10	Trigeminal-Neuralgia-radiotherapy		

(truncated)

Appendix 11 : Cells and cell structure (continued from Table 8)

Freq.	Descriptor	Freq.	Descriptor
88	Cell-Nucleus-metabolism	18	Cell-Division-physiology
88	Antibodies-Monoclonal	18	Antibodies-immunology
81	Cell-Survival-drug-effects	17	Neutrophils-ultrastructure
80	Cell-Survival	17	Neurilemmoma-surgery
65	Cell-Separation	17	Erythrocyte-Indices
63	Cell-Nucleus-ultrastructure	17	Cell-Nucleus-drug-effects
61	Antibodies-Monoclonal-immunology	17	Cell-Transformation-Neoplastic
60	Cell-Division-drug-effects	16	Mitochondria-ultrastructure
58	Erythrocytes-physiology	16	Lymphocytes-chemistry
58	Cell-Cycle	16	Erythrocyte-Count
58	Cell-Membrane-metabolism	16	Epithelial-Cells-metabolism
49	Cell-Movement	16	Cell-Adhesion-drug-effects
47	Cytoplasm-metabolism	16	Cell-Death
46	Cell-Survival-radiation-effects	15	Monocytes-cytology
43	Cell-Adhesion	15	Mitochondria-drug-effects
41	Lymphocyte-Transformation	15	Erythrocytes-enzymology
39	Antibodies-Monoclonal-diagnostic-use	15	Cell-Polarity
38	Erythrocytes-radiation-effects	15	Antibody-Formation-radiation-effects
38	Cell-Division-radiation-effects	14	Neurons-metabolism
37	Neutrophils-metabolism	14	Neurons-physiology
36	Erythrocytes-metabolism	14	Connective-Tissue-pathology
35	Lymphocytes-radiation-effects	14	Cell-Adhesion-Molecules-analysis
35	Chromosome-Mapping	14	Cell-Fractionation
34	Neutrophils-drug-effects	14	Cell-Membrane-radiation-effects
34	Lymphocytes-cytology	13	Melanocytes-pathology
34	Lymphocytes-immunology	13	Lymphocytes-analysis
34	Cell-Separation-methods	13	Lymphocytes-classification
33	Mitochondria-metabolism	13	Lymphocyte-Transformation-drug-effects
32	Erythrocyte-Aggregation	13	Cytoplasm-chemistry
31	Erythrocytes-cytology	13	Chromosomes-Human-ultrastructure
30	Cell-Differentiation	13	Chromatin-ultrastructure
29	B-Lymphocytes-immunology	13	Cell-Adhesion-physiology
28	Cell-Membrane-ultrastructure	13	Cell-Membrane-Permeability-drug-effects
28	Antibody-Specificity	13	Cell-Membrane-pathology
27	Erythrocytes-	13	Antibodies-Monoclonal-pharmacology
27	Erythrocyte-Deformability	12	Mitochondria-radiation-effects
27	Cell-Nucleus-chemistry	12	Hela-Cells-ultrastructure
26	Neutrophils-physiology	12	Erythrocytes-chemistry
26	Erythrocytes-drug-effects	12	Erythrocyte-Membrane-ultrastructure
26	Erythrocyte-Membrane-metabolism	12	Cell-Communication
25	Cytosol-metabolism	12	Cell-Membrane-chemistry
25	Cell-Line-Transformed	12	Cell-Membrane-enzymology
25	Cell-Size	12	Cell-Membrane-immunology
25	Axons-physiology	12	Cell-Membrane-physiology
24	Cell-Membrane-Permeability	12	Antibodies-Monoclonal-analysis
23	Neutrophils-immunology	11	Neutrophils-enzymology
23	Lymphocytes-metabolism	11	Melanocytes-radiation-effects
23	Lymphocytes-ultrastructure	11	Lymphocytes-drug-effects
23	Chromosome-Aberrations	11	Lymphocytes-pathology
22	Spermatozoa-physiology	11	Erythrocytes-immunology
21	Subcellular-Fractions-metabolism	11	Erythrocytes-pathology
21	Neutrophils-cytology	11	Epithelial-Cells-cytology
21	Erythrocytes-ultrastructure	11	Epithelial-Cells-drug-effects
21	Erythrocyte-Membrane-physiology	11	Chromosomes-Human
21	Cell-Membrane-drug-effects	11	Chromatin-metabolism
20	Neutrophils-radiation-effects	11	Cell-Count-methods
20	Neurons-Afferent-physiology	11	Cell-Cycle-physiology
20	Monocytes-metabolism	11	Cell-Movement-physiology
20	Cytoplasm-ultrastructure	11	Antibody-Formation
20	Cell-Compartmentation	11	Antibodies-Monoclonal-therapeutic-use
19	Monocytes-immunology	10	Neutrophils-pathology
19	Cell-Membrane	10	Neurons-Afferent-drug-effects
19	Cell-Separation-instrumentation	10	Neurons-drug-effects
19	Antibodies-	10	Neurons-pathology
19	Antibodies-Monoclonal-metabolism	10	Monocytes-drug-effects
18	Neurons-ultrastructure	10	Lymphocytes-
18	Hela-Cells-radiation-effects	10	Lymphocyte-Transformation-radiation-effects
18	Erythrocyte-Membrane-drug-effects	10	Erythrocytes-analysis
18	Erythrocyte-Membrane-radiation-effects		

