CHAPTER 2
REVIEW OF LITERATURE

2.1 Introduction

The Review of Literature is an important component of any research as it provides the researcher an overview of what has been done, what is being done and the area that seeks the attention for further research in the selected area of study. It also gives understanding of new techniques and methods used by previous researchers and there by enables the researcher to choose appropriate tool and techniques to proceed in the right direction. It is a source from where ideas are drawn and further developed into concepts and finally into theories. Thus, it helps to frame the research study on the chosen topic.

For this purpose, a retrospective search of literature is carried out by using GenBank, PubMed, Web of Science, Scopus, JCCC@infonet, and SJR databases. Attempts were also made to trace and collect the relevant research papers and related documents such as articles, conference papers, books, etc.

A good number of studies have been undertaken in the field of research evaluation, commonly known as bibliometric studies to assess the growth of research publications in a particular discipline, both at national and global level. In this chapter, in order to get better insight of research productivity in the field of Genetics, an attempt has been made to review the published Genetics literature under the headings—Growth of Literature, Growth Models and their application on collected growth data, Scientometrics analysis of different branches, Authorship pattern and collaboration, Ranking of institutes and universities, Ranking of journals and application Bradford’s Law. APA (American Psychological Association) style manual is used for writing references. Hence, a brief review of related literature and theories of study under consideration is presented in this chapter.

2.2 Growth of Literature and Growth Models
Boxenbaum (1982) has analysed the literature growth in pharmacokinetics during 1964-1980. The literature doubled approximately every 1.6 years during most of this period. It is observed from the analysis that little or no growth during 1978-1980. Thus, the pharmacokinetic literature increased at a much more rapid pace than did the total chemical literature in general.

Schubert and Glanzel (1984) have applied a quantitative model for establishing a definite connection between literature growth and publication productivity distribution in prompt nuclear analysis. The model combines two simple and familiar postulates: that of self-reproduction asserting that newcomers in a field joining the population of authors at a rate proportional to the actual number of authors and cumulative advantage establishing a linear relation between the number of papers already published by a given author and his chances to produce a subsequent paper in the field.

Stephenson (1985) has investigated the relationship of the research method used and the growth of published literature in field geochemistry and vertebrate palaeontology. Using a non-experimental design, an evaluative instrument was developed for assigning a quantitative score to published research based on the research method utilized. A Kendal tau c coefficient values were obtained and the hypothesis that a significant correlation exists between the presence of selected research method criteria in the published literature of a branch and the growth rate of the published literature of that branch is found to be supported.

Braun, Schubert and Zsindely (1997) have measured the growth rate of the nano-prefixed terms in the title of journal papers to know the growth and trends of nanoscience and technology fields, the exciting new science. The study showed that the investigations dealing with graphite nanotubes represent kinetically the most active field of research in the nanosciences.

Gupta, Sharma and Sureshkumar (1998) have studied the growth of Indian and World physics literature from 1900-50 by applying growth models. Also focus on
the applicability and validity of two forms of Lotka’s Law, negative binomial
distribution model, and Price square root and 80/20 rule to the cumulative author
productivity data on Indian physics and the increase in the number of practitioners at
different productive levels and the emergence of core authors in Indian physics.

**Gupta and Karisiddappa (2000)** have applied selected growth models to
cumulated growth of publications and authors in Theoretical population genetics from
1907-1980. The study concluded that the power model is the only model among the
models which best explains the growth of publications and author counts in the field.

**Stanhill (2001)** has presented a quantitative description of the growth of
climate change science based on the increase in the number of abstracts. The study
shows doubling time as 11 years, 1.75 as annual rate of publication per author and 2.5
as number of authors per paper. The cost per publishing scientist is very high and the
total global cost of research is estimated to be three billion U.S. dollars annually. Two
growth curves of climate change research and extra-scientific factors in controlling the
growth are presented.

**Gupta et al. (2002)** aimed to study the growth and dynamics of growth of
publications in the branches of social sciences. Also the applicability of selected
growth models to the growth of publications in six sub-disciplines of social sciences
shows that power model followed by logistic model is best fitted to all the sub-
disciplines of social sciences.

**Thompson and Williams (2007)** have tracked the growth of drug therapy
literature using the online provider PubMed MeSH. Publication numbers are complied
each year from 1966 to 2003. It was found that the drug therapy literature is growing
at a faster rate than the disease literature on PubMed.

**Sangam, Meera and Megeri (2008)** have analysed the growth pattern of
chemical science literature in India in eight branches. And also measure the growth by
calculating relative growth rate and doubling time for chemical literature. Further
identify parameters and fit statistical branch for modelling the growth.
**Wani and Gul (2008)** have analysed the growth and development of the scholarly literature in Scopus database from different points of view. The study found that Europe was in the lead in the scientific production, journals are the largest part of the published literature, and the physical sciences are the dominant disciplines. Also that, Asia produces a considerable proportion of worldwide research.

**Bala and Gupta (2010)** have analysed the research output in India in neurosciences during the period 1999-2008 and the analyses includes research growth, rank, global publications share, citation impact, share of international collaborative papers and major collaborative partner countries and patterns of research communication in most productive journals. It also analyses the characteristics of most productive institutions, authors and high-cited papers. The paper compares the publication output and impact of India with China, Brazil and South Korea.

**Sangam, Liming and Ganjihal (2010)** have described the application of growth models to study the growth and dynamics of Indian and Chinese publications in the field of liquid crystals research during 1997-2006.

**Glanzel (2010)** has presented an overview over the opportunities of probabilistic models in scientometrics. Four examples from different topics are used to shed light on some important aspects of reliability and robustness of indicators based on stochastic models. Limitations and future tasks are also discussed.

**Wen and Huang (2011)** have performed bibliometric analysis to determine research trends of oxidative stress publications published between 1991 and 2010 in journals of all the subject categories of the Science citation index. Publication trends are analysed by the retrieved results in publication type and language, characteristics of articles outputs, country, subject categories and journals, and the frequency of title-words and keywords used. Over the years, there is a significant growth in article outputs, with more countries participating and collaborating. The seven major industrialized countries (G7) have published the majority of the world articles while the USA contributed about one-third of the total. Chinese and Indian outputs grew
much faster than those of other countries in the past 5 years. Oxidative stress research in food and environmental related fields gradually become the mainstream of the research. An analysis of the title-words, author keywords and keywords plus show that antioxidants in human or rat cells are the hot topic in the field. In addition, “reaction oxygen species”, “apoptosis”, and “nitric-oxide” are major topics of oxidative stress research recently. More articles have been dealt with diseases that have a strong relationship with oxidative stress, such as inflammation, Alzheimer’s disease, diabetes, and atherosclerosis.

Liu et al. (2011) have performed a bibliometric analysis of published biodiversity research for the period of 1900–2009, based on the Science Citation Index (SCI) database. Analysis reveals the authorial, institutional, spatiotemporal, and categorical patterns in biodiversity research and provides an alternative demonstration of research advancements, which may serve as a potential guide for future research. The growth of article outputs has exploded since the 1990s, along with an increasing collaboration index, references, and citations. The analysis shows Ecology, environmental sciences, biodiversity conservations, and plant science as most frequently used subject categories in biodiversity studies, and Biological Conservation, Journal of Soil and Water Conservation, Conservation Biology and Biodiversity and Conservation as most active journals in this field, and the United States as the largest contributor in global biodiversity research.

