CHAPTER 6

Findings and Conclusions

The present study had focussed on the dynamics of research activities in the field of theoretical population genetics from various perspectives, in terms of bibliometric indicators. Different attributes of publications had been utilized in a quantitative manner to understand this dynamics.

Many scholars including Price noticed that the growth of knowledge, as reflected in publications and authors follows a logistic path of growth. It means that the growth of publications and authors in a scientific specialty passes through various stages of development. The second chapter, therefore, explored the application of selected growth models to the cumulated number of publications and new authors in this field from 1907 to 1980. The results indicate that more than one growth models have explained this growth of publications and authors. On further exploring the particular growth model, which best explains such a growth, the methodology suggested by Egghe and Rao, utilizing two new growth rate functions, was used. It was found that the cumulated number of publications and authors in theoretical population genetics is best explained by Power Growth Model. This observation is, quite in agreement with the results obtained by Egghe and Rao while studying growth of publications in several databases in the field of S&T, but is also contrary to the usually-held view that Logistic Growth Model explains such growth of publications..

In the third chapter, study of the number of hypothesis related to collaboration in the field of theoretical population genetics is presented. It has been found that the number of collaborative publications show a systematic increase with time, along with growth of publications. The proportion of collaborative publications

in total publications has also shown a systematic growth. Similarly, the various types of co-authored publications individually have depicted a systematic growth, but followed different rates of growth. The picture about the extent and size of collaborations in theoretical population genetics has been gauged through mathematical indices, such as the degree of collaboration, collaboration index, and collaboration coefficient, and has been computed for publications data in different period blocks. All the three indices derived for different period blocks indicate a similar systematic growth of collaborative publications, with minor fluctuations, suggesting a growing professionalisation in the specialty.

The study of the trend in the percentage share of single-authored publications with time showed a consistent declining trend. Such a pattern in percentage share of single-authored publications should pass through different stages and should follow a Semi-Logistic Growth Model. In the field of theoretical population genetics, the percentage share in single-authored publications had decreased from around 94% during 1911-15 to about 61% during 1976-80. Such a decline in these publications was studied in three stages, depicting different declining rates and patterns. On exploring the applicability of selected growth models in the percentage decline of single-authored publications in the period blocks of five years, it has been found that Power and Logistic Growth Models best explain this decline. This conclusion partially agrees with the finding that this decline in percentage share of single-authored publications follows some type of Semi-Logistic Model

The applicability of selected probability distributions in the distribution of authorship in five-year period blocks has been studied in TPG publications. Among the various probabilistic distributions, the relatively simple distributions such as Geometric and Truncated Poison could adequately describe the distribution of the number of authors per publication in different time period blocks. It was noticed that when the percentage share of single-authored publications was large, these two distributions showed more positive fits in the publications data on distribution of

authorship. These results agree with the Rousseau in the field of library and information science and few other scholars in different other fields.

A strong relationship between the number of publications and the average number of authors per publications has been pronounced by Solla Price. He presumed that when Lotka's law does not hold good on a given publication data, it does not reflect the real productivity of authors linked to each other through collaboration. Therefore he along with Qin thought that productivity-collaboration linkages will be better reflected in the average number of collaborators per author, and as a result, it might substitute for the number of publications in Lotka's Law. The study of the productivity distributions of authors in theoretical population genetics has indicated that Lotka's Law was not found to be applicable even when using the average number of collaborators per author instead of publications. This result is quiet contrary to the general thinking in the field.

An important question explored relates to the understanding of the levels of productivity (measured by rank) at which authors collaborate among themselves. For understanding this relationship between collaborating authors and collaborators in theoretical population genetics publications, a new type of index, called "Homophily Index" was used. The study demonstrated the inverse relationship between status-distance and preference-contact among authors in theoretical population genetics. The three characteristic properties of collaborating authors, viz. "Birds of the same feather flock together", the "edge effect", and the "inverse-relationship" were amply demonstrated in the TPG publications, in line with the observations made by Kretschmer in a number of disciplines. However, the expected collaboration between the low productivity and high productivity peers was seen in this speciality.

Over the years, the funding support to different disciplines of science and technology has been increasing slowly since the early twentieth century, with time. This funding support has necessitated the research to be carried in collaborative mode, utilizing the expertise of different researchers. In study of theoretical

population genetics publications in period blocks of five years an increasing share of collaborative and funded publications with time was observed. It was also noticed that those authors who tend to work in teams and with funding produce more publications than other authors. In the case of theoretical population genetics, the impact of collaboration and funding on the productivity of authors was clearly visible in the publication data. The average number of publications per author was found to be much larger in collaborated and funded research than in the non-funded and non-collaborated research. This observation agrees with the generally held analogy.

The scientific collaboration, as viewed in terms of international collaboration, weighs heavily towards the United States. Authors in different countries tend to have collaborations with the peers in the United States so as to profit from the advancement in knowledge and funding. The analysis of the publication data clearly brought the changes taking place in the nature of collaborative publications with time. A distinctive shift has been observed from the internal collaborative publications to the national and international collaborative publications, supported by the availability of increasing funding from government agencies. Thus, the trend shows that theoretical population genetics research is taking international character.

The study of the obsolescence measures in theoretical population genetics specialty has shown a slow increasing trend, indicating that the research front and the structure of this specialty is not changing fast with time. It was also found that the age of citations in research papers was best described and modelled by the Lognormal Distribution Model. However, no relation between growth rate, obsolescence rate, and the half-life could be established in TPG, as has been observed by scholars in some fields.

The distribution of authors and their contributions has been found to be highly dependent upon the stage of development of the specialty. A time - effect on

productivity distribution could be perceived in terms of changes in the concentration and scattering indices of data, which were driven further by the expansion and slowness of the development of TPG with time.

Since in the cross-sectional analysis used earlier, the participating authors do not get equal duration for publications, the scientific productivity does not present a real picture of their capacities. To overcome this limitation, groups with equal duration of participation were identified and each was called a cohort. It was found that productivity distribution of all cohorts do not follow Lotka's Law. Each cohort indicated different patterns in the distribution of its productivity, depending on the length of the participation of the authors. It was found that the steepness in the productivity distribution of different cohort's decreases, as their duration of their participation increased. It was also noticed that there does not exist a distinct "cumulated advantage" within the prolific group of authors until participation was for more than 25 years.

The frequency distribution of the duration of participation and the number of authors had found to be distributed on the pattern of Lotka's Law, and also follow Negative Binomial Distribution Model. It was interesting to see that such a distribution followed a Logistic Model, when explored for their goodness-of-fit, through different growth models. Further, the distribution of the speed of publications by authors had found not to be distributed on the pattern of Lotka's Model; rather it showed nearness to Poisson Distribution Model.