(truncated)

Appendix 12 : Musculoskeletal system (continued from Table 8)

Freq.	Descriptor	Freq.	Descriptor
66	Intervertebral-Disk-Displacement-surgery	12	Skull-surgery
48	Hand-blood-supply	11	Bone-Cements
48	Turbinates-surgery	11	Cartilage-Diseases-surgery
40	Leg-	11	Hand-Dermatoses-surgery
39	Nose-Neoplasms-surgery	11	Hand-Injuries-surgery
38	Muscles-blood-supply	11	Intervertebral-Disk-Displacement-pathology
37	Hand-	11	Intervertebral-Disk-pathology
33	Foot-Diseases-surgery	11	Jaw-surgery
31	Fingers-	11	Shoulder-
30	Lumbar-Vertebrae-surgery	11	Synovial-Membrane-pathology
28	Knee-Joint-surgery	10	Bone-Conduction
27	Lumbar-Vertebrae	10	Bone-and-Bones-pathology
27	Palate-surgery	10	Fingers-innervation
26	Nose-Diseases-surgery	10	Hand-surgery
26	Turbinates-pathology	10	Intervertebral-Disk-Displacement-complications
25	Arm-blood-supply	10	Intervertebral-Disk-Displacement-diagnosis
25	Axons-physiology	10	Nose-
25	Joint-Diseases-surgery	10	Synovial-Membrane-surgery
25	Knee-Joint	10	Temporal-Bone-surgery
25	Thoracoscopy-methods	9	Cartilage-transplantation
23	Arm-	9	Facial-Bones-anatomy-and-histology
23	Cartilage-Articular-surgery	9	Intervertebral-Disk-Displacement-radiography
23	Intervertebral-Disk-surgery	9	Joint-Diseases-therapy
23	Toes-blood-supply	9	Leg-Ulcer-pathology
22	Muscle-Smooth-Vascular-pathology	9	Muscle-Skeletal-innervation
22	Thoracoscopy-instrumentation	9	Muscle-Smooth-Vascular-physiopathology
22	Thoracotomy-	9	Muscles-innervation
21	Bone-Neoplasms-surgery	9	Nose-blood-supply
21	Maxilla-	9	Shoulder-Joint
21	Muscles-physiology	8	Alveolar-Process-pathology
20	Maxilla-surgery	8	Bone-Marrow-drug-effects
20	Muscle-Skeletal-blood-supply	8	Cartilage-Articular-radiation-effects
19	Leg-Ulcer-therapy	8	Facial-Bones-surgery
19	Muscles-pathology	8	Ligaments-Articular-surgery
19	Nose-surgery	8	Mandible-anatomy-and-histology
18	Bone-and-Bones-surgery	8	Mandible-pathology
18	Hip-Prosthesis	8	Muscle-Smooth-Vascular-metabolism
18	Mandible-surgery	8	Muscles-physiopathology
17	Bone-Transplantation	8	Orbit-
17	Lumbar-Vertebrae-pathology	8	Orbit-surgery
16	Extremities-blood-supply	8	Skull-
16	Leg-Ulcer-surgery	8	Temporomandibular-Joint-Diseases-surgery
16	Muscle-Contraction	8	Thoracotomy-methods
16	Muscle-Skeletal-physiology	8	Thorax-
15	Bone-Marrow-cytology	7	Bone-Marrow-Transplantation
15	Foot-Dermatoses-surgery	7	Bone-Marrow-Transplantation-adverse-effects
15	Hand-innervation	7	Bone-Plates
15	Muscle-Contraction-physiology	7	Bone-and-Bones-analysis
15	Muscle-Skeletal-metabolism	7	Bone-and-Bones-blood-supply
15	Shoulder-Joint-surgery	7	Facial-Bones-radiography
14	Bone-and-Bones-radiation-effects	7	Fingers-physiology
14	Fingers-surgery	7	Foot-Diseases-physiopathology
14	Leg-Ulcer-physiopathology	7	Foot-surgery
14	Leg-surgery	7	Hand-physiology
14	Nose-Neoplasms-pathology	7	Jaw-Diseases-therapy
14	Palatal-Neoplasms-surgery	7	Jaw-Neoplasms-surgery
13	Cervical-Vertebrae	7	Joint-Diseases-diagnosis
13	Foot-	7	Joint-Diseases-radiotherapy
13	Knee-Joint-pathology	7	Knee-Injuries-surgery
13	Muscle-Smooth-Vascular-physiology	7	Leg-Ulcer-radiotherapy
13	Muscles-metabolism	7	Lumbar-Vertebrae-radiography
13	Nasal-Septum-surgery	7	Mandibular-Neoplasms-surgery
13	Sternum-surgery	7	Muscle-Fibers-physiology
12	Ankle-blood-supply	7	Muscle-Skeletal-chemistry
12	Bone-Marrow-pathology	7	Muscle-Skeletal-pathology
12	Cartilage-Articular-pathology	7	Muscle-Smooth-Vascular-drug-effects
12	Leg-Ulcer-etiology	7	Muscles-surgery
12	Mandible-	7	Nose-pathology
12	Orbital-Neoplasms-surgery		