Varaprasad and Ramesh (2011) have discussed the Indian chemical research activity during 1987 to 2007 using Scopus database. Try to quantify the national contribution to world efforts, and identify areas of relative strengths and weaknesses. Also, model out the trend of growth in the output of Indian chemical research to world as a whole and in sub-fields of chemical science. These details are discussed by using the activity index for the world and India. Also estimate the contribution of different institutions and sub-specialties in chemical sciences.

Gupta and Bala (2011) have analysed the research output of India in asthma during the period from 1999 till 2008. The growth, rank and global publications share,
citation impact, share of international collaborative papers, contribution of major collaborative partner countries and contribution of various subject fields are analysed. Also analyse the characteristics of most productive institutions, authors and high-cited papers. SCOPUS database is used to retrieve the data on publication output in asthma research. India ranks 15th position among the top 23 countries in asthma research, with its global publication share of 1.27% (862 papers), registering an average citation per paper of 3.43 and achieved an h-index of 33 during 1999-2008. Also, the impact and quality of Indian research is low compared to select developed and developing countries.

Gupta and Adarsh (2011) analyze the research activities of India in medicine during 1999-2008, based on the total publication output, its growth rate, quality of papers published and rank of India in the global context. Patterns of international collaborative research output and the major partner countries of India are also discussed. The study also evaluates the research performance of different types of Indian medical colleges, hospitals, research institutes, universities and research foundations and the characteristics of published literature in Indian and foreign journals. It also analyzes the medical research output by disease and organs. The publication data on medicine has been retrieved by using SCOPUS database.

Gupta (2012) analyses the research output of Pakistan for the period 2001-10 on several parameters including its growth and share in the world’s research output, pattern of research communication in journals, geographical distribution of publications, high productive institutions, authors and cited papers. The paper suggests for Pakistan to increase its output and bring improvement in the quality of its research efforts.

Gupta (2012) has analysed the research output of Sri Lanka in S&T during 2001-2010 on several parameters including its growth and global publications share, citation impact, share of international collaborative papers, contribution of major collaborative partner countries, contribution to various subject fields, geographical distribution of its papers, evaluation of the characteristics on its high productive
institutions, authors and papers and the journals publishing the research output. The Scopus Citation Database has been used to retrieve the publication data for 10 years. The study concludes that Sri Lanka needs to increase its output and bring about improvement in the quality of its research efforts.

Saghafi, Asadi and Osareh (2013) have focused on visualizing the structure of the Iranian scientific publications in the field of engineering indexed in ISI accessible via WOS during 1939-2011. To draw the historiographical map of Iranian scientific outputs in the field of engineering, HistCiteTM software is used. Two indexes, Local Citation Score and Global Citation Score, were used for the purpose of ranking and visualizing data. The three subject areas of the clusters are in “liquid membranes”, “applied chemistry”, and “Liquid–liquid equilibrium”.

Zhang (2014) examines China’s performance on tissue engineering using scientometrics measures such as China’s global publication share, rank, growth rate and citation impact, its publication in various sub-fields, top journals in terms of national share based on last 5 years (2008-2012) publications data obtained form ISI Science citation index expanded database. Also determine Chinese share with international collaborative papers at the national level, as well as h-core papers and high-cited papers, etc.

2.3 Scientometric Analysis of different Disciplines

Devarajan (1997) has articles that are based on the survey and research carried out by experts in the field of Library and information science.

Garg and Padhi (1998) have carried out analysis of the patents and scientific papers published in the field of laser in the journal of Current Laser Abstracts during 1967-95. The analysis indicates that innovative activity in laser science is at the peak in the early 70s. A continuous shift in emphasis from applications of lasers to experimental laser research and to theoretical laser research is observed. Further
analysis shows that the USA is at the lead followed by Japan in filling the patents in this area with emphasis on spectroscopy of laser output followed by communication applications of laser.

**Sangam and Munavalli (2004)** have focused on citing pattern of Information Professionals and that have changed with time. The paper concludes that Web based information resources have great role to play with information professionals and witnessed the impact of information technology.

**Sangam et al. (2005)** attempt to assess the qualitative and quantitative research output of demography research based on the distribution of publications in different sub specialities of demography. Priority Index and 7 point scale for qualitative description of research priorities has been used. The relationship between different countries and sub specialities of demography on the basis of citability profiles is carried out by using the principal component analysis.

**McKiernan (2005)** has described Bibliometrics to be traditionally associated with the quantitative measure of documentary materials and embraces all studies which seek to quantify the process of written communication. These include science studies, research evaluation, knowledge management, environmental scanning, trend analysis, and the optimization of library and information resources. Some significant Web resources relating to bibliometrics and related approaches are given.

**Lima-Ribeiro (2007)** has carried out a scientometric analysis in population ecology to understand the importance and trends of the field throughout years, connecting them with the principal geopolitical regions around the world. To that end, a bibliographic survey at Thomson ISI web site is carried out, at the period between 1942 and 2005, using the key-word "population ecology". Data showed an exponential growth in the number of publications on population ecology, most of them developed in USA and Europe and publicized in ecological journals of wide international distribution and high Citation Index. A Principal Component Analysis (PCA) shows distinct temporal trends in population ecology research, leading to more recent decades (1990 and 2000, until 2005) a great variety of organisms studied and
related with other ecology fields and natural sciences. These results contrast with the scientific stagnation widely criticized in ecology and indicate the progress of the population ecology as science, pursuing new horizons as well as new paradigms, laws, theories and principles that might be useful to the society.

**Sangam and Girji (2008)** have reported in the paper that Scientometric has become the need to evolve a satisfactory system for evaluating the impact of scientometrics. Individual scientists and institutions can check the data used in these studies.

**Sangam (2010)** presents the origin and historical survey of the development of the terms Librametrics, Bibliometrics, Scientometrics, Informetrics, Cybermetrics, Netometrics and Webometrics to describe their similar and overlapping methodologies.

**Haddow and Genoni (2010)** have performed citation analyses for Australian social science journals to determine the differences between data drawn from Web of Science and Scopus. These data were compared with the tier rankings assigned by disciplinary groups to the journals for the purposes of a new research assessment model, Excellence in Research for Australia (ERA), due to be implemented in 2010. In addition, citation-based indicators including an extended journal impact factor, the h-index, and a modified journal diffusion factor are calculated to assess whether subsequent analyses influence the ranking of journals. The findings suggest that the Scopus database provides higher number of citations for more of the journals. However, there appears to be very little association between the assigned tier ranking of journals and their rank derived from citations data. The implications for Australian social science researchers are discussed in relation to the use of citation analysis in the ERA.

**Lopez et al. (2010)** have carried out a general overview of academic production from the analysis of sample of articles published between 2005 and 2007 in the Psychology journals covered by Psicoredalyc. The results suggest that research
networks should be strengthened and the publication in journals from other countries
should be fostered.

Priem and Hemminger (2010) have developed the most comprehensive list of
the services to date, assessing the potential value and availability of data. Also suggest
the next steps toward building and validating metrics drawn from the social web.

Lu and Wolfram (2010) have investigated the growth and geographic
distribution of metric research for the period 1987-2008. The United States continues
to dominate as in other studies, but there has been a recent relative decline in North
American contributions overall. European and Asian contributions have grown
substantially. National and institutional collaborations that contribute to this growth do
not necessarily follow close geographic proximity, although European nations have
been more active with international collaborations overall, both within Europe and
elsewhere.

