Preface

Genetics is taught in all life science related disciplines at the undergraduate level, but the most commonly used teaching methods do not motivate students. More specifically the information passed on is largely theoretical and over the years the approaches that have been perfected are the use of a handful of coloured beads and through problem solving.

We strongly felt that there was a need to change the way Genetics was taught to undergraduates. This lab manual is an outcome of our efforts made in the last three years (2012-15) of designing experiments using *Drosophila* as a model system, to teach the principles of transmission genetics. The purpose of *Drosophila* Resource Centre was to demonstrate the ease of learning Genetics through experimentation. Wherever required the existing approaches also complemented the new effort.

It was encouraging to observe the way students became more and more interested in the subject. All that was taken for granted by them from their schooldays was seen in a completely different perspective when they performed crosses, scored flies and analysed their data to 'rediscover' the principle of heredity. They also designed crosses to test their hypothesis. Above all, the students realized the power of simple tools to do science and to generate useful information. They also developed a keen sense of observation.

A lab manual for beginners in Genetics is not available. Even globally a semester course in Genetics emphasizes at best on few experiments such as a Mendelian and a non-Mendelian crosses using *Drosophila*; squashes of salivary glands of Dipteran larva to show large polytene chromosomes; separation of eye pigments and study of few human genetic traits.

The experiments are designed to teach the basic principles of Genetics in a one-semester course. More than 90% of the exercises were conducted using a handful of *Drosophila* mutants.

- The students worked in groups of 3 or 4 depending on the class strength.
- Each group was assigned at least two independent exercises.

- They were expected to spend at least one hour each day usually before the first class. They were encouraged to regularly observe their tubes and record/take photographs of interesting observations.
- Once the final data was available, each group was expected to analyse and explain the underlying genetic basis. Wherever required, the data was analysed statistically.
- Finally, one/two members of the group presented their results and analysis before the class for discussion prior to recording the experiment.
- Experiments that do not require genetic crosses and scoring of large number of progenies were performed individually.
- Few experiments such as testing PTC tasting ability and blood groups were done on human subjects.
- At the end of each exercise we have included two sheets for the student to put their observations.

Most of the exercises are organized in a similar fashion covering 6-8 pages. Each exercise provides background information with supporting examples from literature; protocol; observations and calculations (if any) and finally results and discussion. The data and photographs are from the work of final year students in the past three years.

As the user will carefully analyse the data it will be apparent that some of the results are near perfect while in case of some exercises there is scope for further improvement. This is expected as progenies of a given kind arise as a consequence of chance events and also at times certain mutants have poor survival. We cannot ignore experimental errors. The purpose of such results not only calls for possible explanations, but also tells us that foolproof results as depicted by use of coloured beads or tailor-made problem is not always the case.

The results also guide a newcomer of the need to score large number of progenies to obtain statistically significant results. This kind of work is feasible when students work in small groups and generate more raw data for analysis.

The basic idea to design a manual in this way is deep rooted to our early days of learning quantitation in biochemistry labs. The book that continues to be useful even today is 'Biochemical Calculations' by I. Segal essentially because the author left nothing to imagination but systematically solved all kinds of preliminary calculations required in a biochemistry lab.

We hope that this manual will serve as a starting point for those who wish to teach Genetics through experimentation. Improvements in the manual will be largely based on the feedback from the users.

This work is supported by the DBT star project and we have set up a '*Drosophila* Resource centre' that trains students and provides stocks to affiliated colleges of Delhi University. We aim to broaden this base and make Genetics learning interesting to students.

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