(truncated)

Appendix 13 : Cardiovascular system (continued from Table 8)

Freq.	Descriptor	Freq.	Descriptor
125	Retinal-Vessels-surgery	18	Retinal-Artery-physiology
122	Microcirculation-physiopathology	17	Aorta-physiology
119	Angioplasty-Laser-instrumentation	17	Arteries-
108	Angioplasty-Balloon-Laser-Assisted	17	Heart-radiation-effects
103	Retinal-Vessels-pathology	17	Lymph-Nodes-pathology
101	Angioplasty-Laser-methods	17	Myocardium-ultrastructure
96	Femoral-Artery	17	Retinal-Artery-pathology
92	Femoral-Artery-surgery	17	Retinal-Vessels-radiography
81	Heart-Valve-Prosthesis	16	Angioplasty-Balloon-Laser-Assisted-adverse-
79	Retinal-Vessels-physiology	16	Heart-Failure-Congestive-physiopathology
77	Angioplasty-Laser-adverse-effects	16	Heart-Transplantation
77	Coronary-Vessels-pathology	16	Retinal-Vein-pathology
70	Heart-Rate	15	Retinal-Artery-physiopathology
66	Retinal-Vein-Occlusion-surgery	15	Retinal-Vein-Occlusion-etiology
62	Popliteal-Artery-surgery	15	Umbilical-Arteries-physiology
61	Retinal-Vessels-physiopathology	14	Arteries-physiopathology
59	Myocardium-pathology	14	Carotid-Artery-Diseases-surgery
58	Popliteal-Artery	14	Heart-Defects-Congenital-surgery
56	Retinal-Vein	14	Retinal-Vein-Occlusion-therapy
55	Coronary-Vessels-surgery	13	Aortic-Valve-physiology
51	Retinal-Vein-Occlusion-complications	13	Carotid-Arteries-physiology
51	Retinal-Vein-surgery	13	Carotid-Arteries-surgery
45	Aorta-pathology	13	Coronary-Vessels-physiology
45	Heart-Catheterization	13	Heart-physiopathology
45	Heart-Rate-physiology	13	Mitral-Valve
44	Heart-Rate-drug-effects	12	Angioplasty-Balloon-Laser-Assisted-
38	Aorta-surgery	12	Angioplasty-Laser-statistics-and-numerical-data
38	Blood-	12	Blood-Vessels-physiology
36	Femoral-Artery-radiography	12	Coronary-Vessels
35	Iliac-Artery	12	Coronary-Vessels-physiopathology
35	Lymph-Node-Excision	12	Endocardium-surgery
34	Angioplasty-Balloon-Laser-Assisted-methods	12	Femoral-Artery-physiopathology
33	Iliac-Artery-surgery	12	Heart-Rate-Fetal
33	Saphenous-Vein-transplantation	12	Myocardium-cytology
32	Coronary-Vessels-radiography	12	Popliteal-Artery-pathology
31	Aortic-Diseases-surgery	12	Saphenous-Vein-surgery
31	Vasomotor-System-physiology	12	Umbilical-Veins
28	Arteries-physiology	12	Veins-surgery
28	Arteries-surgery	11	Aorta-Abdominal-pathology
28	Femoral-Artery-pathology	11	Aortic-Valve-Stenosis-physiopathology
28	Retinal-Vein-Occlusion-physiopathology	11	Arteries-ultrasonography
28	Veins-	11	Arteriovenous-Anastomosis-physiology
27	Coronary-Vessels-injuries	11	Blood-Vessels-radiation-effects
26	Microcirculation-radiation-effects	11	Femoral-Artery-ultrasonography
26	Vasomotor-System-physiopathology	11	Heart-Surgery
25	Retinal-Artery	11	Ophthalmic-Artery-ultrasonography
24	Arteries-pathology	11	Umbilical-Arteries-ultrasonography
24	Blood-Vessels-pathology	11	Umbilical-Veins-cytology
24	Heart-Assist-Devices	10	Angioplasty-Balloon-Laser-Assisted-statistics-
24	Heart-Ventricle-surgery	10	Aorta-anatomy-and-histology
24	Myocardium-metabolism	10	Blood-Vessels-anatomy-and-histology
24	Retinal-Vein-Occlusion-pathology	10	Carotid-Arteries-physiopathology
23	Heart-Conduction-System-surgery	10	Coronary-Vessels-anatomy-and-histology
23	Heart-physiology	10	Coronary-Vessels-radiation-effects
23	Retinal-Vein-Occlusion-diagnosis	10	Heart-Conduction-System-physiopathology
23	Retinal-Vessels-drug-effects	10	Heart-radionuclide-imaging
22	Retinal-Vein-physiopathology	10	Microcirculation-anatomy-and-histology
21	Aortic-Diseases-pathology	10	Myocardium-enzymology
21	Aortic-Valve	10	Retinal-Vessels-anatomy-and-histology
21	Coronary-Vessels-ultrasonography	10	Retinal-Vessels-metabolism
21	Heart-Catheterization-instrumentation	10	Vasomotor-System-drug-effects
21	Myocardium-chemistry	10	Veins-physiology
21	Retinal-Artery-surgery	9	Aorta-
20	Iliac-Artery-radiography	9	Aorta-Abdominal-surgery
20	Ophthalmic-Artery-physiology	9	Aortic-Valve-Stenosis-surgery
20	Popliteal-Artery-radiography	9	Arteries-injuries
20	Veins-transplantation	9	Blood-Vessels-abnormalities
19	Umbilical-Arteries-physiopathology	9	Blood-Vessels-drug-effects
18	Heart-Ventricle		