Pouris (2010) has reported the results of scientometric assessment of the
Southern Africa Development Community countries. The National Science Indicators
database of Thomson-Reuters and the online ISI Web of Knowledge are utilized in
order to identify the number of publications of the 15 countries over a period of 15
years; the activity and relative impact indicators of 22 scientific disciplines for each
country and their collaborative patterns.

Arencibia-Jorge and Moya-Anegon (2010) have explored the different metric
approaches to the Cuban scientific activity carried out by national and international
authors. The article also develops a scientometric study of the Cuban Scientific
production as included in Scopus during the period 1996-2007, using socio-economic
indicators combined with bibliometric indicators supported by the SCImago Journal
and Country Rank.

Larsen and Von Ins (2010) have studied the growth rate of scientific
publication from 1907 to 2007 using available data from a number of literature
databases. The study found that growth rate for SCI up to 2007 is smaller compared to
other databases. There are also clear indications that the coverage by SCI is especially low in some of the scientific areas with the highest growth rate, including computer science and engineering sciences. The limited data available for social sciences shows that the growth rate in SSCI is remarkably low and indicates that the coverage by it is declining over time. National Science Indicators from Thomson Reuters is based solely on SCI, SSCI and Arts and Humanities Citation Index (AHCI). Therefore the declining coverage of the citation databases problematizes the use of this source.

Satyanarayana (2010) has traced the evolution of measures and parameters for the evaluation of science and scientific journals from the first attempts during the early part of the last century to the development of the most popular, current and widely used metrics viz., citations, impact factor (IF) etc. It is found that biomedical and medical sciences continue to garner a major share, estimated to be almost two-thirds of total research and development funding of over US $ 350 billion.

Rao (2010) covers lectures on two types of science indicators- quantitative and qualitative. Different growth models applicable to growth of literature; indicators related to scientific productivity of scientists, and issues in scientometrics are discussed.

Khan et al. (2011) have utilized scientometrics approach to analyse and synthesise e-government literature that deals with the topics in developing countries from the lens of socio-technical theory. In the light of the findings, strengths, limitations, and future directions for e-government research in developing countries is discussed.

Andersen and Hammarfelt (2011) have studied the production of dissertations in eight research fields in the natural sciences, the social sciences and the humanities. Data from the ProQuest: Dissertations and Theses database covering years 1950-2007 is used to depict historical trends, and the Gompertz function is used for analysing the data. The study shows a decline in the growth of dissertations in all fields in the mid-eighties and several fields show only a modest growth during the
entire period. Consequently, they propose that the output of dissertations can be used as an indicator of growth, especially in fields like the humanities, where journal or article counts are less applicable.

Jones et al. (2011) have described methods of scientometrics analysis to understand the nature of translational research and monitor policy interventions. The bibliographic and citation data has been downloaded from all articles published in 2009 in 75 leading journals in cancer and in cardiovascular medicine and calculated citation relationships between journals and between articles and extracted the most prevalent natural language concepts.

Pouris and Pouris (2011) have identified the state of pandemic HIV/AIDS related research in South Africa vis-a-vis the rest of the world using evaluative scientometrics in order to inform relevant policy. South Africa is identified as producing an increasing number of HIV/AIDS related publications, making it one of the most prolific fields in the country. The rest of the world appears to have stabilized its research efforts after the development of highly active antiretroviral therapies. The USA is identified as the main producer of HIV/AIDS research while Europe appears to under-emphasise the issue. Comparison of the world’s most prolific universities with those in South Africa identifies that the latter has a fragmented system. A number of policy issues are also discussed.

Nikolic et al. (2011) have explored the research trends and the evolution of publications covered on diadromous fish from 1970s to 2010. Bibliometric analysis on seven patrimonial species is conducted. Bibliometric techniques on the total number of research (articles, books, and conferences) in all country in function of main fields such as growth/age, reproduction, migration, habitat, aquaculture, diseases, diet, abundance, fisheries, climate change, toxicology, dams/fish ways, Genetics, taxonomy, modelling, resource management, and stocking is used. The analysis comparisons show the intensity of certain topics by species with the emergence of new ones, the economic impact on sciences and the increased support of conservation plan management for certain species, such as salmon and lamprey in France. This study
also emerged that French research is not always consistent with the international trend which suggests the dominance of management systems on scientific studies.

**Kharabaf and Abdollahi (2012)** have evaluated the activities in different branches of science in Iran and compared to other countries over the past 35 years. Essential Science Indicators, Web of Science and SCImago Journal & Country Rank (SJR) are searched for scientometrics data. ESI indicated place of Iran among other countries in all 22 scientific categories based on the publication and citation rates. SJR parameters, such as publication rate, citable publications, citation rate, citations per publication and the H-index are used to record the rank of Iran among the world’s countries. A progressive quantitative and qualitative growth of Iranian publications is evident. The field of Chemistry in Iran is found to be the most prolific in terms of the number of publications (16982) whereas Economics and business is the least prolific (156). A growth in the quality of works of Iranian authors is evident by gaining higher H-index in the recent years.

**Yoon and Lee (2012)** have proposed a portfolio of scientometrics methodologies to provide a framework in analysing technological knowledge and enhance the utilization of scientometrics in conducting R&D activities by investigating practical cases thereof. For this, the definitions and types of technological knowledge for planning R&D activities are presented as a knowledge object, and a list of scientometrics methodologies on technological knowledge is compiled to grasp a complete set of possible methodologies through literature survey. In addition, a scientometrics portfolio is developed by aggregating the matching tables of methodologies, technological knowledge and application objectives of the practical cases that scientometrics are applied to examine R&D activities and implement S&T policies.

**Vinluan (2012)** has conducted an objective assessment using bibliometric indicators of research productivity in education and psychology in the Philippines against its Southeast Asian neighbours’ research productivity in the same fields. Results show that the Philippines ranked low in research productivity compared to Singapore, Thailand, and Malaysia, particularly starting in the 1990s. This low
research productivity is explained in terms of economic indicators, the local orientation of many social science research studies, funding, individual characteristics of researchers, and the epistemic culture of knowledge production in the country. However, the reforms initiated by the government, particularly in the higher education sector, would hopefully lead to a better research landscape and, consequently, improve research productivity in the near future.

**Hassan et al. (2012)** have employed basic bibliometric methodology in order to draw a picture of Southeast Asian research strengths as well the amount and focus of S&T cooperation between the countries in Southeast Asia and the European Union. The results are found to be useful for interested public as well as scientific community and innovation policy-making.

**Karamourzov (2012)** attempts to assess the results of the independent development of the CIS countries in the field of science over the period 1990–2009. The analysis of the numerous scientometric indicators reveals the decrease of the number of expert researchers and the significant decrease in the scientific and technical output. The article also provides the information about the dynamics of a set of indicators which allows drawing conclusions about the effectiveness of the research activity in the CIS countries.

**Guo et al. (2014)** have undertaken bibliometric analysis of soil contamination research with articles published in journals in the SCI and SSCI databases from 1999 to 2012. The results showed environmental science, engineering environment, soil science and applied microbiology as the most frequently used subject categories, Chemosphere as the most active journal, USA exceeded all other countries with the most independent and collaborative papers and heavy metal pollution as the hottest issue.

### 2.4 Authorship and Collaboration works in different Disciplines

**Gordon (1980)** has presented data which shows that a significant relationship exists between level of multiple authorship for papers submitted to a leading
Astronomy journal and their frequency of acceptance for publication. Also argue that there is need for more extensive qualification while drawing inferences about actual social aspects of research activity, from trends in the multiple authorship of published papers.

Sangam (2000) investigates the nature and type of collaborated research in India as reflected in Psyclit CD-ROM database 1974-98. The paper indicates the authorship pattern, explores the degree of collaboration in different sub-specialities of psychology. Concludes that there is high degree of collaboration in the field of psychology research in India.

Beaver (2001) presents a paper on personal observations and reflections on scientific collaboration and its study, past and present, and future, containing new material on motives for collaboration, and on some of its salient features. Concludes with continuing methodological problems signed out, together with suggestions for future research to solve problems in collaboration.

Maclas-Chapulas, and Muangos-Nolasco (2002) have presented the bibliometric analysis of AIDS documents with AIDSLINE 1980-2000 for literature search. Bibexcel and Microsoft excel tools are used for analysis of records. Results indicate - main participating countries as Democratic Republic of the Congo and Cameroon, high pattern of collaboration, most documents published in English in journals and subject content mainly focused on epidemiological, complications and prevention and control issues on HIV infections and AIDS. The authors have compared Central African countries and other developing countries.

Alfaraz and Calvino (2004) have presented a bibliometric analysis of the scientific production in food science and technology field for the period 1991-2000, in Iberian-America. It is found that 8 selected IA countries contribute 97.6% of IA production and accounted for 6.6% of the world production. The journal articles are the most frequent document type in English. Retrieved records display characteristically authorship patterns and preferred subject areas. Also 50 top ranked
journals, 80% of which are indexed by the SCIE, encompass 2/3rd of the IA production.

**Sangam and Keshava (2005)** have presented the collaborative research in six sub disciplines of social science. The paper finds that the proportion of collaborative publication has a consistent growth with time and the study is found useful in understanding various disciplines.

**Kademani et al. (2006)** have present the quantitative growth and development of world literature on thorium in terms of publications output as in SCI (1982-2004). USA is the top among 94 countries, followed by India in this field. Authorship and collaboration trend shows towards multi-authored papers. Bhabha Atomic Research Centre (India) topped the list followed by Los Alamos National Laboratory (USA). Most preferred journals are listed and English is the most predominant language used by the scientists for communication.

**Sangam and Meera (2009)** have examined the collaboration in research that is affected by various socioeconomic and other environmental factors prevailing in the society. The collaborative outputs of different subject areas are science, social science and humanities. The investigation of such nature may be found useful in understanding the research and communication patterns for Indian chemical science.

**Keshava et al. (2010)** have carried out study to know the characteristics of literature published in JCCC.UGC-INFONET e-journals consortia on a burning issue ‘global warming’. The results show year wise distribution of articles, authorship pattern and degree of collaboration among authors in the field during 2005-2009.

**Biradar and Rajashekhara (2010)** present a study based on references appended to the articles published in open access e-journal AgBioForum for the year 1998-2009. The study highlights the authorship trend, average citations per article, collaborative research and use of web references. The study found that team research is preferred than solo research in the field of Biotechnology and maximum number of articles are contributed from USA.
Hadagali et al. (2010) present paper on authorship pattern, degree of collaboration and collaborative index in the field of Library and information science on Information Literacy, Knowledge management and Knowledge organisation.

Sagar et al. (2010) have performed a scientometric analysis of all Tsunami related publications as per the Scopus (TM) database during 1997-2008. The parameters studied includes growth of publication, country-wise distribution of publications, activity index of countries, most-frequently cited publications, authorship pattern, co-authorship index, and distribution of keywords. United States of America, Japan, United Kingdom, India and Australia produced 54.20% of the total output. It is also observed that a spurt in number of publications was observed after the Indonesia's tsunami occurred on 26 December 2004.

Bartneck and Hu (2010) performed a bibliometric analysis of the CHI conference proceedings to determine if papers that have authors from different organization or countries receive more citations than papers that are authored by members of the same organization. The study showed no significant difference between these groups, indicating that there is no advantage for collaboration in terms of citation frequency. Furthermore, tested papers written by authors from different organizations or countries receive more best paper awards or at least award nominations.

Hennemann et al. (2011) have made use of the extensive information found in bibliographic data and assesses the reliability of this information as a proxy indicator for the spatial dimension of scientific collaboration in emerging economies. This is undertaken using the example of the emerging field of biotechnology in China from 2000 onwards. Two data sets have been prepared: (1) the frequently used ISI Web of Knowledge (SCI-Expanded) and (2) the domestic ChineseChongqing VIP database. Both data sources are analysed using a variety of bibliometric and network scientific methods.
Hui-Zhen Fu et al. (2011) have provided an overview of the characteristics of research in China, a bibliometric evaluation of highly cited papers with high-level representation conducted during the period from 1999 to 2009 based on the Essential Science Indicators (ESI) database. China is found more active in ESI fields of Chemistry and Physics, but more excellent in Material science, Engineering and Mathematics. About one half of China’s ESC papers are internationally collaborative and the eight major industrialized countries (the USA, Germany, the UK, Japan, France, Canada, Russia, and Italy) play a prominent role in scientific collaboration with China, especially the USA. The Chinese Academy of Sciences takes the leading position of institutions with many branches. The “985 Project” stimulated the most productive institutions for academic research with a huge funding injection and the universities in Hong Kong showed good scientific performance. The citation impact of internationally collaborative papers differed among fields and international collaborations has made positive contributions to academic research in China.

Sangam (2012) attempts to investigate the pattern of authorship, type of collaborated research and the degree of collaboration in the field of demography. The data is collected from population index for time span 1988-1999. The trend in the computed values of CI and DC of different period blocks is almost consistent, reflecting the growing collaboration and pointing towards increasing professionalism in demography with time.

Jaric et al. (2012) have applied a bibliometric approach to identify recent patterns and trends in the methods, subjects, and authorships in the literature published in Fisheries science (2000–2009). The results indicate that the most frequently studied group of species to be Salmonidae, although the interest for these species seems to be diminishing. The number of experimental studies was markedly low, but they were also the most frequently cited. The United States is the most productive country over the last decade with a gradually increasing output over the time, but it is surpassed by the total European Union output. An apparent difference in the research output has been recorded between the developed and developing countries. The findings of this study, however, indicate a positive tendency in this direction. A growing rate of
publications based on international collaboration is recorded, and such publications also demonstrate a higher number of citations than the single-country publications.

**Gunasekaran and Balasubramani (2012)** have analysed the artificial intelligence research output during 1973-2011. The different parameters including authorship pattern, growth, rank with global publication, institutions contribution, most productive journals are analysed. Scopus citation database is used to retrieve the data. The authors have compared the profile of India’s research output with other countries with the help of scientometrics technique. The study shows that India stands in the first position among the top 17 countries with 96.05% papers.