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## Appendix 14 Respiratory system (continued from Table 8)

Freq.	Descriptor	Freq.	Descriptor
193	Tracheal-Neoplasms-surgery	23	Voice-Disorders-etiology
184	Larynx-surgery	22	Laryngeal-Neoplasms-mortality
174	Tracheal-Stenosis-surgery	22	Tracheal-Neoplasms-radiotherapy
171	Laryngeal-Diseases-surgery	21	Bronchoscopy-adverse-effects
162	Laryngeal-Neoplasms-pathology	21	Laryngeal-Diseases-etiology
121	Vocal-Cords-surgery	21	Voice-Disorders-surgery
117	Laryngostenosis-surgery	20	Bronchial-Diseases-diagnosis
101	Bronchial-Diseases-surgery	20	Bronchial-Neoplasms-secondary
96	Tracheal-Stenosis-etiology	20	Respiratory-Tract-Diseases-surgery
91	Lung-Neoplasms-pathology	20	Tracheal-Neoplasms-secondary
87	Bronchoscopy-instrumentation	19	Bronchial-Neoplasms-mortality
83	Lung-Neoplasms-drug-therapy	19	Trachea-injuries
78	Trachea-surgery	18	Laryngostenosis-diagnosis
77	Bronchoscopy-methods	17	Respiratory-Tract-Neoplasms-surgery
74	Lung-Neoplasms-complications	17	Laryngostenosis-therapy
73	Tracheal-Diseases-surgery	16	Respiratory-Insufficiency-etiology
68	Lung-Neoplasms-radiotherapy	16	Respiratory-Sounds-etiology
66	Laryngeal-Neoplasms-radiotherapy	16	Laryngeal-Masks
65	Larynx-pathology	16	Trachea-
63	Lung-Neoplasms-therapy	15	Bronchi-radiation-effects
61	Lung-Neoplasms-diagnosis	15	Bronchial-Diseases-pathology
60	Laryngeal-Neoplasms-diagnosis	15	Lung-metabolism
60	Tracheotomy-	15	Tracheal-Stenosis-pathology
58	Laryngeal-Neoplasms-therapy	15	Vocal-Cords-physiopathology
57	Vocal-Cord-Paralysis-surgery	14	Laryngeal-Diseases-complications
55	Bronchi-surgery	14	Laryngeal-Neoplasms
55	Lung-Neoplasms-secondary	14	Larynx-injuries
54	Laryngoscopy-instrumentation	14	Tracheal-Stenosis-diagnosis
49	Laryngostenosis-etiology	14	Tracheoesophageal-Fistula-etiology
48	Turbinates-surgery	14	Vocal-Cord-Paralysis-etiology
48	Voice-Quality	14	Vocal-Cord-Paralysis-physiopathology
47	Laryngectomy-	14	Voice-
47	Tracheal-Stenosis-therapy	14	Voice-Disorders-diagnosis
46	Bronchial-Neoplasms-pathology	13	Laryngeal-Diseases-congenital
45	Lung-surgery	13	Lung-Diseases-Obstructive-surgery
44	Laryngeal-Neoplasms-drug-therapy	13	Lung-Diseases-pathology
43	Bronchial-Diseases-therapy	13	Lung-Diseases-therapy
42	Bronchial-Neoplasms-complications	13	Lung-Neoplasms-metabolism
42	Vocal-Cords-pathology	13	Tracheal-Diseases-diagnosis
41	Bronchial-Diseases-etiology	13	Tracheal-Neoplasms-drug-therapy
41	Tracheal-Neoplasms-complications	13	Tracheal-Neoplasms-radiography
39	Lung-Neoplasms-mortality	13	Tracheotomy-adverse-effects
38	Lung-Diseases-surgery	12	Bronchitis-etiology
38	Lung-pathology	12	Laryngeal-Neoplasms-microbiology
37	Bronchi-pathology	12	Lung-Diseases-radiography
37	Respiration-	12	Lung-Transplantation-adverse-effects
37	Respiratory-Function-Tests	12	Tracheal-Diseases-etiology
35	Laryngoscopy-methods	11	Bronchi-injuries
32	Laryngectomy-methods	11	Bronchial-Diseases-radiotherapy
32	Tracheostomy-	11	Bronchoalveolar-Lavage-Fluid-cytology
31	Vocal-Cords	11	Laryngeal-Cartilages-surgery
30	Tracheal-Neoplasms-pathology	11	Laryngeal-Diseases-physiopathology
29	Bronchial-Neoplasms-therapy	11	Laryngeal-Edema-surgery
29	Respiration-Artificial	11	Lung-blood-supply
29	Laryngeal-Diseases-diagnosis	10	Respiratory-Insufficiency-therapy
27	Lung-Neoplasms-radiography	10	Larynx-physiopathology
27	Trachea-pathology	10	Lung-Diseases-Obstructive-physiopathology
26	Bronchial-Neoplasms-radiotherapy	10	Lung-Neoplasms-epidemiology
26	Respiration-physiology	10	Lung-Neoplasms-physiopathology
26	Turbinates-pathology	10	Lung-Transplantation
25	Laryngeal-Neoplasms-complications	10	Lung-cytology
24	Bronchi-	10	Lung-physiopathology
24	Bronchial-Neoplasms-diagnosis	10	Lung-radiation-effects
24	Lung-radiography	10	Paranasal-Sinus-Neoplasms-surgery
24	Tracheal-Neoplasms-diagnosis	10	Pleura-surgery
24	Tracheal-Neoplasms-therapy	10	Tracheal-Diseases-pathology
23	Bronchial-Neoplasms-drug-therapy	10	Tracheostomy-adverse-effects
23	Respiration-Artificial-methods	9	Bronchitis-radiotherapy
23	Laryngeal-Diseases-pathology		