**Zheng et al. (2012)** have studied China’s international S&T collaboration from the perspective of paper and patent analysis. The results show that China’s total papers and patents have continuously increased from 2004 to 2008, the papers and patents resulting from China’s international collaboration also present a steady growth. However, there is a decline in the share of international collaboration papers and patents with a certain range due to the rapid independent R&D. China’s International Scientific Collaboration (ISC) is broadly distributed over many countries, the USA being the most important ISC partners. China’s international technological collaboration (ITC) is mainly carried out with USA and Taiwan, and Taiwan has been the most significant ITC partner of when taking countries’ patent output into account. Besides, ISC shows a continuous raise of Chinese papers’ citation. Even the countries with a small amount of papers and ISC with China, exert a positive influence on the impact of citation of Chinese papers as well. However, ITC does not always play an active role in the improvement of citation impact of Chinese patents.

**Manimekalai and Amsaveni (2012)** analyse the growth of research publications and the authorship pattern on Genetics and other related subject for the data taken from the articles listed in Web of Science covering the period 1998 to 2011. The records considered for the study is 871 and the pattern of productivity of various author categories are identified. The total number of authors (4433) papers is divided into different categories, namely all authors, first authors, non-collaborative authors
and co-authors. The collaborative publications show a systematic increase and the single author seem to be in a decline in the proportion. Simple probabilistic distributions are explored for their goodness of fit in the publication data on the number of authors per publication in Genetics from India.

Gupta (2013) analyses the research output of Bangladesh in S&T during 2001-10 on several parameters including its growth and country publications share in the world’s research output, country publications share in various subjects in the national and global context, pattern of research communication in core domestic and international journals, geographical distribution of publications, share of international collaborative publications at the national-level as well as across subjects and characteristics of high productivity institutions, authors, and cited papers. The Scopus Citation database is used to retrieve the publication data for 10 years. They conclude that Bangladesh needs to increase its output and bring about improvement in the quality of its research efforts further.

Bajwa et al. (2013) analyse the research trends in Pakistan in the field of nanoscience and nanotechnology. Starting with just few publications in the year 2000, this number has steadily increased. Among the top 15 institutions with publications in nanotechnology, 13 are universities and only two are R & D organizations. Almost 35% of the research publications are in the field of material sciences followed by Chemistry and Physics in that order. The growth in the publications for period 2000-2011 is studied through relative growth rate and doubling time. The authorship pattern is measured by different collaboration parameters. Finally the quality of papers is assessed by means of the h-index, g-index, hg-index and p-index.

Shelton and Lewison (2013) present an analysis of the North Korean, the Democratic People’s Republic of Korea one of the world’s most secretive and reclusive states presence in the world’s scientific literature, and of the possibilities for collaboration which offers a mechanism for positive development for their citizens and also for their neighbours.
Kato and Ando (2013) examine the robustness of the results presented by Abramo et al. (Scientometrics 86:629–643, 2011b) and the relationship between international collaboration and mobility among researchers by using a data set in Chemistry. The results confirm the robustness of the previous study and raised the possibility that the higher citation rate of international papers is not solely explained by the higher performance of researchers. Therefore, international research collaboration seems to exert some kind of “bonus” effect because of internationalization. The results also indicate that researchers who collaborate internationally accumulate science and technology human capital through collaboration. A positive relationship between the international mobility of researchers and their performance is also shown although the direction of the cause and effect is not yet clear.

Rafols et al. (2014) have explored the pharmaceutical R & D dynamics by examining the publication activities of all R & D laboratories of the major European and US pharmaceutical firms (Big Pharma) during the period 1995-2009. It is observed that there is a slow decline in their total number of publications particularly in Europe. There are more external collaboration and research in non-traditional disciplines. The results also suggest that Big Pharma firms are increasingly network integrators.

Zyoud, Al-Jabi and Swelleh (2014) have analysed the worldwide research output in the waterpipe tobacco smoking field to examine the authorship and collaboration pattern and the citations retrieved from the Scopus database for over a decade (2002-2012). The study revealed a promising rise and a good start for research activity in the field with USA producing largest number of publications.

Thanuskodi (2014) has analysed the journal titled “D-Lib Magazine” for the period 2003 to 2012 to know the research output of Library and information science subjects. The study includes number of articles, authorship pattern, subject wise distribution of articles, average number of reference per articles, forms of documents cited, year wise distribution of cited journals etc. The results showed more number of
joint authored articles, highest contribution from universities, and that majority of the contributors preferred journals as the source of information which occupied the top position with highest number of citations of the total citations.

### 2.5 Ranking of Journals and Institutions

Sengupta (1985) has applied bibliometric technique to rank periodicals in the field of biophysical literature based on citation data collected from the bibliographic database published in the source journal namely Annual Review of Biophysics. Other findings are dominance of the USA journals and English language. The data is also analysed according to subject categorisation of the ranked periodicals and has been discussed in relation to Bradford’s law of scattering.

Archibald and Line (1991) have studied a sample of 190 journals in different subject fields to obtain a picture of the situation of growth of serial literature in terms of articles per serial. The number of articles in each journal was counted and the analysis showed a rapid growth in most of the subjects up to 1970, a much slower growth between 1976 and 1980, and a slow growth or decline between 1980 and 1987; the fields of decline included general and physical science and technology. Although it is possible that more recently established journals would show a different pattern in the rate of growth of the total number of journal articles.

Jain and Garg (1992) have analysed the publications in the field of laser, published from India during 1967-84. The results indicate that Indian output comprises only 1% of the international output with major portion in foreign journals. Also the emphasis has been on the theoretical aspects of laser research than on experimental and applied research. The study also indicates that Indian scientists have little international collaboration in this field.

Karki and Garg (1997) have assessed alkaloid chemistry research in India as viewed through Chemical Abstracts quantitatively and qualitatively. The paper while focusing on world and India’s output in terms of publications identifies the centres of excellence, research groups involved their channels of communication and citedness
in the field. It is also found that Alkaloid chemistry research in India to be fairly collaborative and part of main stream science.

**Bottle and Efthimiadis (1998)** have investigated the sampling issues of LISA, ISA, RZI, BS and CCA for the year 1983 to know the characteristics of library and information science literature. Single author documents, English language and journals are found dominant. Most of the literature has originated from North America and Western Europe. The journals from Ulrich guides show exponential growth.

**Tsay, Jenjou and ShinMa (2000)** have investigated the growth of semiconductor literature based on the INSPEC database. Bradford-Zipf’s plot and Lotka’s law have been employed to further explore the characteristics of semiconductor literature. Quantitative results on the literature growth, form of publication, research treatment, publishing country and language, author productivity and affiliate are reported. Also 25 core journals in semiconductor field are identified and analysed using Bradford-Zipf’s plot.

**Sangam et al. (2003)** have examined the performance of five state universities of Karnataka which have covered 7 subject fields from 1996-2004 and the study reveals that the Mysore University has the maximum output of publications.

**Patra, Bhattacharya and Verma (2003)** have analysed the growth pattern, core journals and author’s distribution in the field of bibliometrics using data from LISA. Bradford’s law of scattering is used to identify core journals and determine ‘Scientometric’ as the core journal in the field. Lotka’s law is used to identify authors’ productivity patterns. Study also identifies 12 most productive authors in the field.

**Munshi and Pant (2004)** have investigated the growth pattern, journal characteristics and citation usage pattern of Indian Nuclear science literature published during 1991 – 2000 based on subject search along with country search in SCI database. The paper focuses on growth models, 25 core journals as identified by
Bradford’s distribution pattern and citoanalytical parameters within the area of nuclear science.

Tsay (2004) has investigated the growth pattern, journal characteristics and author productivity of the subject indexing literature from 1977-2000 in LISA database. Logistic and Bradford-Zipf S-shaped curve are found to fit well for literature growth and journals respectively. Information organisation, processing, storage and retrieval, and systems and services are the four major research topics in the area of subject indexing. The most productive 15 authors are identified with single authored articles in majority.

Dios et al. (2009) have aimed to perform a scientometric analysis of neurological science journals in the 2006 Journal citation Reports- Science Citation Index (JCR-SCI) edition. Three areas dedicated to neurological sciences (Neurosciences, Clinical Neurology and Neuro imaging) in the 2006 JCR-SCI edition have been studied. Journals, articles, citations, impact factor, immediacy index, half life and journals with the greatest IF in each speciality are the bibliometric indicators used.

Sangam, Keshava and Agadi (2010) have pointed out that there is an increase in periodical literature by the significant increase in the quantum of research of national and international institutions. Also, the application of scientometrics to marine engineering and its characteristics is useful in understanding the communication and information use pattern in the field.

Kaur and Gupta (2010) have examined India's performance based on its publication output in dental sciences during 1999-2008, based on several parameters, including the country annual average growth rate, global publication share and rank among 25 most productive countries of the world, national publication output and impact in terms of average citations per paper, international collaboration output and share and contribution of major collaborative partners, contribution and impact of selected top 25 Indian institutions and selected top 15 most productive authors,
patterns of communication in national and international journals and characteristics of its 45 high cited papers.

Singh (2010) has made attempts to provide a short historical background of the development of Nanoscience and Technology (NST) field in the world in general and India in particular over last 20 years (1988-2007). Also presents a brief literature survey of the scientific productivity along with the reason for why data has been taken from Web of Science. Attempts to find out the institutes that are emerging as important centres in NST research, the scientists who are actively engaged in NST research, their impact through citations received and their publication pattern.

Zavadskas et al. (2011) have focused on evolution of scientific publications released in the Baltic States (Lithuania, Latvia and Estonia). The article discusses the contribution of Kaunas University of Technology, Vilnius Gediminas Technical University, Riga Technical University and Tallinn University of Technology to the total number of publications in these countries. The investigation is based on databases of Thomson Reuters Web of Science, Essential Science Indicators and Journal Citation Report. Additionally, it employed the Scimago ranking system based on Scopus database. Data analysis also involves similar indices that provide the number of papers and their citation results as well as the average number of citations per paper.

Fakhree and Jouyban (2011) using Scopus as search engine, have compared the scientific outcomes of the Iran University of Medical Sciences, Isfahan University of Medical Sciences, Mashhad University of Medical Sciences, Shahid Beheshti University of Medical Sciences, Shiraz University of Medical Sciences, Tabriz University of Medical Sciences, and Tehran University of Medical Sciences with each other. These universities are compared by the number of published articles per year, number of citations received per year, number of citations received per year per article, total H-indices, top ten authors, and top ten journals. The results of the study show the order of the studied universities in research performance. In addition, the
data of Tehran University of Medical Sciences as the top medical university of Iran is compared with some of top medical universities around the world.

Sangam and Meera (2011) have pointed out the periodicals as the best tool for scientific information communication. The data on chemical science journals has been collected using SCI Finder Scholar-online Chemical Abstract database. The study reveals five most productive journals. Out of 120 journals, 13 are basically from medical sciences, 17 physics and 8 belong to environmental sciences showing the interdisciplinary and multidisciplinary character of Chemical Science Literature. The distribution pattern of the articles in chemical science journals has followed the Bradford’s distribution which shows that Bradford’s law of scattering goes well with the Chemical Science literature.

Kim et al.(2012) have examined the nature of agricultural innovation of the two Northeast Asian countries—Korea and China and consider agricultural R&D investments and activities as well as the roles of university, industry, and government (UIG), which are the three units comprising the triple helix. As an empirical extension of the qualitative analysis, they have collected bibliometric information of agricultural scientific publications from 1990 to 2010 and patent information from 1980 to 2010. By calculating transmission of uncertainty, which indicates collaboration among UIG, this paper tracks the relationship dynamics of the units comprising the triple helix. In addition, analyse topics in scientific publications and patents in order to observe and compare the sub areas that are the focus in the two countries. The findings reveal both commonalities and differences between the two countries, thus providing knowledge of and insights into the agricultural sector.

Liu et al. (2012) have evaluated earthquake research performance based on a bibliometric analysis of 84,051 documents published in journals and other outlets contained in the Scientific Citation Index (SCI) and Social Science Citation Index (SSCI) bibliographic databases for the period of 1900–2010. Also summarize significant publication indicators in earthquake research, evaluate national and institutional research performance, and present earthquake research development from
a supplementary perspective. Research output descriptors suggest a solid development in earthquake research, in terms of increasing scientific production and research collaboration. Leading authors, institutions, and nations in earthquake research, and uneven distribution of publications at authorial, institutional, and national levels are identified.

**Coutinho et al. (2012)** analyse the Brazilian scientific production in the area of science education. The study is structured on: data by research groups registered in Conselho Nacional de Desenvolvimento Científico e Tecnológico; analysis of the post-graduate strictus sensu programs; analysis of theses and dissertations linked to post-graduate programs; and papers in international databases. Research is conducted strictly via World Wide Web, from December 2009 to September 2010. It is found that both number of research groups, researchers, post-graduate programs, thesis, dissertations and papers present a marked increase, especially in the last decade (from 2000 onwards). The major research centres are found to be located in public universities from Brazilian southeast and south regions. However, it is observed a tendency of decentralization, due to a recent investment in new public universities in the other Brazilian regions.

**Wardikar and Gudadhe (2013)** review the contribution in library and information science and theoretical aspects of the law. The applicability of Bradford’s law of scattering is examined on periodicals in theses during 1982-2010. Rank list of journals is prepared and applicability of law in various methods is tested.

**Pandita, Singh and Gaur (2014)** have undertaken bibliometric analysis of medical literature output in four most primer medical and research institutions of India. For the study, data has been collected from Web of Science with a view to assess the general publication trend of medical sciences in India by four medical institutes AIIMS, JIPMER, PGIMER and SGPGIMS. It is found that among four AIIMS, New Delhi has published and contributed maximum research results with steady increase in the research publications in medical sciences.
Magnone (2014) has analysed systematically all chemistry-related scholarly communications collected from the Web of science in South Korea during 1993-2012. The study parameters included the growth in number of publications, language, document type, category, source, organization and collaboration-wise distribution of the South Korean communications. It was found the South Korean stood at the 15th rank in the world in terms of informational communication activity in chemistry.

2.6 Genetics and Databases

Wright and Gaut (2005) have discussed some of the theoretical and statistical issues surrounding the detection of selection, with focus on plant populations, and also summarize the empirical plant molecular population genetics literature.

Benjcamini (2005) has aimed to lay a solid foundation for the use of the false discovery rate in QTL (Qualitative Trait Loci) mapping. Authors review the false discovery rate criterion, the appropriate interpretation of the FDR, and alternative formulations of the FDR that appeared in the statistical and Genetics literature. Also discuss important features of the FDR approach, some stemming from new developments in FDR theory and methodology, which deem it especially useful in linkage analysis.