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Appendix 15 : Tissues and embryonic structures (continued from Table 8)

Freq.	Descriptor	Freq.	Descriptor
68	Epithelium-surgery	8	Bone-Marrow-drug-effects
49	Nasal-Mucosa-blood-supply	8	Cartilage-Articular-radiation-effects
40	Gastric-Mucosa-pathology	8	Epithelium-physiopathology
38	Blood-	8	Gastric-Mucosa-physiopathology
38	Muscles-blood-supply	8	Intestinal-Mucosa-surgery
33	Mouth-Mucosa-surgery	8	Membranes-
31	Membranes-Artificial	8	Muscles-physiopathology
27	Mouth-Mucosa-pathology	8	Nasal-Mucosa-metabolism
26	Cicatrix-	8	Nasal-Mucosa-pathology
26	Membranes-surgery	8	Placenta-surgery
25	Epithelium-cytology	7	Bone-and-Bones-analysis
25	Intestinal-Mucosa-blood-supply	7	Bone-and-Bones-blood-supply
25	Intestinal-Mucosa-pathology	7	Basement-Membrane-ultrastructure
24	Cicatrix-prevention-and-control	7	Bone-Marrow-Transplantation
24	Epithelium-physiology	7	Bone-Marrow-Transplantation-adverse-effects
24	Epithelium-ultrastructure	7	Cicatrix-radiotherapy
23	Cartilage-Articular-surgery	7	Connective-Tissue-radiation-effects
22	Epithelium-metabolism	7	Epithelium-radiation-effects
21	Muscles-physiology	7	Intestinal-Mucosa-cytology
21	Placenta-blood-supply	7	Mucous-Membrane-surgery
20	Gastric-Mucosa-metabolism	7	Muscles-surgery
19	Muscles-pathology	7	Neurilemmoma-pathology
19	Umbilical-Arteries-physiopathology	7	Placenta-enzymology
18	Bone-and-Bones-surgery	7	Placenta-pathology
18	Cicatrix-complications	6	Bone-Marrow-metabolism
18	Gastric-Mucosa-surgery	6	Bone-Marrow-radiation-effects
18	Intestinal-Mucosa-metabolism	6	Cartilage-cytology
18	Mouth-Mucosa-radiation-effects	6	Cicatrix-Hypertrophic-prevention-and-control
17	Gastric-Mucosa-drug-effects	6	Elastic-Tissue-pathology
17	Neurilemmoma-surgery	6	Fetus-surgery
16	Gastric-Mucosa-radiation-effects	6	Mouth-Mucosa-physiopathology
16	Mucous-Membrane-pathology	6	Mucous-Membrane-ultrastructure
15	Bone-Marrow-cytology	6	Muscle-Smooth-metabolism
15	Granulation-Tissue-pathology	6	Nasal-Mucosa-physiopathology
15	Membranes-pathology	5	Adipose-Tissue-pathology
15	Umbilical-Arteries-physiology	5	Adipose-Tissue-surgery
14	Bone-and-Bones-radiation-effects	5	Bone-and-Bones-metabolism
14	Chick-Embryo	5	Basement-Membrane
14	Cicatrix-Hypertrophic-surgery	5	Basement-Membrane-metabolism
14	Cicatrix-therapy	5	Cartilage-radiation-effects
14	Connective-Tissue-pathology	5	Cicatrix-diagnosis
14	Nasal-Mucosa-drug-effects	5	Fetus-cytology
13	Cicatrix-physiopathology	5	Fetus-metabolism
13	Muscles-metabolism	5	Gastric-Mucosa-physiology
13	Nasal-Mucosa-surgery	5	Gastric-Mucosa-secretion
12	Basement-Membrane-pathology	5	Mouth-Mucosa-cytology
12	Bone-Marrow-pathology	5	Muscles-analysis
12	Cartilage-Articular-pathology	5	Muscles-chemistry
12	Epithelium-drug-effects	5	Muscles-cytology
12	Fetus-	5	Muscles-transplantation
12	Granulation-Tissue-surgery	5	Nasal-Mucosa-immunology
12	Umbilical-Veins	5	Nasal-Mucosa-secretion
11	Cicatrix-Hypertrophic-etiology	5	Neurilemmoma-radiography
11	Granulation-Tissue	5	Placenta-metabolism
11	Mouth-Mucosa	5	Placenta-ultrasonography
11	Umbilical-Arteries-ultrasonography	5	Trophoblast-cytology
11	Umbilical-Veins-cytology	4	Adipose-Tissue-blood-supply
10	Bone-and-Bones-pathology	4	Amnion-metabolism
10	Epithelium-chemistry	4	Bone-and-Bones
10	Fetus-blood-supply	4	Bone-and-Bones-anatomy-and-histology
10	Fetus-physiology	4	Bone-and-Bones-transplantation
10	Mouth-Mucosa-blood-supply	4	Bone-Marrow-chemistry
9	Cartilage-transplantation	4	Cartilage-metabolism
9	Cicatrix-Hypertrophic-pathology	4	Connective-Tissue-anatomy-and-histology
9	Cicatrix-Hypertrophic-therapy	4	Embryo-cytology
9	Intestinal-Mucosa-drug-effects	4	Epithelium-enzymology
9	Intestinal-Mucosa-radiation-effects	4	Epithelium-immunology
9	Muscles-innervation	4	Epithelium-injuries
9	Umbilical-Arteries		

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Appendix 16 : Body fluids and related substances (continued from Table 8)