Carey (2006) has summarized the issues surrounding the publication of case reports in the current medical literature. Here, he addresses three questions about case reports: 1. Do journals still publish single case reports? 2. What do medical journals call these reports? 3. And how should we classify reports of single clinical observations? Authors analysis shows that 32% of reviewed journals published case reports and 32% did not, while the remainder of journals published this class of papers but in a modified fashion and not regularly. Journals varied in what term they use to describe case reports. The author proposes a classification system for case reports in the Human genetics literature.

Johnson and O'Donnell (2009) have provided access to a full gene-annotated GWAS database which could be used for further querying, analyses or integration
with other genomic information. Of reported associated SNPs, 40% lie within the boundaries of a Ref Seq gene and 68% are within 60 kb of one, indicating a bias toward gene-centricity in the findings. Authors have found considerable heterogeneity in information available from GWAS suggesting the wider community could be benefited from standardization and centralization of results reporting and identified novel, highly suggestive loci for a variety of traits that did not meet genome-wide significant thresholds in prior analyses, in some cases with strong support from the primary Medical genetics.

Liu (2009) has studied the age distribution at the time of publication of the scientists (called the publication age distribution), taking highly cited scientists in the field of Molecular Biology & Genetics and Physics as a case study with the method of scientometrics, and conclude that these scientists publish most of their articles mainly between the age of 40 and 55 (called middle age), showing the characteristic of cubic polynomial model. In addition, a further study on the publication age distribution of older highly cited scientists is also made in this paper.

Babu and Ramakrishn (2010) present a scientometric study of Indian contribution in the field of HIV/AIDS covered in the bibliographic database, namely MEDLINE. The results of the Activity Index indicate that the India’s efforts in HIV/AIDS research are greater in 5 years during the study period 1997-2006. Also have found that the collaboration research tends to be more in the field of HIV/AIDS.

Szu-chia (2010) has tried to demonstrate the linkage between science research and technology development through non-patent citation analysis to reveal that the important knowledge resources from science research has significant impact on technology development. Genetic engineering technology is the field examined in this study. From the references listed in the patents, it was observed that the technology development in genetic engineering was influenced heavily by the research done by public sector. Over 90% of the citations were non-patent literatures, and the majority of no patent citations were journal articles. Citing preferences, such as country preference and institute preference were observed from the data included in this study.
Jonkers (2010) has explored the concentration in the global plant molecular life science research output. In the past 15 years, especially the share of articles which refer to the model organism *Arabidopsis thaliana* has increased rapidly. Citation analyses have showed an even greater rise in the importance of this organism. Attempts are discussed to come to a scientometric definition of model organisms. For this purpose a comparison is made with applied microbiology. However, few shared scientometric characteristics were found which could help characterize model organisms. A distinction between major economic organisms and model organisms will therefore continue to rely on qualitative data.

Roche et al. (2010) have chosen one field, Molecular Biology, to identify and characterize emerging topics within that domain. Two analytical approaches are combined: the first one introduces a model of the terminological evolution of the field based on bibliometric indicators and the second one operates a diachronic clustering analysis. Their objective is to answer to questions such as: Which technological aspects can be detected? Which of them are already established and which of them are new? How are the topics linked to each other?

Laurens et al. (2010) have stated that the experiment in the field of genomics, where a corpus of documents has been built by a hybrid citation-lexical method, and then clustered into research themes. Experts of the field were associated in the various stages of the process: lexical queries for building the initial set of documents, the seed; citation-based extension aiming at reducing silence; final clustering to identify noise and allow discussion on border areas. The analysis of experts' advices show a high level of validation of the process, which combines a high-precision and low-recall seed, obtained by journal and lexical queries, and a citation-based extension enhancing the recall. These findings on the genomics field suggest that hybrid methods can efficiently retrieve a corpus of relevant literature, even in complex and emerging fields.
Spreckelsen, Deserno and Spitzer (2010) have discussed on PubMed search forms, the publication date which retrieves results with both the date of electronic and printed publication leading to misinterpretations of search results. A query formulation that unambiguously retrieves literature from PubMed by date of publication is suggested in conclusion.

Ortega and Aguillo (2010) have analysed the collaboration network of the 6th Framework Programme of EU, specifically the “Life sciences, Genomics and Biotechnology for health” thematic area. Several statistical tests and structural indicators are used to uncover the main characteristic of this collaboration network. Results show that the network is constituted by a dense core government research organizations and universities which act as large hubs that attract new partners to the network, mainly companies and non-profit organizations.

Patil et al. (2010) have subjected seventeen classical swine fever virus (CSFV) isolates recovered during the period of 3 years (2006-2008) from India to nucleotide sequencing in the 5’ untranslated region (UTR) available either in the GenBank or published literature. Based on the phylogenetic analysis, the Indian isolates could be grouped in to two groups, viz., 1.1 and 2.2. The study also reveals predominance of subgroup 1.1 and involvement of viruses of more than one subgroup in an outbreak.

Schoffel et al. (2010) have applied density-equalizing algorithms, scientometric methods and large scale data analysis to evaluate the quality and quantity of scientific efforts in the field of rheumatoid arthritis. Data is taken from PubMed and ISI Web during the period 1901-2007. The analysis reveals single areas of interest, the most prolific journals, authors and institutions dealing with the topic.

Garg et al. (2010) have analysed papers published by Indian scientists during 1991-2008 and indexed by Science Citation Index-Expanded indicating that the growth of publication output is slow in the initial stages, which start increasing after 2000. The analysis shows the highest output in the sub-field of Molecular genetics, that a significant portion of papers are published in journals that originated from
advanced countries of the West and in journals with impact factor >1, Indian Council of Agricultural Research papers have the lowest impact, and among the institutes Madras University has the highest impact, while Indian Veterinary Research Institute has the lowest impact.

**Pradhan et al. (2011)** have presented Indian Genetic Disease Database (IGDD) release 1.0 covering 52 diseases with information on 5760 individuals carrying the mutant alleles of causal genes. Information on locus heterogeneity, type of mutation, clinical and biochemical data, geographical location and common mutations are furnished based on published literature. The IGDD web portal, planned to be made freely available, contains user-friendly interfaces and is expected to be highly useful to the geneticists, clinicians, biologists and patient support groups of various genetic diseases.

**Zhao and Strotmann (2011)** have attempted to approach the intellectual structure of the stem cell research field 2004–2009 through a comprehensive author co-citation analysis (ACA), with stem cell literature compiled from PubMed and Scopus. Despite the theoretically highly interdisciplinary nature of the field, stem cell research has been dominated by a few central medical research areas. The study also serves as a baseline against which the effectiveness of a range of author-based bibliometric methods and indicators can be tested, especially when based on less comprehensive datasets using less optimal analysis methods.

**Ying An and Qiang Wu (2011)** have used co-word analysis to analyze the evolvement in stem cell field. Articles in the stem cell journals are downloaded from PubMed for analysis. Terms selection being the most important step in co-word analysis, the useless and the general subject headings are removed firstly, and then the major subject headings and minor subject headings are weighted respectively. Then, improved information entropy is exploited to select the subject headings with the experts consulting. Hierarchical cluster analysis is used to cluster the subject headings and the strategic diagram is formed to analyse the evolutionary trends in the stem cell field.
**Cruz and Dierig (2012)** have analysed the bibliographic records on eight new crops from Agricola, CAB Abstracts, Scopus, and Web of Science for historical and recent trends on the areas of research, author distribution, and quantity and impact of publications. The highest number of records is found to be on *Thlaspi* while the least on *Stokesia*. There is an increase of more than ten-fold in the number of publications on new crops and relatives from 1950 to 2010 and this is paralleled by a similar increase on articles in popular and news media. The $h$-index values, indicating the collective impact of publications by researchers in the crop groups, show an increasing trend until the year 2000 then followed by a decline. It is determined that in recent times, there are fewer papers in the areas of chemistry, agronomy and horticulture, and more publications dealing with Genetics and plant biology.