Freq.	Descriptor	Freq.	Descriptor
16	Tears-metabolism	2	Pleural-Effusion-radiography
15	Aqueous-Humor-secretion	2	Pleural-Effusion-surgery
14	Tears-secretion	2	Plasma-physiology
14	Aqueous-Humor	2	Plasma-radiation-effects
11	Milk-Human-chemistry	2	Pericardial-Effusion-surgery
11	Body-Fluids-chemistry	2	Pericardial-Effusion-therapy
11	Aqueous-Humor-chemistry	2	Mucus-physiology
10	Aqueous-Humor-drug-effects	2	Mucus-secretion
9	Urine-cytology	2	Milk-Human-enzymology
9	Cerebrospinal-Fluid-Proteins-analysis	2	Feces-microbiology
8	Tears-chemistry	2	Feces-parasitology
8	Saliva-chemistry	2	Cervix-Mucus
8	Aqueous-Humor-immunology	2	Cerebrospinal-Fluid-physiology
7	Hyalin-	2	Body-Fluids-physiology
7	Extracellular-Space-metabolism	2	Ascitic-Fluid-chemistry
7	Cervix-Mucus-physiology	2	Aqueous-Humor-microbiology
7	Amniotic-Fluid-cytology	2	Aqueous-Humor-radiation-effects
6	Tears-physiology	1	Urine-metabolism
6	Saliva-enzymology	1	Urine-physiology
6	Saliva-physiology	1	Tears-
6	Exudates-and-Transudates-metabolism	1	Tears-drug-effects
6	Body-Fluids	1	Tears-radiation-effects
6	Body-Fluids-analysis	1	Synovial-Fluid-drug-effects
6	Body-Fluids-metabolism	1	Synovial-Fluid-physiology
6	Aqueous-Humor-analysis	1	Sweat-physiology
6	Amniotic-Fluid-analysis	1	Sputum-
5	Synovial-Fluid-analysis	1	Sputum-analysis
5	Sputum-cytology	1	Sputum-immunology
5	Semen-cytology	1	Semen-enzymology
5	Saliva-analysis	1	Semen-physiology
5	Plasma-chemistry	1	Semen-radiation-effects
4	Semen-analysis	1	Saliva-Artificial-chemistry
4	Semen-chemistry	1	Pleural-Effusion-Malignant-diagnosis
4	Pericardial-Effusion-etiology	1	Pleural-Effusion-chemistry
4	Cerebrospinal-Fluid-Shunts	1	Pleural-Effusion-cytology
4	Amniotic-Fluid	1	Pleural-Effusion-drug-therapy
3	Urine-microbiology	1	Pleural-Effusion-enzymology
3	Tears-cytology	1	Pleural-Effusion-epidemiology
3	Tears-enzymology	1	Pleural-Effusion-immunology
3	Sweat-analysis	1	Pleural-Effusion-metabolism
3	Saliva-immunology	1	Pleural-Effusion-radiotherapy
3	Pleural-Effusion-Malignant-therapy	1	Plasma-analysis
3	Pleural-Effusion-diagnosis	1	Plasma-drug-effects
3	Pleural-Effusion-etiology	1	Plasma-immunology
3	Pleural-Effusion-therapy	1	Pancreatic-Juice-enzymology
3	Lymph-physiology	1	Mucus-
3	Lymph-radiation-effects	1	Mucus-analysis
3	Exudates-and-Transudates-chemistry	1	Mucus-cytology
3	Extracellular-Space	1	Mucus-drug-effects
3	Extracellular-Space-physiology	1	Mucus-metabolism
3	Cervix-Mucus-analysis	1	Milk-Human
3	Cervix-Mucus-cytology	1	Milk-Human-analysis
3	Bile-	1	Milk-Human-immunology
3	Ascitic-Fluid-metabolism	1	Lymph-immunology
2	Urine-	1	Lymph-metabolism
2	Urine-analysis	1	Lymph-secretion
2	Urine-chemistry	1	Labyrinthine-Fluids
2	Synovial-Fluid-chemistry	1	Hyalin-metabolism
2	Synovial-Fluid-immunology	1	Hyalin-radiation-effects
2	Synovial-Fluid-metabolism	1	Hemolymph-chemistry
2	Sputum-chemistry	1	Gastric-Juice-chemistry
2	Sputum-microbiology	1	Gastric-Juice-metabolism
2	Semen-Preservation	1	Feces-immunology
2	Sebum-secretion	1	Exudates-and-Transudates-analysis
2	Saliva-	1	Exudates-and-Transudates-physiology
2	Saliva-drug-effects	1	Exudates-and-Transudates-radiation-effects
2	Saliva-metabolism	1	Exudates-and-Transudates-ultrasonography
2	Saliva-microbiology	1	Extracellular-Space-enzymology
2	Saliva-radiation-effects		

(truncated)



Appendix 17 : Endocrine system (continued from Table 8)

Freq.	Descriptor	Freq.	Descriptor
5	Thyroid-Cartilage-surgery	1	Endocrine-Glands-drug-effects
5	Thyroidectomy-	1	Endocrine-Glands-radiation-effects
4	Parathyroid-Hormones-pharmacology	1	Endocrinology-
4	Pituitary-Irradiation	1	Endocrinology-trends
4	Thyroid-Gland	1	Islets-of-Langerhans-immunology
4	Thyroid-Neoplasms-complications	1	Islets-of-Langerhans-secretion
4	Thyroid-Neoplasms-genetics	1	Neurosecretory-Systems-physiopathology
4	Thyroid-Neoplasms-radiotherapy	1	Parathyroid-Glands-cytology
4	Thyroiditis- Autoimmune-immunology	1	Parathyroid-Glands-drug-effects
3	Adrenal-Cortex-Hormones-pharmacology	1	Parathyroid-Glands-injuries
3	Adrenal-Gland-Neoplasms-pathology	1	Parathyroid-Glands-metabolism
3	Adrenal-Gland-Neoplasms-surgery	1	Parathyroid-Glands-pathology
3	Adrenal-Glands-cytology	1	Parathyroid-Glands-secretion
3	Parathyroid-Glands-blood-supply	1	Parathyroid-Glands-transplantation
3	Pituitary-Gland-chemistry	1	Parathyroid-Hormones-analysis
3	Pituitary-Gland-radiation-effects	1	Parathyroid-Hormones-blood
3	Pituitary-Neoplasms-diagnosis	1	Parathyroid-Hormones-secretion
3	Pituitary-Neoplasms-physiopathology	1	Parathyroid-Neoplasms-complications
3	Thyroid-Diseases-immunology	1	Pineal-Body
3	Thyroid-Diseases-surgery	1	Pituitary-Adrenal-System-physiology
3	Thyroid-Gland-pathology	1	Pituitary-Adrenal-System-radiation-effects
3	Thyroid-Gland-surgery	1	Pituitary-Gland-Anterior
3	Thyroidectomy-adverse-effects	1	Pituitary-Gland-Anterior-blood-supply
3	Thyrotropin-blood	1	Pituitary-Gland-Anterior-chemistry
3	Thyroxine-blood	1	Pituitary-Gland-Anterior-cytology
2	Adrenal-Cortex-cytology	1	Pituitary-Gland-Anterior-enzymology
2	Adrenal-Cortex-metabolism	1	Pituitary-Gland-Anterior-physiology
2	Adrenal-Gland-Neoplasms-metabolism	1	Pituitary-Gland-Anterior-secretion
2	Adrenal-Glands-drug-effects	1	Pituitary-Gland-Anterior-surgery
2	Adrenal-Glands-secretion	1	Pituitary-Gland-Anterior-ultrastructure
2	Adrenal-Medulla-metabolism	1	Pituitary-Gland-Posterior-blood-supply
2	Chromaffin-Granules-metabolism	1	Pituitary-Gland-enzymology
2	Endocrine-Glands-physiology	1	Pituitary-Gland-radiography
2	Islets-of-Langerhans-cytology	1	Pituitary-Hormones-analysis
2	Islets-of-Langerhans-metabolism	1	Pituitary-Hormones-blood