**Gupta (2012)** has analysed the heredity blood disorder research output carried out during 2002-11 on different parameters including the global publications share and citation quality of top 10 leading countries, India’s growth, citation impact, share of international collaborative papers, contribution of major collaborative partner countries, contribution of various subject fields and by type of heredity blood disorder, pattern of research communication in most productive journals, productivity and citation profile of top Indian institutions and authors and characteristics of high cited papers. The SCOPUS Citation Database has been used to retrieve the data for 10 years (2002-11). Conclude that there is a need to create comprehensive care services, including diagnosis and management of the heredity blood disorders in Indian context. For this purpose, there is need to undertake more R&D, develop trained manpower at different levels and create sufficient infrastructure to handle the problems associated with heredity blood disorders.

**Eghbal et al. (2012)** have used bibliometric indicators to compare the research productivity in endodontic between Iran and 28 selected Asian countries. Medical Subject Headings keyword-searching of PubMed up to 2012 is conducted to compare the scientific publications in Iran and neighboring countries. Highest 5 PubMed-
indexed endodontic journals are also searched to retrieve the number of published articles of the top five countries. Data extracted are tabulated and compared to identify the ranks as well as trends.

Asgary et al. (2013) illustrate statistical information about published articles in PubMed-index journals vis-à-vis the various aspects of this biomaterial. PubMed search is performed to retrieve the relative articles from 1993 to August 2012. Citation of each article till 2009 is obtained from Scopus and Google scholar databases. Data are analysed to determine the related scientometric indicators. The majority of articles are four-authored (19.6%). Most of the articles originate from USA (21.9%), Brazil (18.5%) and Iran (8.76%). The average number of citation for the top ten articles from Scopus is 231. Further, the data demonstrates that during the past two decades, research on this novel endodontic biomaterial has a rapid positive trend especially during the last 5 years.

Sangam et al. (2013) attempt to assess the qualitative and quantitative research output of Genetics research based on the distribution of publications in different branches of Genetics. The study compares the research priorities of 16 branches of Genetics in 13 countries for two time-spans; 2002-2006 and 2007-2011. Since the raw publication counts are confounded by the size of the countries and the size of the subject specialities, cross-national comparison is made using a relative indicator-Research Priority Index.

Maisonobe et al. (2013) explain the current state of DNA Repair studies’ global geography by focusing on the genesis of the community. Bibliometric data is used to localize scientific activities related to DNA Repair at the city level. In order to do so, the places where the first “DNA Repair” publications were signed fifty years ago are localized and the following spatial diffusion process, which led to the current geography of the field. Then, focus on the evolution of the research activity of “early entrants” in relation to the activity of “latecomers”. This article is an opportunity to share with DNA Repair scientists some research results of a dynamic field in Science studies: spatial scientometrics.
Mishra and Balhara (2013) attempt to draw inferences on the trajectory of four broad domains of Medical sciences in India over the span of 16 years, utilizing the available scientometrics information. The results are found to be indicative of differential growth trajectory in many sub-disciplines of Medical sciences. Also the specialities such as epidemiology, obstetrics and gynaecology, geriatrics and psychiatry and mental health, need to be pursued more seriously.

Sangam et al. (2014) have assessed the qualitative and quantitative research output of Genetics research based on the distribution of publications in different branches of Genetics. The study compares the research priorities of 16 branches of Genetics in 10 Asian countries for two time-spans; 1992-2001 and 2002-2011. Since the raw publication counts are confounded by the size of the countries and the size of the subject specialities, cross-national comparison is made using a relative indicator-Research Priority Index.

Jeong and Huh (2014) have performed citation analysis of seven journals that have been indexed in PubMed/PMC since 2008. Trends for the impact factors of different years were analysed using dBSTAT ver. 5.0. It was found that there was an increasing rate of the impact factor for the seven non-Medline journals and five Medline journals concluding that it was an effect of the platform in which the journals are listed and not just an effect of free access.

Song et al. (2014) have conducted bibliometric analysis of the field of Bioinformatics by extracting citation data from PubMed for the period 2000 to 2011. Four measures used to identify productivity were most productive authors, countries, organizations and subject terms. Results showed that the overall trends between the periods 2000 to 2003 and 2004 to 2007 were dissimilar, while trends between the periods 2004 to 2007 and 2008 to 2011 were similar. In addition, the field of bioinformatics has undergone a significant shift, co-evolving with other biomedical disciplines.
McCall (2014) has conducted bibliometric analysis to describe the annual trends in publication on PubMed during 1950 to 2012. The analysis shows that systematic reviews and yoga trials are increasing exponentially, indicating increasing prevalence of yoga research in western healthcare.

Fei-Cheng et al. (2014) have evaluated the global progress and trends on translational medical research by using a scientometric approach in SCI-E, PubMed and SSCI from 1992 to 2012. It was found that translational medicine research has increased rapidly over past 20 years, 11 key papers, research foci and journals are also identified. American institutions have made great advances in paper production, citations and cooperation.

Baskarna and Sivakami (2014) have carried out quantitative analysis on Swine influenza disease research based on data obtained from PubMed database during 2006-2010. Analysis showed publication frequency, country, institution productivity, collaboration, characteristics of most productive institutions, language and journals, also with majority scientists preferring to publish papers in multiple authorship.

Alvarez et al. (2014) have evaluated the impact of anatomy as multidisciplinary area and identified trends in research by anatomists during 1898 to 2012. Data has been collected from SJR, PubMed and JCR databases. Results show the percentage of publication in different databases and that the scientific production of anatomists has improved the quantity and quality of multi-disciplinary scientific activity in different knowledge areas.

Fatehi, Gray and Wootton (2014) have provided various capabilities that can enhance our search performance in PubMed database. So for more control over the search process one can use the Advanced Search Builder interface which provides a history of previous searches from which complex search query can be developed by using Boolean operators. Also suggest identifying more appropriate MeSH vocabulary terms and using them in our searches.
2.7 Inferences

Thereby it can be inferred that there are a good number of studies undertaken on growth of a particular branch of Genetics, bibliometric analysis of a particular branch or species, scientometric methods to evaluate the quality and quantity of scientific efforts in the field of a particular disease or disorder, collaboration studies, and citation analysis on particular branch of Genetics.

With the review of literature the following inferences may be made:
1. Genetics is the study of heredity and differences and the research on the subject Genetics gained tremendous movements after unveiling the molecular structure of DNA (Deoxyribose Nucleic Acid) by Watson and Crick during 1956.
2. It has been observed that USA, Japan, and Germany are the predominant nations in the Genetics research.
3. The research on Genetics and its related branches have yielded enormous amount of related literature. India occupies the 9th position.
4. Few scientometric studies are noticed related to the field of Genetics.

Need of the hour is the systematic study of qualitative and quantitative evaluation of Genetics literature.

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