2	Parathyroid-Neoplasms-surgery	1	Pituitary-Hormones-isolation-and-purification
2	Pineal-Body-radiation-effects	1	Pituitary-Hormones-radiation-effects
2	Pituitary-Gland-pathology	1	Pituitary-Neoplasms-analysis
2	Pituitary-Gland-surgery	1	Pituitary-Neoplasms-chemistry
2	Pituitary-Neoplasms-therapy	1	Pituitary-Neoplasms-enzymology
2	Thyroid-Cartilage-pathology	1	Pituitary-Neoplasms-epidemiology
2	Thyroid-Diseases-diagnosis	1	Pituitary-Neoplasms-genetics
2	Thyroid-Gland-physiopathology	1	Pituitary-Neoplasms-mortality
2	Thyroid-Gland-radiation-effects	1	Pituitary-Neoplasms-pathology
2	Thyroid-Neoplasms-diagnosis	1	Pituitary-Neoplasms-radiography
2	Thyroid-Neoplasms-mortality	1	Pituitary-Neoplasms-ultrastructure
2	Thyroid-Neoplasms-therapy	1	Thyroid-Cartilage-abnormalities
2	Thyroxine-analysis	1	Thyroid-Cartilage-anatomy-and-histology
1	Adrenal-Cortex-Hormones-blood	1	Thyroid-Diseases-complications
1	Adrenal-Cortex-Hormones-secretion	1	Thyroid-Diseases-pathology
1	Adrenal-Cortex-Neoplasms-metabolism	1	Thyroid-Diseases-physiopathology
1	Adrenal-Cortex-drug-effects	1	Thyroid-Diseases-radiotherapy
1	Adrenal-Cortex-physiology	1	Thyroid-Gland-abnormalities
1	Adrenal-Gland-Neoplasms-drug-therapy	1	Thyroid-Gland-blood-supply
1	Adrenal-Glands-growth-and-development	1	Thyroid-Hormones-pharmacology
1	Adrenal-Glands-metabolism	1	Thyroid-Neoplasms-blood-supply
1	Adrenal-Glands-pathology	1	Thyroid-Neoplasms-chemistry
1	Adrenal-Glands-physiology	1	Thyroid-Neoplasms-enzymology
1	Adrenal-Glands-physiopathology	1	Thyroid-Neoplasms-etiology
1	Adrenal-Glands-radiation-effects	1	Thyroid-Neoplasms-metabolism
1	Adrenal-Medulla-physiology	1	Thyroid-Nodule-diagnosis
1	Adrenal-Medulla-transplantation	1	Thyroid-Nodule-surgery
1	Adrenalectomy-instrumentation	1	Thyroiditis-Autoimmune-diagnosis
1	Adrenalectomy-methods	1	Thyroiditis-Autoimmune-drug-therapy
1	Chromaffin-Granules-secretion	1	Thyroiditis-Autoimmune-pathology
1	Endocrine-Diseases-complications	1	Thyroiditis-Autoimmune-radiotherapy
1	Endocrine-Diseases-radiotherapy	1	Thyroiditis-Autoimmune-surgery
1	Endocrine-Diseases-therapy	1	Thyroiditis-immunology
1	Endocrine-Glands-chemistry		

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